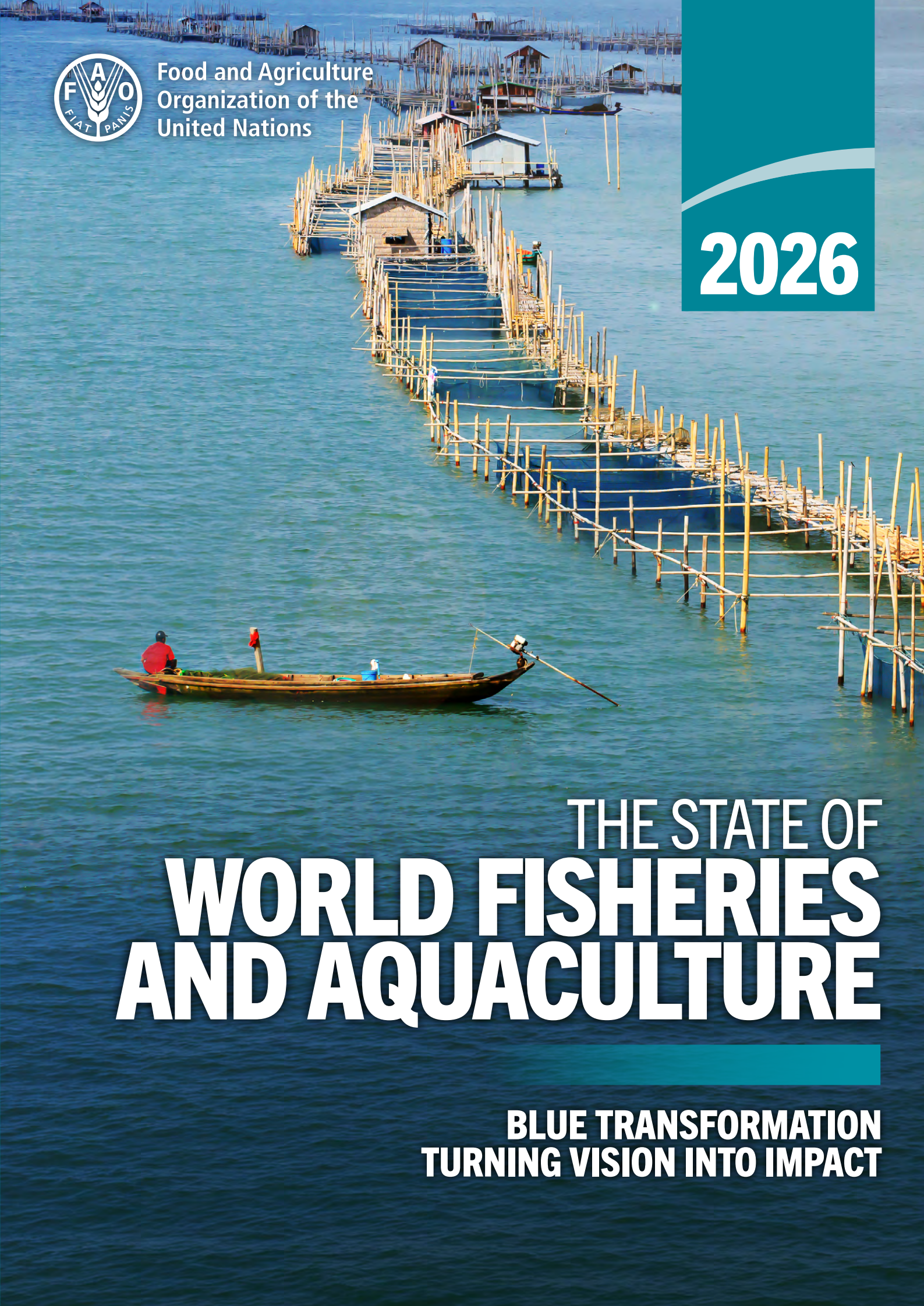


Food and Agriculture Organization of the United Nations

2026

THE STATE OF WORLD FISHERIES AND AQUACULTURE

BLUE TRANSFORMATION TURNING VISION INTO IMPACT

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THAILAND. Farmer overseeing marine aquaculture cages.

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TURNING VISION INTO IMPACT

Food and Agriculture Organization of the United Nations
Rome, 2026

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FOREWORD

In recent years we have witnessed both an unprecedented number of high-level multilateral initiatives on global fisheries and aquaculture, and a growing recognition and appreciation of the significant contribution of aquatic foods to food security and nutrition. FAO's leading role is important and visible and its actions impactful in these global debates, highlighting the critical role aquatic food systems can play to sustain healthy diets, improve global food security, enhance livelihoods, and preserve aquatic biodiversity and the environment. World leaders, country representatives, and economic and civil society organizations have joined the call for accelerated action to mobilize all stakeholders to conserve and sustainably use aquatic ecosystems, and have reaffirmed the strategic importance of FAO's Blue Transformation Roadmap. Launched in 2021, the Roadmap aims to unlock the potential of fisheries and aquaculture by scaling up sustainable aquaculture to meet the rising demand for aquatic foods; achieving effective management of all fisheries to secure healthy stocks and inclusive development; and upgrading aquatic food value chains to maximize their benefits while guaranteeing their social, economic and environmental sustainability.

International efforts to conserve and sustainably use global aquatic living resources must be grounded in reliable data and up-to-date information to guide policies that collectively address multiple challenges. *The State of World Fisheries and Aquaculture 2026* comes at a critical juncture, with less than five years remaining to deliver on the 2030 Agenda for Sustainable Development. It provides robust, evidence-based and forward-looking insights based on cutting-edge science and knowledge to support practical, concrete actions to achieve sustainable fisheries and aquaculture.

The report presents updated, verified global statistics on fisheries and aquaculture, and showcases how FAO, together with Members, local communities, national institutions, industry and partners, is translating the Blue Transformation vision into measurable impact. The initiatives featured span regions and contexts, addressing effective governance, regional cooperation, innovation and technology, improved management practices, investment in resource-efficient and low-impact fisheries and aquaculture operations, and more equitable access to resources and services.

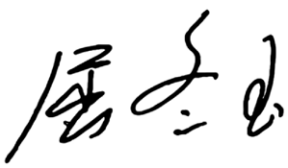
This 2026 edition presents a comprehensive evidence base to inform and guide policy, investment and action at all levels, and conveys encouraging messages. Global production of aquatic resources has continued to grow, reaching a new high of 235 million tonnes in 2024, including both aquatic animals and algae, driven primarily by aquaculture. In 2024, this subsector surpassed a record 100 million tonnes of aquatic animal production. In the same year, an estimated 21.3 kg per capita of aquatic animal foods were available for consumption globally. Aquatic animal foods contributed 15 percent of animal protein availability globally; and provided at least 20 percent of animal protein availability for over 40 percent of the world's population in 2023. About 36 percent of the 2024 aquatic animal production was traded worldwide. Overall, trade in aquatic products involved almost 230 economic territories and generated an estimated USD 186 billion in revenue. In parallel, employment in the primary sector increased to over 65 million workers, supporting the livelihoods of more than 600 million people.

Yet progress remains uneven across regions and countries. Africa, in particular, has significant natural aquatic resources and is highly dependent

on aquatic animal foods for its animal protein availability. With targeted interventions and sustained investment in capacity building, the continent has the potential to contribute far more than its current 6 percent share of global production, in particular by expanding aquaculture production, thus increasing the average per capita availability of aquatic animal foods, which is the lowest in the world (9.1 kg in 2023). Targeted policies, adequate investment, technology transfer and effective management of aquaculture are needed to ensure the supply of aquatic foods meets the growing demand in the continent.

On the capture fisheries front, the share of assessed stocks classified as biologically sustainable declined to 62.4 percent in 2023, from 64.5 percent in 2021, with wide differences across regions and species groups. Several areas and species groups maintain good or improved sustainability records, reflecting continuous implementation of science-based management systems and harvest strategies, but other areas subject to high fishing pressure, strong environmental variability or limited management capacity continue to face persistent challenges. Importantly, the report reveals a more encouraging sustainability score: when weighted by volume, 72.6 percent of 2023 landings of assessed stocks monitored by FAO are estimated to originate from sustainably fished stocks, confirming that larger and more productive stocks tend to be better managed.

The report illustrates that, more than ever before, a healthy planet requires a healthy ocean and healthy inland waters. The international community remains concerned with the threats that the impacts of the climate crisis, pollution and ecosystem degradation pose to the marine and inland aquatic ecosystems. We need to ensure that all necessary efforts are made to reverse the decline in sustainability and secure the long-term potential of the sector, for generations to come. This edition of *The State of World Fisheries and Aquaculture* explores new frontiers and illustrates how FAO, in collaboration with Members, partners and local communities, is turning vision into impact, addressing the challenges and opportunities facing fisheries and aquaculture in the twenty-first century to ensure their contribution towards the four betters: better production, better nutrition, a better environment and a better life – leaving no one behind.



Qu Dongyu
FAO Director-General

METHODOLOGY

The State of World Fisheries and Aquaculture 2026 was prepared by the FAO Fisheries and Aquaculture Division (NFI) under the guidance of an editorial board, chaired by the FAO Assistant Director-General and Director of NFI. The editorial board was responsible for developing the overall structure of the report, establishing its thematic focus, and providing strategic oversight throughout the preparation process.

Starting in June 2025, the editorial board members led the development of the thematic sections, drawing on proposals from FAO officers at headquarters and in Decentralized Offices. They considered current and emerging issues, ongoing FAO initiatives, and the outcomes of high-level global and regional events and undertakings relevant to fisheries and aquaculture. The majority of contributions were prepared by FAO authors, in collaboration with external experts where appropriate (see **Acknowledgements**), and engaged a total of 120 contributors. A core executive group from NFI and the FAO Office of Communications provided operational and technical support throughout the preparation and production process.

All sections of the report underwent review, validation and clearance by their respective leaders at each stage of development. Parts 2 and 3 (excluding outlook projections) were also subject to external review by a panel of internationally recognized experts (see **Acknowledgements**). Part 1 and the outlook projections of Part 3 were finalized in April 2026 once FAO had completed the process of updating, curating and validating the official fisheries and aquaculture statistics.

The final report was submitted for executive review and approval by NFI management, the Office of the FAO Deputy Director-General, and the Office of the FAO Director-General, ensuring the highest standards of accuracy, technical rigour, and policy relevance.

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The final report underwent a rigorous technical review by FAO senior management and technical experts from different divisions and units, both at headquarters and in Decentralized Offices.

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ABBREVIATIONS

ABNJ	areas beyond national jurisdiction
AdMP	adaptive management plan
AGFD	anti-ghost fishing device
ALDFG	abandoned, lost or otherwise discarded fishing gear
AMA	aquaculture management area
AMR	antimicrobial resistance
ASEAN	Association of Southeast Asian Nations
BBNJ Agreement	Agreement under the United Nations Convention on the Law of the Sea on the Conservation and Sustainable Use of Marine Biological Diversity of Areas beyond National Jurisdiction
BFAR	Bureau of Fisheries and Aquatic Resources (Philippines)
BMO	basin management organization
B_{MSY}	biomass corresponding to maximum sustainable yield
BMZ	Federal Ministry for Economic Cooperation and Development (Germany)
CAFS	Chinese Academy of Fishery Sciences
CAPFISH	Cambodia Programme for Sustainable and Inclusive Growth in the Fisheries Sector
CMMs	conservation and management measures
CCRF	Code of Conduct for Responsible Fisheries
CECAF	Fishery Committee for the Eastern Central Atlantic
CFi	community fisheries (Cambodia)
CFR	community fish refuge (Cambodia)
CODOPESCA	Dominican Fisheries and Aquaculture Council
COFI	Committee on Fisheries
CPPL	Central Pacific Producers Ltd (Kiribati)
dFAD	drifting fish aggregating device
EAF	ecosystem approach to fisheries
EMP	environmental monitoring programme
ENSO	El Niño Southern Oscillation
EO	environmental objective
EU	European Union
EUMOFA	European Market Observatory for Fisheries and Aquaculture Products
FAD	fish aggregating device
FBS	food balance sheet
FiA	Fisheries Administration (Cambodia)
FIMS	Fisheries Information Management System (Cambodia)
FishMIP	Fisheries and Marine Ecosystem Model Intercomparison Project
FLW	food loss and waste
FMP	fisheries management plan
FPI	FAO Fish Price Index
FRA	fisheries restricted area
FVDD	Fishing Vessel Design Database
GDP	gross domestic product
GEF	Global Environment Facility
GFCM	General Fisheries Commission for the Mediterranean
GIES	Global Information Exchange System
GIPRO	Inter-institutional Group on Social Protection for Fisheries and Aquaculture (Colombia)
GIS	geographic information system
GSA	Guidelines for Sustainable Aquaculture

ABBREVIATIONS

IFFO	The Marine Ingredients Organisation
IGA	income-generating activity
ILO	International Labour Organization
IMO	International Maritime Organization
INFOFISH	Intergovernmental Organization for Marketing Information and Technical Advisory Services for Fishery Products in the Asia and Pacific Region
INFOPESCA	Centre for Marketing Information and Advisory Services for Fishery Products in Latin America and the Caribbean
IOTC	Indian Ocean Tuna Commission
ISSCAAP	International Standard Statistical Classification of Aquatic Animals and Plants
ISSF	International Seafood Sustainability Foundation
IUCN	International Union for Conservation of Nature
IUU fishing	illegal, unreported and unregulated fishing
IWRM	integrated water resources management
LOA	length overall
LVFO	Lake Victoria Fisheries Organization
MAFF	Ministry of Agriculture Forestry and Fisheries (Cambodia)
MCS	monitoring, control and surveillance
MFOR	Ministry of Fisheries and Ocean Resources (Kiribati)
MLAFWRD	Ministry of Lands, Agriculture, Fisheries, Water and Rural Development, Zimbabwe
MP	management procedure
MSMEs	micro-, small- and medium-sized enterprises
MSS	minimum social safeguards
MSY	maximum sustainable yield
NACA	Network of Aquaculture Centres in Asia-Pacific
NDCs	nationally determined contributions
nei	not elsewhere included
NFP	national focal point
NGO	non-governmental organization
NPOA-SSF	National Plan of Action for Small-Scale Fisheries
NRV	nutrient reference value
NTT	National Task Team
NTWG	National Technical Working Group (Philippines)
NVCTF	National Value Chain Task Force
OACPS	Organisation of African, Caribbean and Pacific States
OECD	Organisation for Economic Co-operation and Development
PMP/AB	Progressive Management Pathway for Aquaculture Biosecurity
PPA	Programme Priority Area
PSMA	Agreement on Port State Measures to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing
QA	quality assurance
RAMP	regional aquaculture management plan
RAOHS	Regional Aquatic Organism Health Strategy
RCP	Representative Concentration Pathway
RFAB	regional fisheries advisory body
RFB	regional fishery body

RFMO	regional fisheries management organization
ROMS	Regional Oceanographic Modelling System
SDGs	Sustainable Development Goals
SEAPODYM	Spatial Ecosystem and Population Dynamics Model
SIDS	Small Island Developing States
SIUBEN	Unified Beneficiaries System (Dominican Republic)
SRFC	Subregional Fisheries Commission
SSC	South–South cooperation
SSF	small-scale fisheries
SSF Guidelines	Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries in the Context of Food Security and Poverty Eradication
SSP	Shared Socioeconomic Pathway
SVC4SIDS	Sustainable Fish Value Chains for Small Island Developing States
SVCD	sustainable value chain development
TRY	TRY Oyster Women's Association (Gambia)
TSC	technical screening criteria
UN	United Nations
UN DESA	United Nations Department of Economic and Social Affairs
UNOC	United Nations Ocean Conference
VMS	vessel monitoring system
WTO	World Trade Organization
ZWG	Zoning Working Group

CORE MESSAGES

1 Global fisheries and aquaculture production is at a record high, but ensuring sustainable and equitable growth remains a major challenge.

- Global fisheries and aquaculture production reached a new record of 235 million tonnes in 2024, confirming the sector's expanding role in feeding a growing global population.
- Aquatic animal production reached 195 million tonnes and has grown steadily over decades, expanding at an average annual rate of 3.2 percent since 1950.
- Aquatic animals play an increasingly important role in healthy diets, with 89 percent of production destined for human consumption, and average per capita availability exceeding 21 kg per year.
- Aquatic food systems employed 65 million people in the primary sector in 2024, playing a critical role in rural economies and coastal communities. Women represent 27 percent of the employment in primary production and 56 percent in processing activities.[a]
- Despite these gains, access to aquatic animal foods and their benefits remains uneven. While global availability continues to outpace population growth, thus making net contributions to nutritional improvements, per capita availability in some regions, particularly Africa, remains far below the global average.
- Targeted policies are needed to address these disparities and ensure that growth in production translates into improved food security, nutrition and livelihoods across all regions.

2 Aquaculture is the main driver of growth in aquatic food systems. While production remains concentrated in Asia, other regions such as Africa hold significant untapped potential.

- World aquaculture production of aquatic animals and algae reached a new record of 142 million tonnes in 2024, confirming its increasing contribution to global supply of aquatic foods.
- Aquaculture produced 103 million tonnes of aquatic animals, an all-time record, equivalent to 53 percent of global aquatic animal output, and over 59 percent of aquatic animal foods for human consumption.
- Aquaculture production remains concentrated, with Asia accounting for around 89 percent of global aquatic animal aquaculture production, and the top five countries together producing 82 percent of the total output.
- Freshwater systems dominate aquaculture production of aquatic animals, accounting for 64 million tonnes (63 percent), compared to 38 million tonnes (37 percent) from marine and coastal systems.
- In low-income countries, particularly in Africa, aquaculture production is constrained, despite significant potential for development and its important role in food security and nutrition.
- Scaling up aquaculture expansion and intensification – in line with the FAO Guidelines for Sustainable Aquaculture and backed by targeted policies, technical support and investment – will be essential to support this potential where it is most needed.

a The percentage for processing activities excludes data from Bangladesh. When Bangladesh is included, women represent 28 percent of the employment in processing activities.

3 Global capture fisheries production remains stable, but concern over the state of marine fishery stocks persists, underscoring the urgent need to scale up effective fisheries management.

- In 2024, capture fisheries production remained stable at 92 million tonnes (excluding algae), continuing its long-term pattern of fluctuation within the range of 86 and 94 million tonnes since the late 1980s.
- Marine capture fisheries remain the main source of aquatic animal production, with about 80 million tonnes harvested, accounting for 41 percent of total aquatic animal production.
- Inland fisheries reached a record 12.3 million tonnes in 2024, driven by significant increases in countries where they play a critical role in national food security.
- The share of the world's marine fishery stocks fished within biologically sustainable levels declined to 62.4 percent in 2023, down by 2.1 percentage points from 2021. This is driven by methodological adjustments as well as sustainability declines in specific regions.
- When weighted by volume, 72.6 percent of the landings of assessed stocks monitored by FAO are estimated to originate from sustainably fished stocks, indicating that larger and more productive stocks tend to be better managed.
- At the regional level, several areas have maintained high shares of sustainable stocks, reflecting the continued application of science-based management and precautionary approaches. Other areas continue to face persistent challenges linked to fishing pressure, environmental variability and limited management capacity.
- Achieving the SDG target of 100 percent of stocks within biologically sustainable levels remains extremely challenging, particularly in regions characterized by complex multispecies fisheries and limited assessment and management capacity.
- These trends underscore the urgency of coordinated and effective fisheries data collection, assessment and management systems to sustain fishery resources and support their long-term sustainability.

4 Aquatic foods are essential for nutrition, and their rise in availability for human consumption continues to outpace population growth globally, yet their benefits remain inequitably distributed across regions.

- Aquatic foods make an ever-increasing critical contribution to human nutrition, providing essential micronutrients, omega-3 fatty acids and high-quality proteins that support healthy diets.
- In 2023, aquatic animal foods accounted for at least 20 percent of per capita animal protein supply for over 40 percent of the world's population, underscoring their importance in food security and nutrition.
- Their role is particularly important in low-income countries where aquatic animal foods are among the most affordable and accessible sources of high-quality proteins, supporting diet quality where it is needed most.
- In Africa, aquatic animal foods contribute around 19 percent of animal protein availability – the second-highest share globally.
- Realizing the potential of aquatic foods requires targeted policies and investments to improve availability, accessibility and affordability for wider inclusion in diets.

5 Trade in aquatic products continues to expand, reflecting strong global demand and greatly contributing to economic development and higher nutrition levels.

- In 2024, global trade in aquatic products reached USD 186 billion – comprising USD 184 billion in aquatic animal products and USD 2 billion in algae and other aquatic products – and involved 230 countries and territories.
- The value of trade in aquatic animal products is comparable to that in terrestrial meats, and aquatic trade accounts for 9 percent of total agricultural trade (excluding forestry) and about 1 percent of total merchandise trade.

CORE MESSAGES

- Approximately 36 percent of global aquatic animal production in weight was traded internationally in 2024, helping supply nutritious foods where domestic production falls short, and highlighting the sector's strong integration in global markets.
- Africa has a negative trade balance in product weight (–1 million tonnes), yet a positive trade balance in economic value (+USD 2 billion) together with a gain in proteins (+126 000 tonnes), as the region exports commodities of high economic value and imports products that, although of low economic value, are nutrient-rich, contributing to economic development and increasing nutrient availability.
- Strengthening traceability, food safety and efficiency of equitable trade systems will be key to enhancing the availability of nutritious foods where they are most needed, while supporting livelihoods across the aquatic value chain.

6 Future growth in aquatic animal production will be mainly driven by aquaculture, and its sustainability will depend on efficiency, innovation and equitable access.

- FAO projections to 2034 indicate continued growth in fisheries and aquaculture production, consumption and trade, with total aquatic animal production expected to reach 214 million tonnes.
- Aquaculture will remain the main driver of growth, with production projected to reach 119 million tonnes by 2034.
- Capture fisheries are expected to recover to around 95 million tonnes, as a direct result of improved management and reduced losses.
- Over 90 percent of production is expected to be available for human consumption, with per capita availability reaching 21.9 kg globally. However, this increase will not be evenly distributed.
- The highest growth rate of aquatic animal food availability, from both domestic production and imports, is forecast to be in Africa (18 percent). Nevertheless, per capita availability is projected to decline as population growth will outpace supply.
- Trade in aquatic animal products is expected to continue expanding, although at a slower pace, with a slight decline in the share of production exported.
- Ensuring that growth translates into positive outcomes will require aligning expansion with environmental sustainability, resource efficiency and inclusive development.

7 Investment, effective governance and innovation are key to transforming aquatic food systems towards greater sustainability and productivity. Without sufficient progress in these areas, growth will outpace equity and sustainability.

- Targeted investment, innovation and strong policy frameworks are essential to scale up aquaculture production, while minimizing social, economic and environmental impacts, especially in regions with capacity constraints.
- The adoption of science- and ecosystem-based approaches to fisheries needs to be widened to rebuild and maintain fish stocks at sustainable levels and safeguard both aquatic resources and the people who depend on them.
- Upgrading value chains towards greater efficiency and equity can increase availability of aquatic foods, and promote better job conditions, particularly for small-scale actors, women and youth.
- FAO's Blue Transformation Roadmap provides a quantifiable global framework to realize these objectives and transform aquatic food systems into an even stronger driver of food security, livelihoods and sustainable development.

EXECUTIVE SUMMARY

The important role aquatic foods systems play in global food security, nutrition and poverty alleviation continues to gain worldwide recognition. *The State of World Fisheries and Aquaculture 2026* presents verified, updated statistics on global fisheries and aquaculture up to 2024, showcasing how FAO is translating the Blue Transformation vision into impact.

WORLD REVIEW

World production of fisheries and aquaculture reached a new high of 235 million tonnes in 2024 – 195 million tonnes of aquatic animals (live weight equivalent) and 40 million tonnes of algae (wet weight) – a significant increase of 5.2 percent compared to 2022. The total first sale value was estimated at USD 565 billion. Around 67 percent of the total quantity was harvested from marine waters (51 percent capture fisheries and 49 percent aquaculture) and 33 percent from inland waters (16 percent capture fisheries and 84 percent aquaculture). Asian countries produced 76 percent of the total, followed by Latin America and the Caribbean (8 percent), Europe (7 percent), Africa (6 percent), Northern America (2 percent) and Oceania (1 percent).[b]

Production of aquatic animals reached an all-time high of 195 million tonnes in 2024 (53 percent from aquaculture and 47 percent from capture fisheries), with first sale value estimated at USD 545 billion. Production from marine areas was 118 million tonnes (61 percent of the total: 67 percent capture fisheries and 33 percent aquaculture). Inland waters produced 77 million tonnes (39 percent of the total: 16 percent capture fisheries and 84 percent aquaculture).

World aquaculture production reached a new record in 2024 at 142 million tonnes, with an estimated first sale value of USD 391 billion. It comprised 103 million tonnes (live weight equivalent) of aquatic animals, valued at USD 371 billion, and 39 million tonnes (wet weight) of algae, valued at USD 20 billion. Asia contributed 92 percent of the total, followed by Latin America and the Caribbean (3 percent), Europe (2 percent), Africa (2 percent), Northern America (0.4 percent) and Oceania (0.2 percent). The top five countries (China, Indonesia, India, Viet Nam and Bangladesh) produced 84 percent of the total.

Aquaculture of aquatic animals achieved a new production record in 2024 at 103 million tonnes, confirming its role as driver of aquatic animal production growth. Asia contributed 89 percent of the total, followed by Latin America and the Caribbean (4 percent), Europe (3 percent), Africa (2 percent), Northern America (1 percent) and Oceania (0.2 percent). The top five producing countries were China (56 percent of the total), India (12 percent), Indonesia (6 percent), Viet Nam (5 percent) and Bangladesh (3 percent); together, they accounted for 82 percent of the total. A large share (63 percent) was farmed in inland waters, dominated by finfish (89 percent), followed by crustaceans (9 percent), aquatic turtles and frogs (1 percent), molluscs (0.3 percent) and other invertebrates (0.1 percent). Marine and coastal aquaculture produced 38 million tonnes of aquatic animals, dominated by molluscs (53 percent), followed by finfish (24 percent), crustaceans (22 percent) and marine invertebrates (2 percent). In addition, 39 million tonnes of algae were farmed in 2024, of which 39 percent were from marine environments.

World capture fisheries production reached 93 million tonnes in 2024, comprising 92 million tonnes (live weight equivalent) of aquatic animals and 1 million tonnes (wet weight) of algae. Asia continues to lead capture fisheries production[c] (52 percent of the total), followed by Latin America and the Caribbean (15 percent), Europe (14 percent), Africa (12 percent), Northern

b Percentages may not always add up to 100 due to rounding.

c For capture fisheries by marine area, data by region refer to the quantities caught and retained by all countries in a given region, irrespective of the marine fishing area where they fished; they do not refer to the quantities caught and retained in the marine waters surrounding a given region.

America (5 percent) and Oceania (2 percent). The top five countries (China, Indonesia, India, Peru and Russian Federation) accounted for 41 percent of the total.

Capture fisheries production of aquatic animals has oscillated since the late 1980s between 86 and 94 million tonnes as the biological and ecological limits of some wild fish stocks are reached. Nevertheless, capture fisheries remain vital for food security and poverty alleviation, particularly in coastal areas and developing regions, where small-scale fisheries support livelihoods of millions.

Marine fisheries landed 80 million tonnes of aquatic animals in 2024. The top five producers together accounted for 42 percent of the total, led by China (15 percent), followed by Indonesia (9 percent), Peru (7 percent), the Russian Federation (6 percent) and India (5 percent).

World catches of aquatic animals in **inland waters** reached their highest ever in 2024 at over 12 million tonnes, an increase of 5.9 percent compared to the average of the previous three years. This growth is explained by improvements in data collection and reporting to FAO, in addition to effective increases in production, notably in India, Bangladesh and the United Republic of Tanzania, where inland fisheries are highly relevant for national food security.

Concern over the **state of marine fisheries resources** persists, despite noticeable improvements in several fishing areas. The share of the world's **biologically sustainable marine stocks** dropped from 64.5 percent of all stocks assessed by FAO in 2021 to 62.4 percent in 2023. The decline reflects assessment revisions, methodological updates and the inclusion of new fish stocks.

However, when weighted by volume, 72.6 percent of the landings of assessed stocks monitored by FAO in 2023 originated from sustainably fished stocks. The substantial heterogeneity characterizing FAO Major Fishing Areas continues. In 2023, several areas maintained high proportions of sustainable stocks, reflecting the continuous implementation of science-based management systems and precautionary harvest strategies. Conversely, areas subject to high fishing pressure, strong environmental variability or limited assessment and management capacity faced persistent challenges.

The **world fishing fleet** was estimated at about 4.7 million vessels in 2024, operating mainly in Asia (72 percent of the total), followed by Africa (18 percent), Latin America and the Caribbean (6 percent), Northern America and Europe (2 percent each), and Oceania (less than 1 percent).

Motorized vessels represented over two-thirds of the global fishing fleet in 2024. Asia hosts both the largest motorized fleet (80 percent) and the largest non-motorized fleet (53 percent). Africa has the second largest non-motorized fleet (42 percent). Many fishing nations (e.g. China, Japan and European Union Member States) continue policies of reducing the size of their fishing fleets.

Employment in the primary sector of fisheries and aquaculture benefited over 65 million people in 2024: 35 percent in aquaculture and 56 percent in capture fisheries, with the remaining 9 percent unspecified. Asia accounted for 85 percent of total workers, followed by Africa (9 percent) and Latin America and the Caribbean (5 percent), while Europe, Oceania and Northern America combined accounted for just 1 percent. Ten countries represented 83 percent of employment in the primary sector, of which nine Asian countries provided around 80 percent, while Brazil assumed the other 3 percent.

Where data were disaggregated by sex, 27 percent of those employed in the primary sector were women. The share of female workers was highest in inland fisheries (31 percent), lowest in marine fisheries (21 percent) and close to the primary sector average in aquaculture (26 percent). In processing, women accounted for 28 percent of workers, rising to 56 percent when data from

Bangladesh were excluded. The fisheries and aquaculture sectors reported, respectively, 56 and 64 percent of full-time workers and 17–25 percent of part-time and occasional workers. In processing, about three-quarters of workers were employed on a full-time basis, with part-time and occasional employment representing, respectively, 11 percent and 12 percent.

Utilization and processing of aquatic products continue to improve, with 89 percent of world aquatic animal production being available for human consumption in 2024. The remaining (11 percent) was mainly used to produce fishmeal and fish oil. The largest share (44 percent) of aquatic animal foods was distributed in live, fresh or chilled forms, followed by frozen (34 percent), prepared and preserved (12 percent), and cured (10 percent), prepared by drying, salting, fermentation or smoking.

Overall, in 2024, most aquatic animal foods were distributed in high-income countries as frozen (60 percent), prepared and preserved (25 percent), or cured (11 percent) products, with an ever-expanding range of convenience and ready-to-eat foods. In contrast, in many low- and middle-income countries, a substantial proportion of aquatic animal foods (up to 70 percent) continues to be distributed in live, fresh or chilled forms, reflecting infrastructure constraints, consumer preferences and shorter supply chains; in 2024, about 20 percent was cured, and only 9 percent was frozen.

Global aquatic animal food availability reached an estimated 171 million tonnes (live weight equivalent) in 2023, with Asia accounting for 74 percent, followed by Europe (9 percent), Africa (8 percent), Northern America (5 percent), Latin America and the Caribbean (4 percent) and Oceania (1 percent). Aquatic animal foods contributed at least 20 percent of the per capita protein availability from all animal sources to over 40 percent of the world's population. Globally, aquatic animal foods contributed 15 percent of animal protein availability and 6 percent of all protein availability. Together, these trends underscore the role of fisheries and aquaculture in supporting diets and nutrition.

Per capita aquatic animal food availability averaged 21.1 kg (live weight equivalent) in 2023, rising to a preliminary estimate of 21.3 kg in 2024. It ranged from 9.1 kg in Africa to 26.3 kg in Asia; Northern America (22.1 kg), Europe (21.2 kg) and Oceania (20.6 kg) recorded comparable levels, while availability in Latin America and the Caribbean remained significantly lower (10.1 kg). At the country level, differences in availability are more striking, ranging from negligible quantities to nearly 100 kg per capita. Despite having the lowest per capita availability of aquatic animal foods (9.1 kg) in 2023, Africa recorded the second-highest contribution of aquatic animal proteins to the total supply of animal proteins (19 percent), suggesting a strong reliance on aquatic resources as a key source of animal proteins.

The global value of **international trade in aquatic products** reached USD 186 billion in 2024, involving 230 countries and territories, trading mainly (USD 184 billion, 99 percent) aquatic animal products, with algae, sponges and shells accounting for the remaining USD 2 billion. Globally, the value of trade in aquatic products represented 9 percent of total agricultural trade (excluding forestry) and about 1 percent of total merchandise trade. The value of the trade in aquatic animal products was similar in magnitude to that in terrestrial meats and meat preparations.

Europe accounted for 38 percent of the total aquatic animal export value in 2024, followed by Asia (34 percent) and Latin America and the Caribbean (15 percent), while Northern America (6 percent), Africa (5 percent) and Oceania (2 percent) played smaller roles. Likewise, Europe remained the largest importing region (41 percent of the total import value), followed by Asia (34 percent) and Northern America (17 percent),

with the other regions accounting for small shares: Latin America and the Caribbean (3 percent), Africa (3 percent) and Oceania (1 percent).

The top five exporters accounted for 35 percent of the total in 2024, led by China (11 percent), followed by Norway (9 percent), Viet Nam (6 percent), and Ecuador and Chile (5 percent each). The European Union was the largest single market, importing USD 63 billion of aquatic animal products, including USD 31 billion of intra-European Union trade. The top five importing countries accounted for 43 percent of the total, led by the United States of America (15 percent), followed by China (12 percent), Japan (7 percent), Spain (5 percent) and Italy (4 percent).

The most traded aquatic animal products in 2024 were finfish (68 percent of the total value), crustaceans (22 percent), and molluscs and other aquatic invertebrates (11 percent). By species group, salmonids remain the most valuable (21 percent of the total value), followed by shrimps and prawns (16 percent), tunas, bonitos and billfishes (10 percent), cods, hakes and haddocks (8 percent), and cephalopods (7 percent).

BLUE TRANSFORMATION: TURNING VISION INTO IMPACT

Advancing Blue Transformation

Since its launch in 2021, the FAO Blue Transformation Roadmap has received worldwide recognition as a key framework for achieving long-term sustainability in the fisheries and aquaculture sector. In collaboration with Members, partners and key stakeholders, FAO has developed and implemented a wide range of projects and activities around the world, delivering Blue Transformation on the ground.

These projects benefit greatly from FAO's unique global network of Decentralized Offices, with their strong presence and contextual know-how, consolidated by the multidisciplinary, technical expertise and knowledge base of headquarters.

Towards sustainable aquaculture development

On the ground, through its Blue Transformation, FAO has deployed aquaculture projects to upgrade national and regional science-based governance processes and mobilize investments that integrate the aquaculture sector into cross-sectoral policies and plans.

Efforts to improve governance and spatial planning include a **science-based aquaculture zoning** project in Lake Victoria that has piloted solutions requiring community engagement, responsive planning and harmonized transboundary policies. It has introduced innovative digital tools, improved enforcement, and strengthened extension services. The project demonstrates how regulatory, spatial and environmental tools can guide sustainable cage aquaculture in a transboundary ecosystem.

FAO and the Chinese Academy of Fishery Sciences have signed a five-year memorandum of understanding (2023–2028) for the dissemination of innovative practices that **integrate aquaculture, solar power generation, and research**, adapting them to country contexts.

Sustainable freshwater aquaculture pilots have been carried out to upgrade value chains in Kyrgyzstan, trout farming in Lesotho and integrated rice–fish culture in Uganda, with a strong focus on women and youth. In Kyrgyzstan, these efforts have contributed to the establishment of over 500 farms and an increase in production from 58 tonnes in 2000 to 19 400 tonnes in 2024. These interventions have empowered small- and medium-scale farmers to access knowledge, technologies and resources from seed production to processing and marketing.

To promote **sustainable feed management and innovative feeding practices**, FAO has implemented targeted technical assistance projects to empower farmers in over 24 countries in Africa, Asia and Latin America, promoting locally sourced and affordable feed ingredients. These interventions, complemented with stronger

sectoral policies, have improved feed formulation and quality, on-farm feed management, and nutrition.

Restorative aquaculture has been piloted in inclusive seaweed aquaculture projects in Latin America and the Caribbean, and in mangrove oyster farming in West Africa. The seaweed initiatives have created employment opportunities for women and youth, strengthening their leadership roles, and have improved access to technologies, services resources and infrastructure that support resilient and profitable enterprises. In West Africa, an FAO project has introduced improved mangrove oyster farming methods and water quality and oyster health monitoring techniques; provided support in ecosystem management and marketing; and fostered alternative livelihoods.

FAO provides support to **strengthen data collection and analysis**. A comprehensive survey in Zimbabwe revealed that tilapia farming had been grossly underestimated in the country; around 62 percent of tilapia farms had appeared as recently as 2022 and 2023, with most farmers struggling to access quality fingerlings and facing high feed costs. The survey has enabled informed decision-making – key for achieving the sector's full potential.

In Peru, FAO has introduced a **digital biosecurity system**, which integrates water quality monitoring, mobile applications to share health observations, satellite data on rainfall and temperatures, and diagnostic results from national laboratories. The data are consolidated in a digital platform, which generates health risk alerts disseminated rapidly to farmers and the authorities for preventive action.

TOWARDS EFFECTIVE MANAGEMENT OF ALL FISHERIES

Sustainable management and exploitation of fisheries resources require effective fisheries governance, with particular focus on small-scale fisheries, equitable access to resources and services, improved fishing technology and efficiency, strong regional cooperation, and better monitoring, control and surveillance, particularly for managing migratory, transboundary, straddling and high seas fish stocks.

Regional fishery bodies (RFBs) are key to facilitating state cooperation towards the adoption and implementation of measures for the effective conservation and management of transboundary aquatic species. FAO assumes the Secretariat of the RFB Secretariats' Network, which fosters dialogue, coordination and knowledge exchange. In addition, it manages the secretariats of several regional fisheries management organizations and regional fisheries advisory bodies.

FAO promotes sustainable **management of transboundary fisheries** through the activities of the Fisheries and Resources Monitoring System partnership and the EAF-Nansen Programme. Likewise, FAO supports regional **monitoring, control and surveillance** across flag, coastal and port states to combat illegal, unreported and unregulated (IUU) fishing from pre-fishing to post-harvest and trade. Ongoing initiatives include vessel monitoring systems, catch documentation schemes, and high seas inspection programmes.

The FAO **Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries** (SSF Guidelines) have been adopted globally. However, the lack of an enabling environment and adequate support frequently impedes their application at national and local levels. To address these gaps, FAO has supported the implementation of National Plans of Action for Small-Scale Fisheries in several countries; they have proved effective for adapting the

SSF Guidelines to national or local realities, encouraging on-the-ground change to secure the long-term sustainability of small-scale fisheries.

To promote effective policies, governance and institutions, FAO pursues its efforts to mobilize resources and provide technical assistance for the implementation of international agreements aimed at strengthening global fisheries governance. In Cambodia, FAO has supported the upgrading and implementation of strategic planning frameworks for fisheries up to 2034, drafting a new law on fisheries and developing subsidiary legislation to operationalize conservation and management measures for marine and inland fisheries and aquaculture. The law introduces measures aligned with international agreements to combat IUU fishing, implement fishing control regulations, and enforce labour and safety standards for fishing crews.

Technological innovations to deploy a new generation of fishing fleets and techniques are contributing to safer, more efficient, profitable and ecofriendly operations. In 2022, FAO established the Fishing Vessel Design Database, an open global repository of fishing vessel designs and drawings to enable shipyards and naval architects to access proven and innovative design solutions to support fishers' safety, fishing efficiency, and resource sustainability.

Other innovations include drifting fish aggregating devices that are both biodegradable and non-entangling for vulnerable species like sharks and turtles, and biodegradable fishing gears that reduce ghost fishing.

Towards efficient, inclusive and environmentally responsible aquatic food value chains

Efficiency, inclusivity and environmental responsibility are key to the sustainability of agrifood systems. This requires participatory approaches to assess the needs in technological innovation, capacity building, equitable access to services, finance and infrastructure, and the distribution of economic, social and environmental costs and benefits along aquatic value chains.

Participatory multistakeholder approaches are essential to support sustainable value chain upgrading. In Cabo Verde, a multistakeholder platform enables all stakeholders to reach a shared understanding of challenges and opportunities. Through targeted capacity building, focus groups and validation sessions, consultation has translated into active co-development of strategies. The platform has supported climate adaptation planning and technological innovations, such as vessel monitoring, renewable energy, seawater desalination and water recycling, to enhance climate resilience and reduce environmental footprint.

In Kiribati, an FAO project has supported the co-development of a ten-year strategy to **upgrade the domestic tuna value chain** (2023–2033). In addition to trainings on small-scale processing and business planning, the project has provided technical support to small-scale commercial fishery centres and introduced the use of hygienic trolleys by women vendors. To deliver these activities, the project installed an improved data collection system for supervision and informed decision-making.

In the Dominican Republic, FAO is implementing a ten-year strategy to **upgrade the mahi-mahi value chain** (2024–2033). The strategy aims to enhance community well-being, support economic growth, and safeguard the environment. Fishers, vendors and processors receive training and equipment to improve the handling and processing of mahi-mahi and its by-products, strengthen their marketing skills and facilitate business connections with buyers. Following a national survey on essential socioeconomic and vulnerability data, 61 percent of the surveyed fishers and their families are being considered for inclusion in the Dominican social security system.

South Sudan, the world's youngest nation, is a striking illustration of how FAO's interventions can cover **emergency relief, through fisheries reconstruction to long-term development**. Amid 20 years of conflict, displacement and humanitarian crisis, FAO focused on emergency aid, supplying over 400 000 households with basic fishing kits and technical advice, contributing to the restoration of livelihoods and improved nutrition for millions. During reconstruction, the project introduced improved processing, and local canoe-building innovations. Communities gained equitable access to fishing grounds and honed their technical skills, producing a surplus that could be traded. As stability gradually returned to parts of the country, the focus shifted to the building of resilient, inclusive and sustainable fisheries. Today, around 1.9 million people rely on the sector: fisheries are often the most stable source of livelihoods, providing an accessible and affordable source of animal proteins.

To boost nutrition, for years FAO has supported initiatives to promote the use of aquatic products in **school feeding programmes**, taking into account their acceptability, quality, affordability and convenience. Building on these experiences, FAO and partners are strengthening the capacity of local small-scale operators in Malawi and Honduras to include fish powder in school meals. In addition to the health and nutrition benefits, this creates more opportunities for local actors and communities.

CONTEMPORARY ISSUES AND OUTLOOK

The fisheries and aquaculture sector is increasingly shaped by a rapidly changing global context. The climate crisis, environmental degradation, economic shocks and shifting international political dynamics are influencing the sustainability and performance of aquatic food systems. This report examines these interconnected issues and explores how they inform the future prospects of aquatic food production, and scientific advances in climate projections and adaptation. This analysis helps address these issues effectively, strengthening the resilience and sustainability of aquatic systems, and ultimately supports FAO's efforts to mobilize Members, partners and key stakeholders to translate this knowledge into action.

From commitments to action

FAO is committed to supporting actions that bridge science and policy for effective fisheries management and to strengthening the capacity of Members and RFBs. This requires adequate resources to foster strong partnerships with governments, donors, the private sector and civil society organizations, as well as capacity development adapted to developing countries' needs.

Multilateral fisheries management in a changing world

Regional fishery bodies remain at the forefront of fisheries and aquaculture governance, promoting multijurisdictional cooperation and translating international commitments into actionable regional measures. They are increasingly instrumental in the implementation of new and emerging international instruments addressing the climate crisis, IUU fishing, pollution, fisheries subsidies, and conservation and sustainable use of biological diversity.

To address current and future challenges, RFBs require strengthened mandates, enhanced coordination, and more inclusive governance that actively engages key sectors and stakeholders. Building adaptability into decision-making processes is essential as RFBs confront emerging issues such as shifting species distribution, technological innovation, and greater coherence across fisheries, biodiversity and climate agendas.

Climate projections for informing adaptation strategies

The climate crisis requires the integration of climate considerations into global, regional and national fisheries management to sustain productivity, protect ecosystems, safeguard livelihoods, and plan adaptation. Despite the

uncertainty of climate risks, worldwide studies on the impacts of climate change on aquatic systems document the relevance of adaptation measures, urging decision-makers to integrate climate change considerations into planning and management.

Changes in ocean temperature may be associated with shifts in productivity, spatial distribution and abundance of marine species. Under high emissions scenarios, exploitable marine fish biomass is projected to decline by over 10 percent by 2050 in several regions. These changes risk undermining management efforts, particularly where stocks cross jurisdictional boundaries or enter unregulated areas. Regional fishery bodies can help manage these risks through joint research, data sharing, and adaptive, precautionary approaches that enhance fisheries resilience.

The sustainability of fisheries in the future will be the result of management action setting adequate exploitation levels that take into account changes in productivity and distribution of stocks. Global models show that if fishing pressure is reduced and stocks are allowed to rebuild, biomass losses under warming scenarios can be partially offset, particularly under low emissions pathways.

Fisheries and aquaculture projections, 2024–2034

The FAO outlook for fisheries and aquaculture foresees increases in world production, utilization and trade for the period up to 2034, although at slower rates compared to previous decades. World production of aquatic animals is projected to increase by 10 percent to reach 214 million tonnes in 2034, 119 million tonnes from aquaculture and 95 million tonnes from capture fisheries, increasing, respectively, by 16 percent and 3 percent.

Aquaculture will account for 56 percent of the total production of aquatic animals and 62 percent of total aquatic animal food availability, estimated at 193 million tonnes. Aquatic animal food availability will increase by 11 percent (19 million tonnes) to reach on average 21.9 kg per capita in 2034. Exports of aquatic products are expected to decline slightly to 35 percent of total production in 2034, down from 36 percent in 2024. Prices are expected to increase moderately in nominal terms and decline slightly in real terms over the period 2024–2034. Nominal prices are expected to rise slightly faster for aquaculture than for capture fisheries, reflecting higher feed, energy and compliance costs.

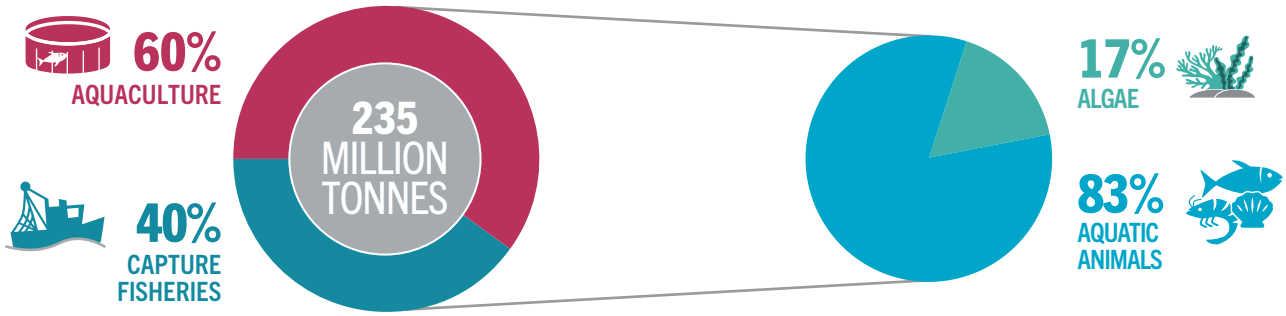
As in the past, changes are expected to be uneven across regions, shaped by differences in population growth, income dynamics, technological development, urbanization and dietary trends.

Governance effectiveness remains a critical determinant of future outcomes. Weak management, habitat degradation, illegal, unreported and unregulated fishing, and disease outbreaks could undermine sustainability and productivity. Conversely, continued improvements in governance, technology and innovation – aligned with FAO's Blue Transformation objectives – will support more resilient, inclusive and sustainable aquatic food systems in the long term.

FISHERIES AND AQUACULTURE IN NUMBERS

SCALE OF THE SECTOR – 2024

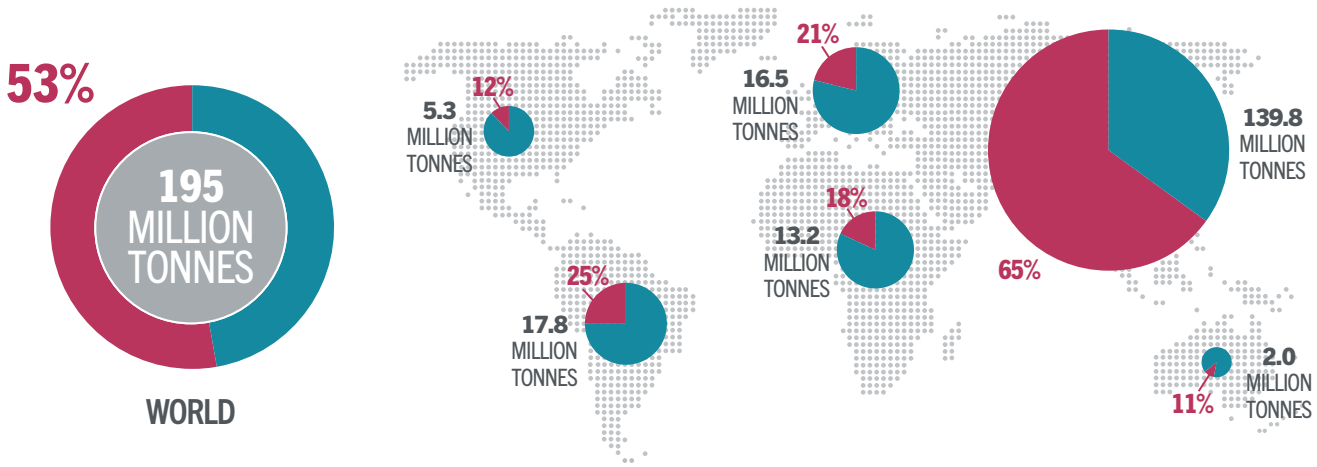
GLOBAL PRODUCTION



AQUATIC ANIMAL PRODUCTION: INLAND VS MARINE



WHERE IS AQUATIC ANIMAL PRODUCTION CONCENTRATED?

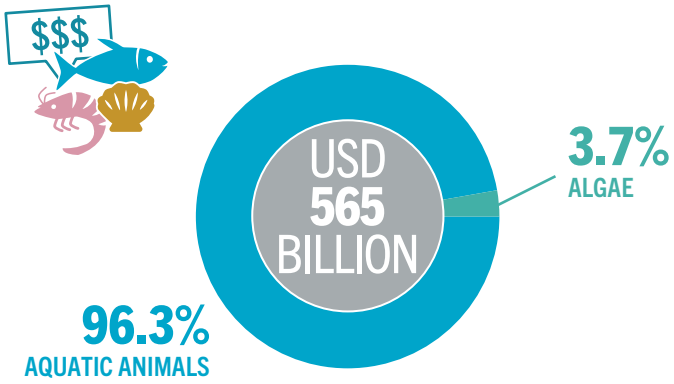


Figures in million tonnes represent total fisheries and aquaculture production by region.

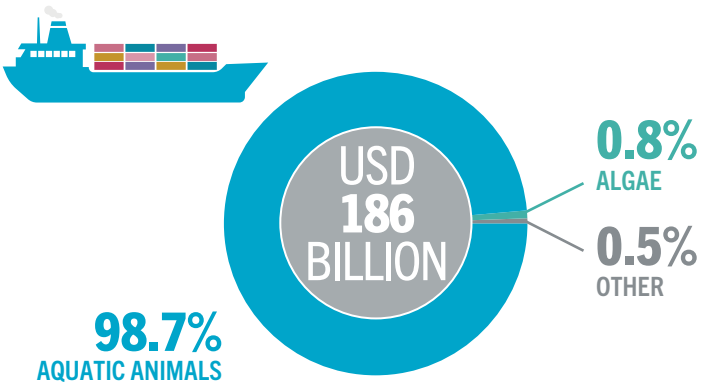
Refer to the disclaimer on the copyright page for the names and boundaries used in this map.

ECONOMIC VALUE AND TRADE – 2024

FIRST SALE VALUE



GLOBAL TRADE IN AQUATIC PRODUCTS (VALUE)



GLOBAL TRADE VALUE: TERRESTRIAL MEAT VS AQUATIC ANIMAL PRODUCTS

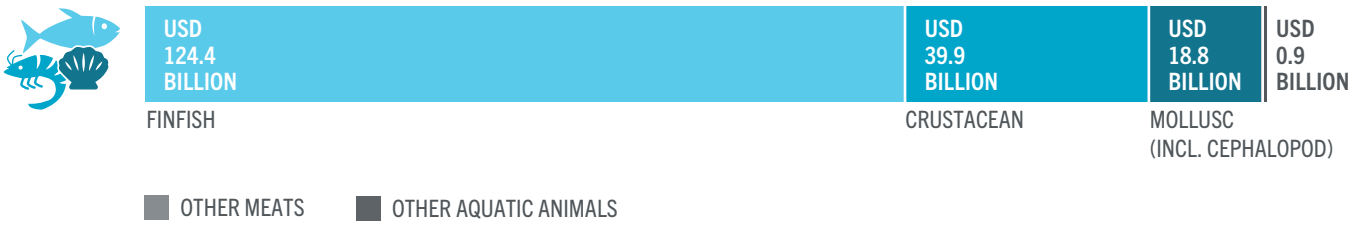
TERRESTRIAL MEAT PRODUCTS

TOTAL TRADED = USD 198 BILLION



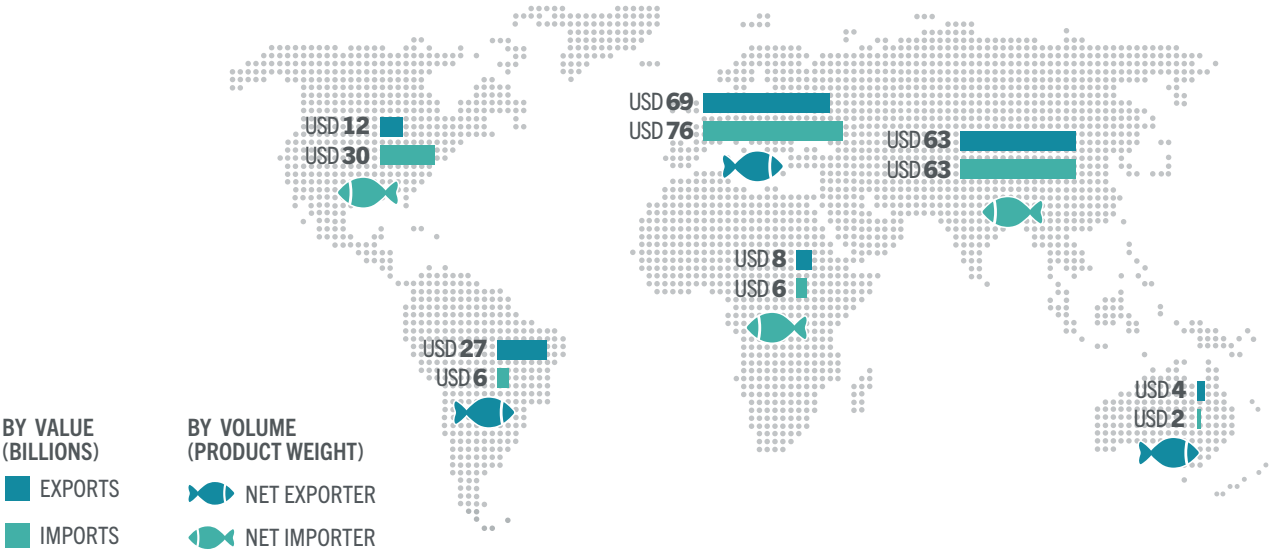
AQUATIC ANIMAL PRODUCTS

TOTAL TRADED = USD 184 BILLION



OTHER MEATS OTHER AQUATIC ANIMALS

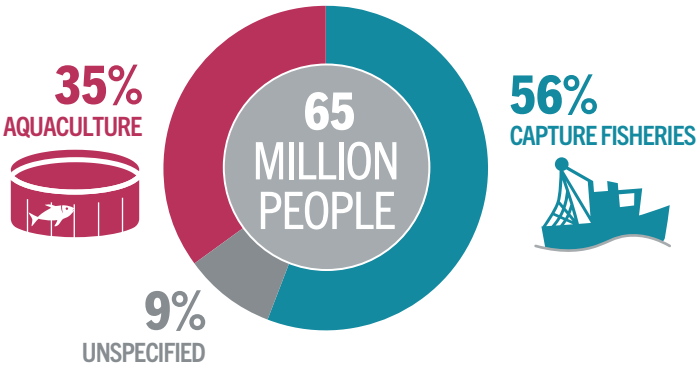
HOW DOES AQUATIC ANIMAL TRADE VARY ACROSS REGIONS?



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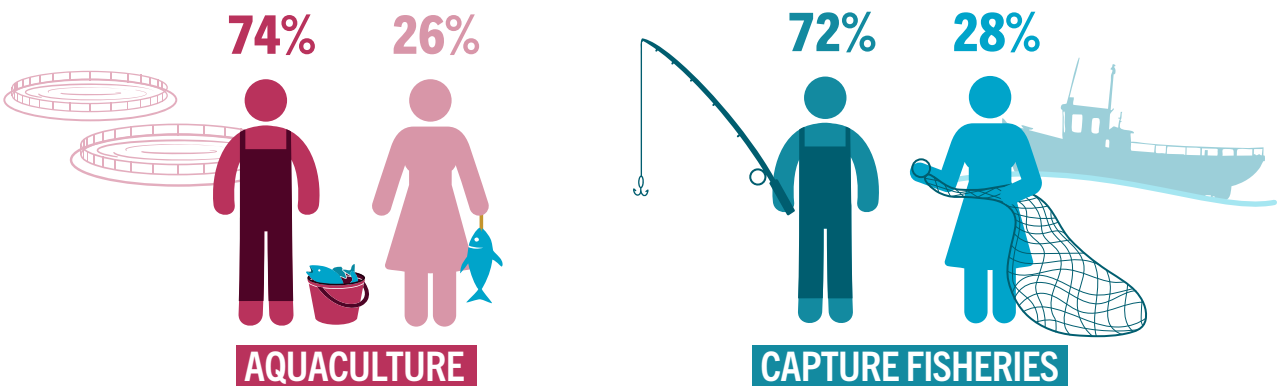
THE PEOPLE IN THE SECTOR – 2024

EMPLOYMENT IN THE PRIMARY SECTOR



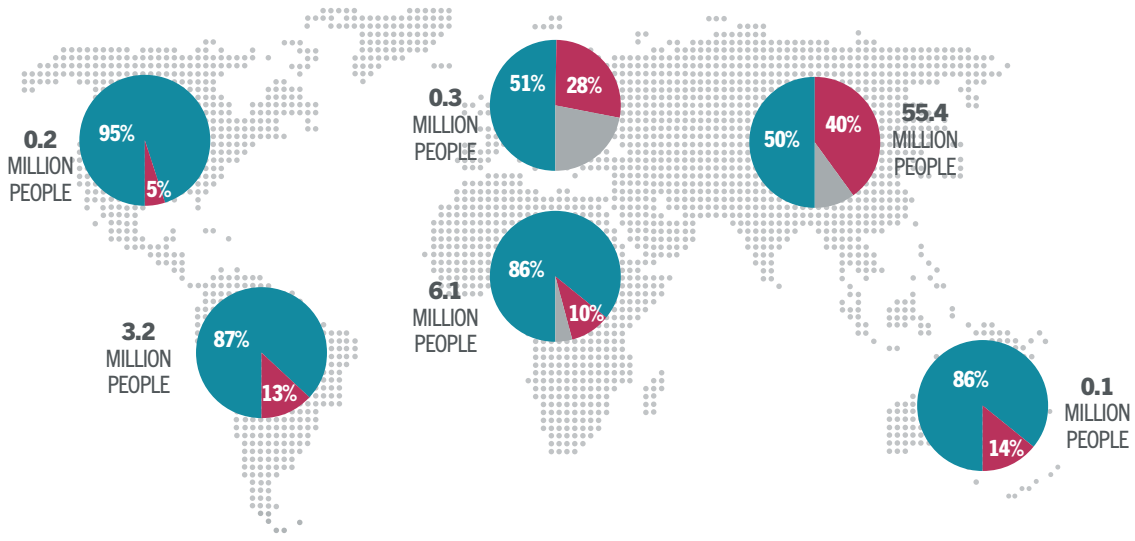
FISHERIES AND AQUACULTURE VALUE CHAINS SUPPORT THE **LIVELIHOODS OF 600 MILLION PEOPLE**

FISHERS AND FISH FARMERS: EMPLOYMENT DATA BY SEX



Shares are based on available sex-disaggregated employment data (coverage: 61% aquaculture; 71% capture fisheries).

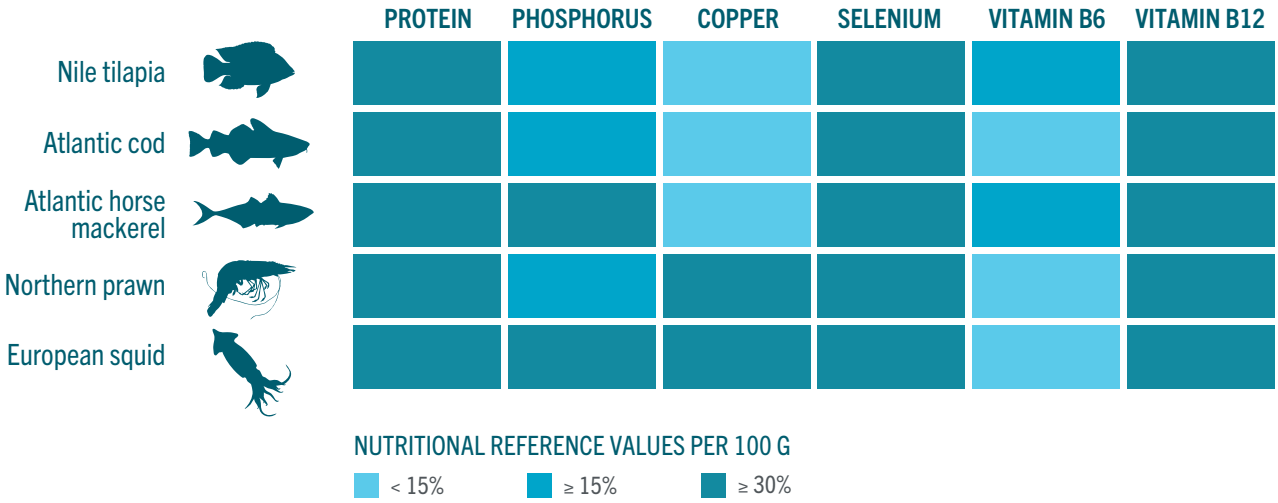
WHERE DO FISHERS AND FISH FARMERS WORK?



Figures in million people represent primary sector employment in fisheries and aquaculture by region.
Refer to the disclaimer on the copyright page for the names and boundaries used in this map.

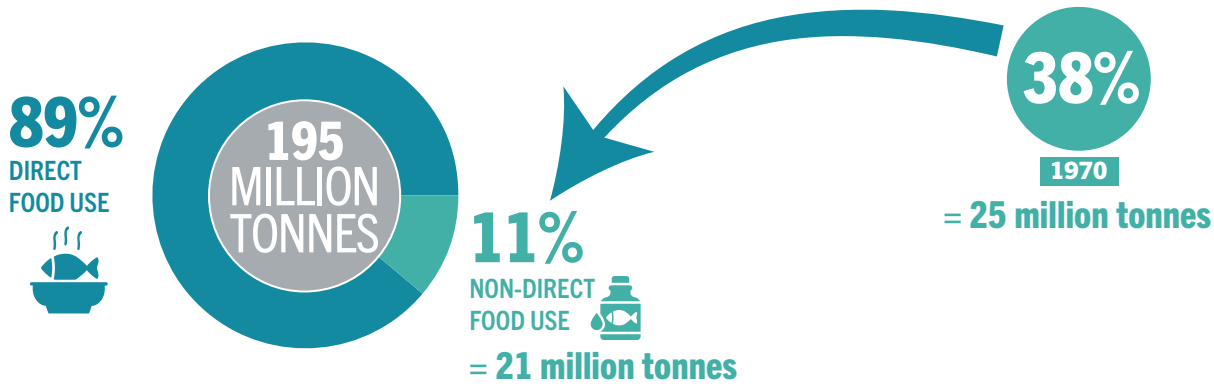
AQUATIC ANIMAL FOODS: NUTRITION, USE AND AVAILABILITY

NUTRIENT LEVELS

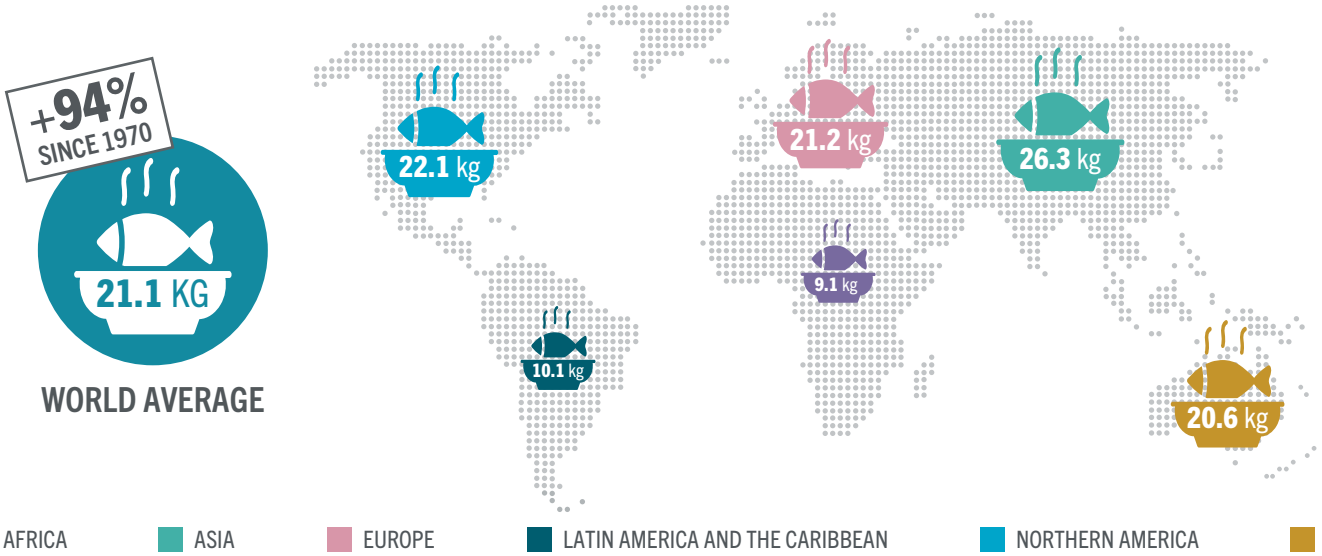


See Box 1.7 for further details.

USE OF AQUATIC ANIMAL PRODUCTION: DIRECT VS NON-DIRECT FOOD USE – 2024



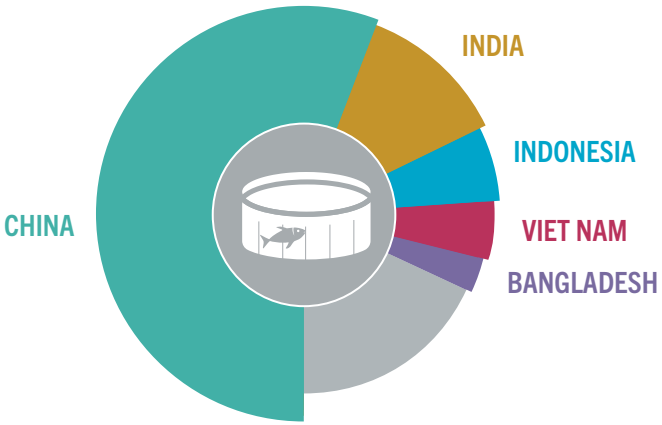
WHERE IS AQUATIC ANIMAL FOOD MORE AVAILABLE (PER CAPITA)? – 2023



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TOP PRODUCERS – 2024

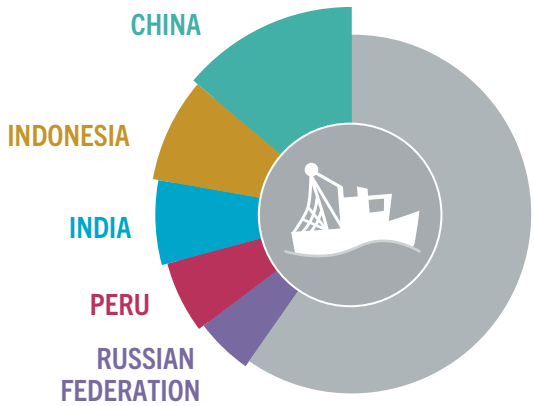
AQUACULTURE: WHO ARE THE WORLD'S LEADING PRODUCERS OF AQUATIC ANIMALS?



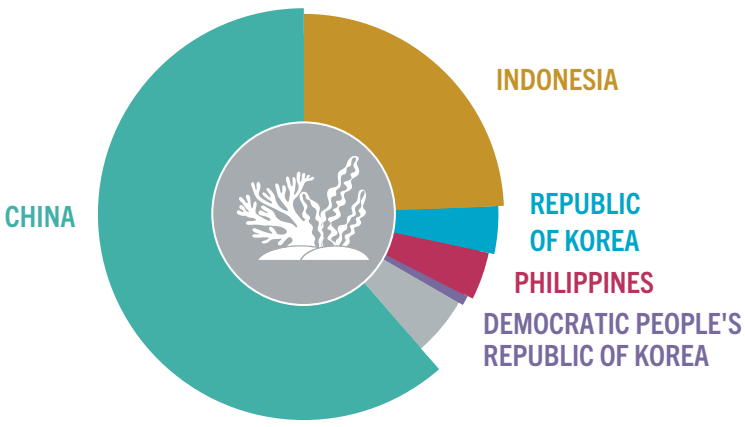
TOP FIVE PRODUCERS ACCOUNT FOR **82%** OF GLOBAL PRODUCTION

CAPTURE FISHERIES: WHO ARE THE WORLD'S LEADING PRODUCERS OF AQUATIC ANIMALS?

TOP FIVE PRODUCERS ACCOUNT FOR **41%** OF GLOBAL PRODUCTION



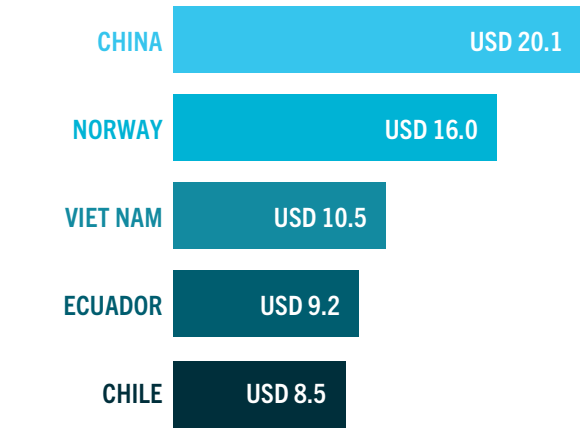
FISHERIES AND AQUACULTURE: WHO PRODUCES MOST OF THE WORLD'S ALGAE?



TOP FIVE PRODUCERS ACCOUNT FOR **95%** OF GLOBAL PRODUCTION

TRADE OF AQUATIC ANIMAL PRODUCTS AND FOOD AVAILABILITY

TOP FIVE EXPORTING COUNTRIES OF AQUATIC ANIMAL PRODUCTS (BILLIONS) – 2024

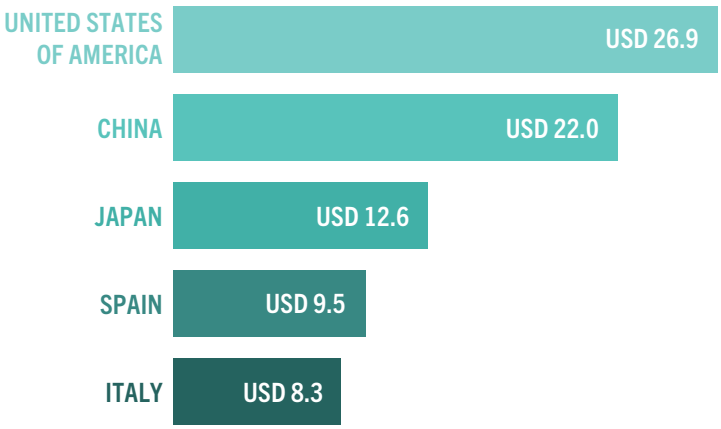


TOP FIVE SHARE OF GLOBAL EXPORTS



35%

TOP FIVE IMPORTING COUNTRIES OF AQUATIC ANIMAL PRODUCTS (BILLIONS) – 2024

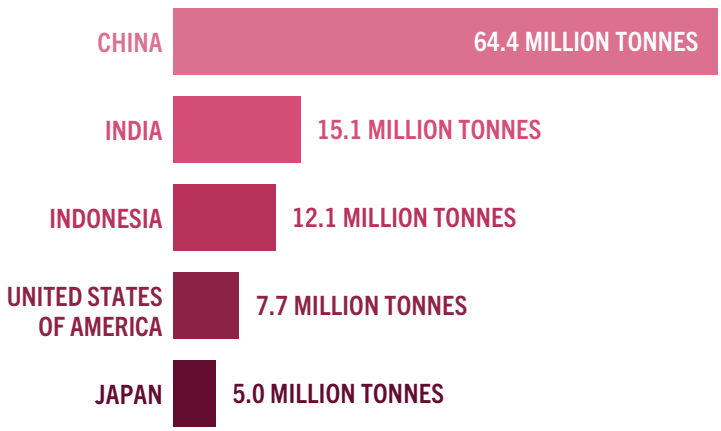


TOP FIVE SHARE OF GLOBAL IMPORTS

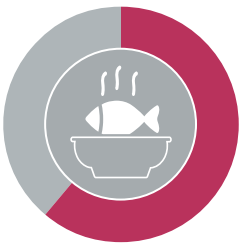


43%

TOP FIVE COUNTRIES BY AQUATIC ANIMAL FOOD AVAILABILITY – 2023



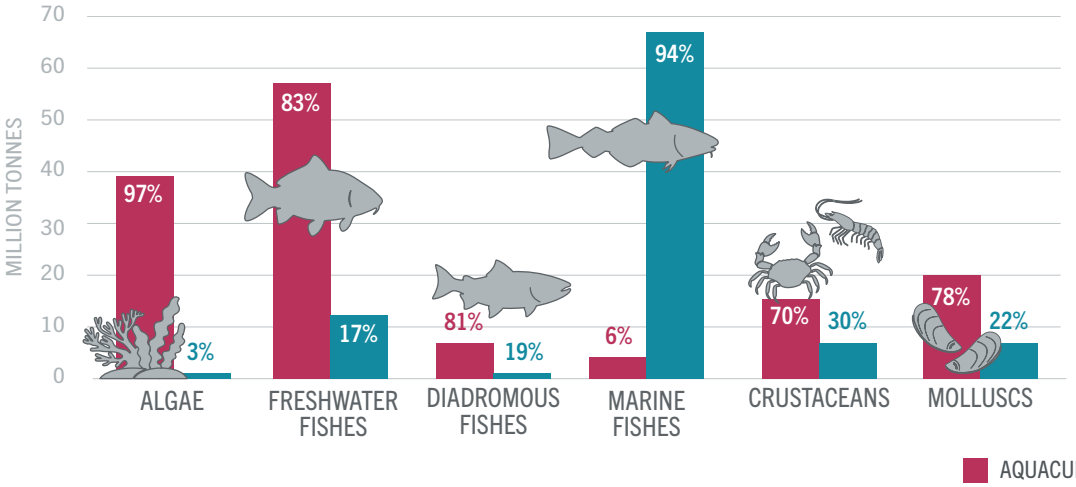
TOP FIVE SHARE OF GLOBAL AVAILABILITY



61%

AQUATIC PRODUCTION AND BIODIVERSITY – 2024

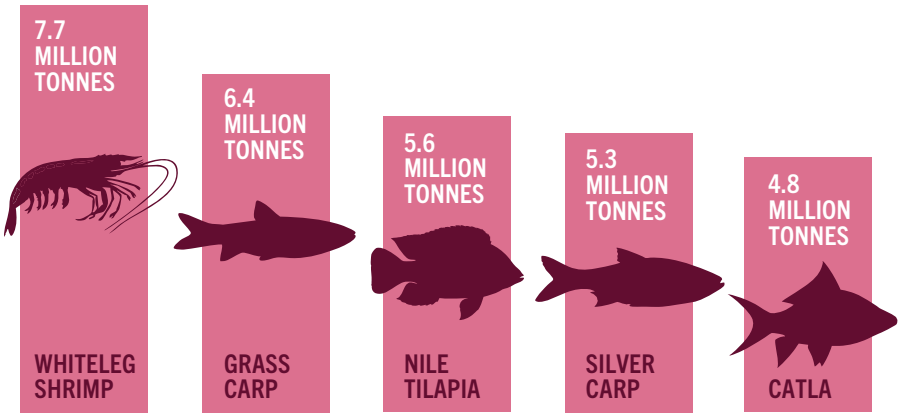
GLOBAL AQUACULTURE AND CAPTURE FISHERIES PRODUCTION BY SPECIES GROUP



770
SPECIES FARMED

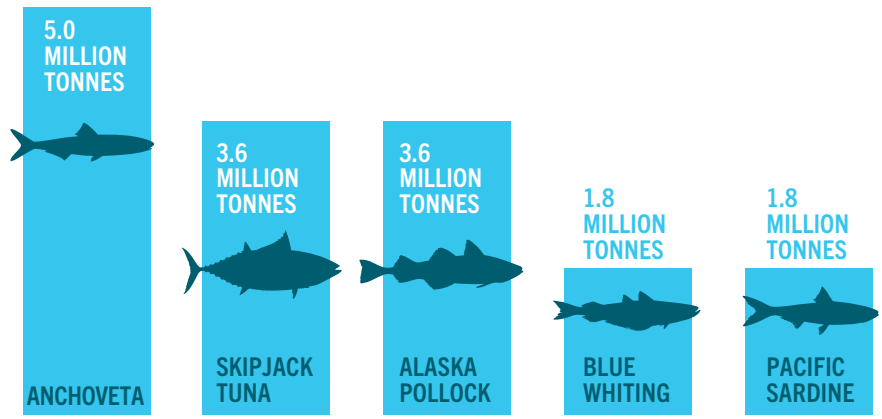
3 900
SPECIES FISHED

TOP SPECIES IN AQUACULTURE PRODUCTION (AQUATIC ANIMALS)



THESE FIVE SPECIES ACCOUNT FOR
29%
OF GLOBAL AQUACULTURE PRODUCTION

TOP SPECIES IN CAPTURE FISHERIES PRODUCTION (AQUATIC ANIMALS)

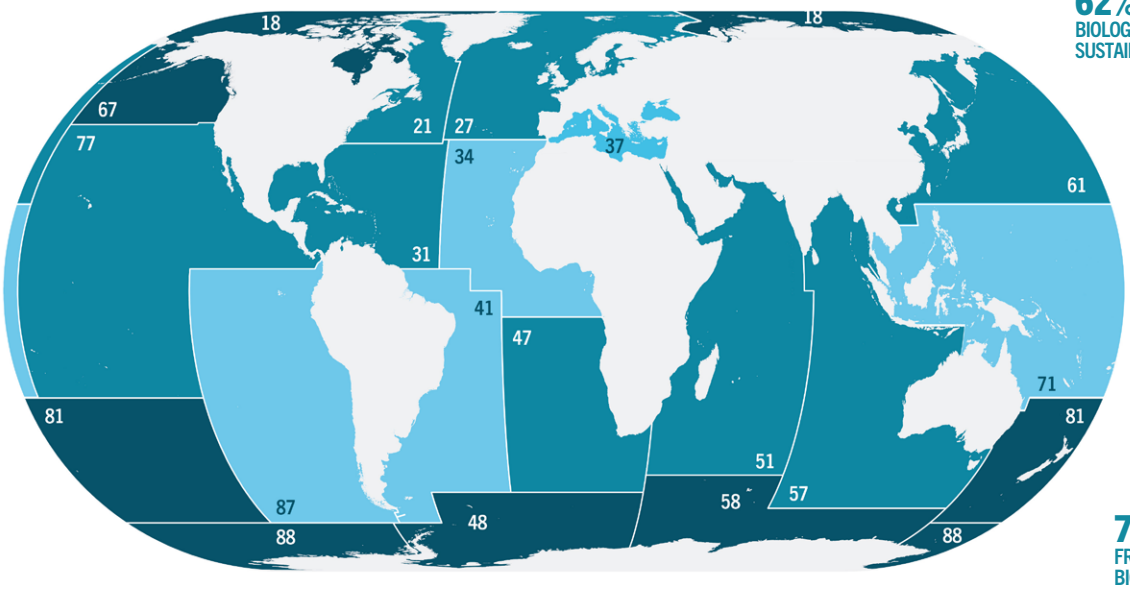


THESE FIVE SPECIES ACCOUNT FOR
17%
OF GLOBAL CAPTURE FISHERIES PRODUCTION

THE STATE OF FISHERY RESOURCES

MARINE FISHERY: SHARE OF BIOLOGICAL SUSTAINABLE STOCKS – 2023

2 665 ASSESSED STOCKS

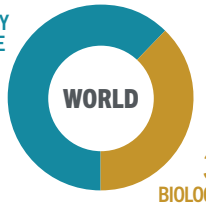


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BY FAO MAJOR FISHING AREA

40–55% 56–70% 71–85% 86–100%

BY NUMBER



62% BIOLOGICALLY SUSTAINABLE

38% BIOLOGICALLY UNSUSTAINABLE

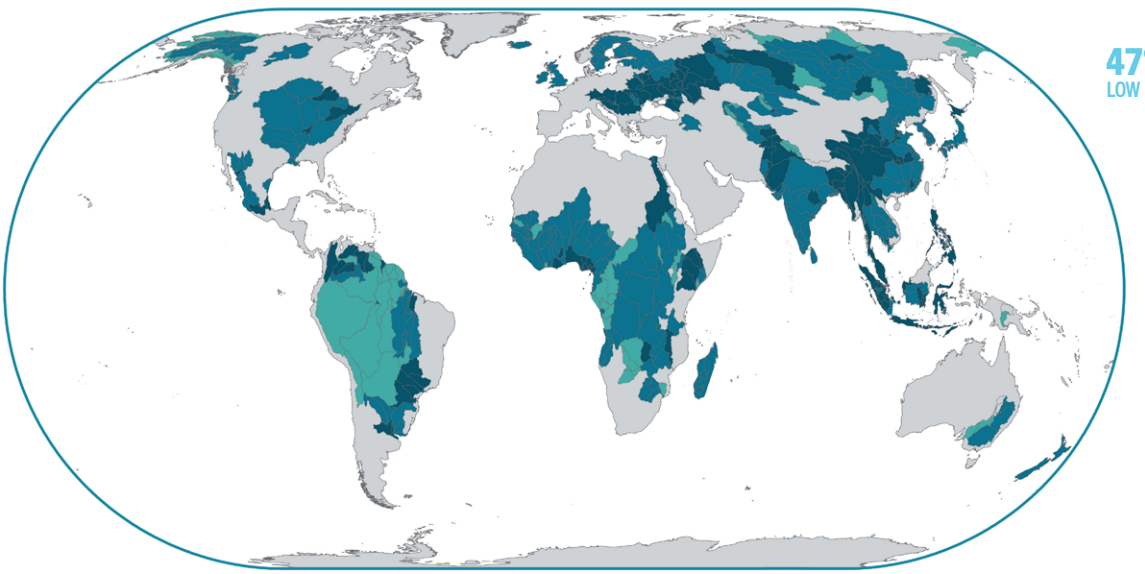
BY LANDINGS



73% FROM BIOLOGICALLY SUSTAINABLE STOCKS

27% FROM BIOLOGICALLY UNSUSTAINABLE STOCKS

INLAND FISHERIES: DOMINANT THREATS AND PRESSURE LEVELS ON MAJOR BASINS – 2024

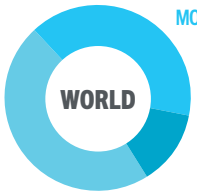


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DOMINANT THREATS BY MAJOR FISHING BASIN

HABITAT DEGRADATION POLLUTION CLIMATE CHANGE

40% MODERATE



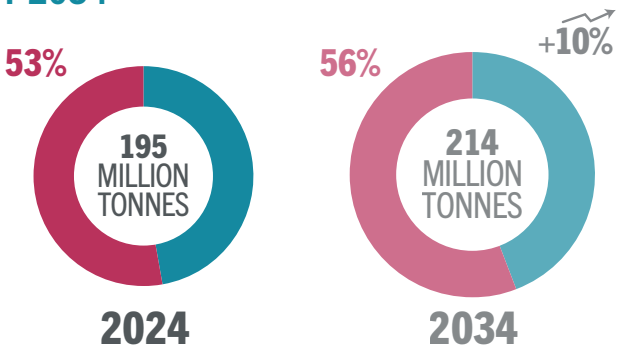
47% LOW

13% HIGH

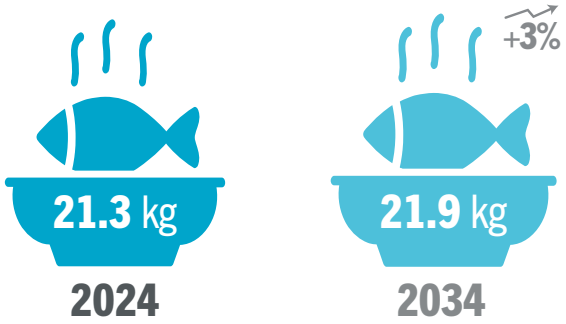
PRESSURE LEVELS ON MAJOR FISHING BASINS

THE FUTURE OF AQUATIC FOODS

AQUATIC ANIMAL PRODUCTION BY 2034

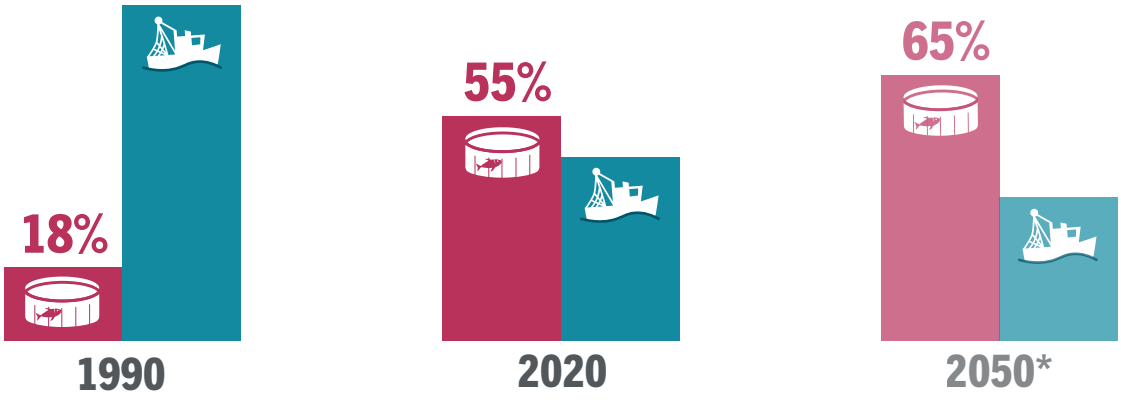


AQUATIC ANIMAL FOOD AVAILABILITY PER CAPITA BY 2034



AQUACULTURE CAPTURE FISHERIES

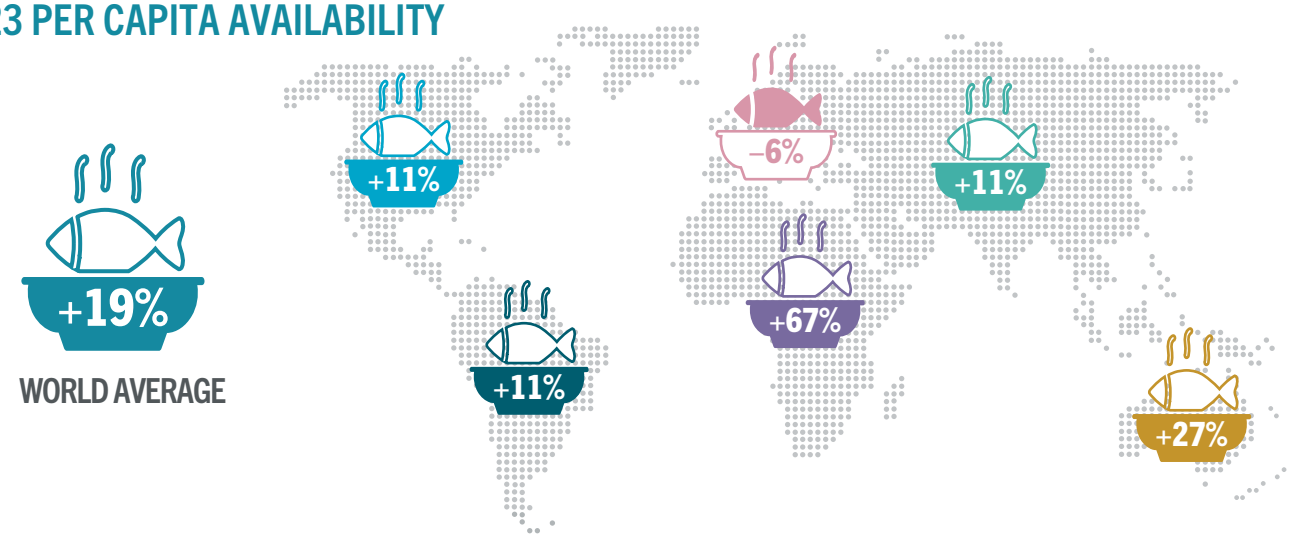
AQUACULTURE'S CONTRIBUTION TO AQUATIC ANIMAL FOOD AVAILABILITY BY 2050



AQUACULTURE CAPTURE FISHERIES

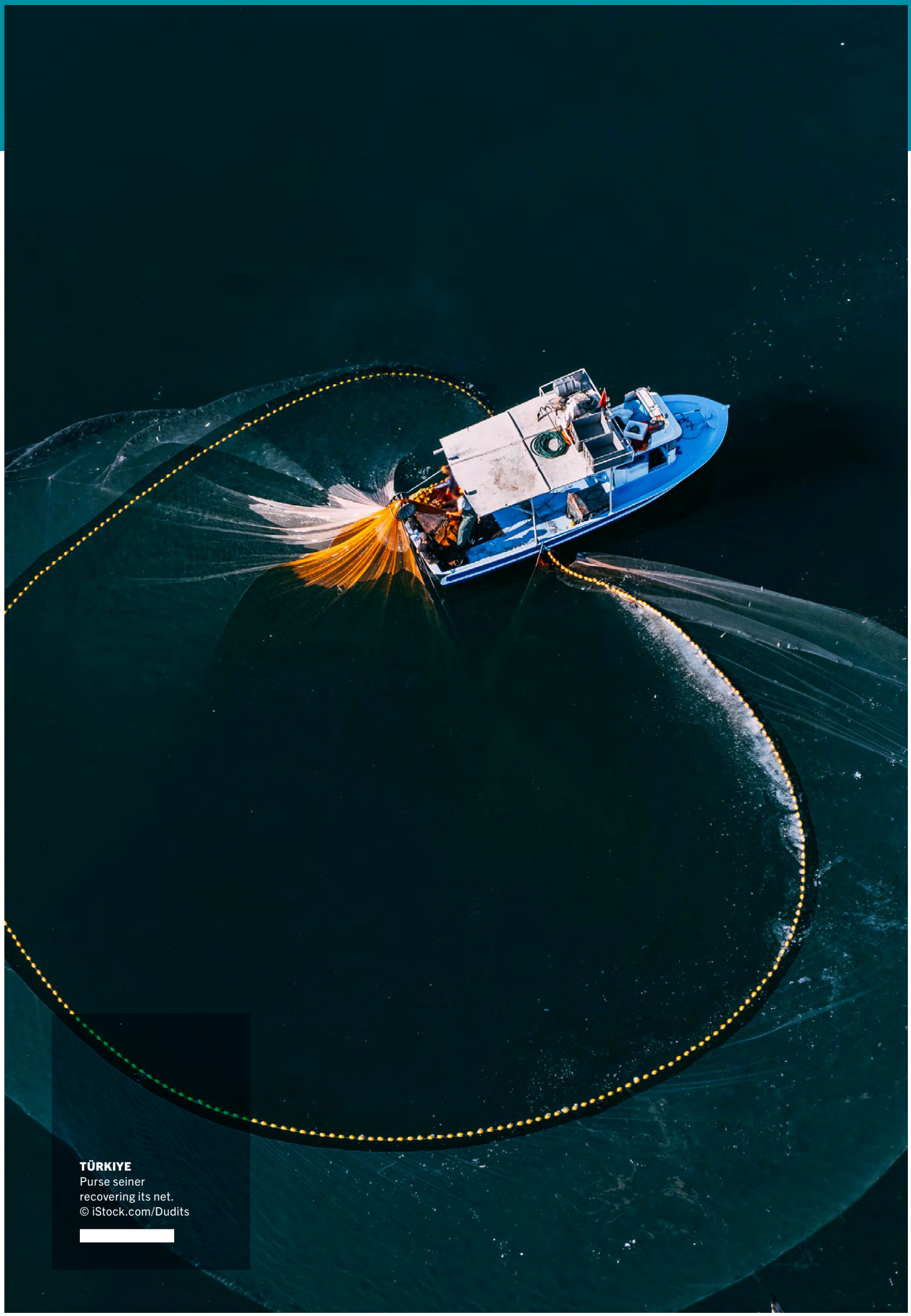
* Estimated share if all growth in food availability comes from aquaculture.

2050: AQUATIC ANIMAL FOOD SUPPLY GROWTH NEEDED TO KEEP 2023 PER CAPITA AVAILABILITY



AFRICA ASIA EUROPE LATIN AMERICA AND THE CARIBBEAN NORTHERN AMERICA OCEANIA

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TÜRKIYE
Purse seiner recovering its net.
© iStock.com/Dudits

PART 1
WORLD REVIEW

GLOBAL FISHERIES AND AQUACULTURE AT A GLANCE

Aquatic food systems represent a viable solution to sustain healthy diets and livelihoods, improve global food security and nutrition, and preserve the aquatic environment and its biodiversity, including ecosystems. Nevertheless, aquatic life and the ocean's well-being continue to face mounting threats from climate change, pollution and ecosystem degradation, as well as from complex socioeconomic and geopolitical crises. Despite this, decisive action can reverse the trend, using innovations and technology, enhancing science- and knowledge-based management, and disseminating, scaling up and replicating successes.

Implementation of the FAO Strategic Framework 2022–2031 is built around 20 Programme Priority Areas (PPAs) that support the transformation to more efficient, inclusive, resilient and sustainable agrifood systems. In 2021, FAO launched the Blue Transformation PPA and Roadmap to respond to the international community's call for accelerating global aquatic food systems transformation in support of achieving the relevant targets of the 2030 Agenda for Sustainable Development. The Blue Transformation Roadmap[d] aims to support sustainable aquaculture intensification and expansion, effective management of global fisheries, and upgrading of aquatic food value chains.

d See: https://openknowledge.fao.org/server/api/core/bitstreams/2f12c8a2-fc0a-4569-bb97-6b5dbf5b6fbe/content

The State of World Fisheries and Aquaculture 2026 presents updated and verified statistics on global fisheries and aquaculture, showcasing FAO's work to translate the Blue Transformation's vision into impact, sharing successful initiatives deployed in the field to accelerate sustainable transformation of global aquatic food systems. With FAO's strengthened data collection and analytical frameworks, this edition sheds new light on global aquaculture and capture fisheries production, enhancing our understanding of their status, management and landings, and of the utilization and trade of aquatic products.

Global production of aquatic animals reached a new world high of 195 million tonnes (live weight equivalent) in 2024, an increase of 5.1 percent from 2022. At 103 million tonnes, aquaculture production surpassed a symbolic 100 million tonnes milestone, reinforcing its role as the major source of global aquatic animals (53 percent of the total), with capture fisheries accounting for the remaining 92 million tonnes (47 percent). Production from marine areas was 118 million tonnes (61 percent of the total), of which 67 percent was from capture fisheries and 33 percent from aquaculture. Inland waters produced 77 million tonnes (39 percent of the total), with 84 percent from aquaculture and 16 percent from capture fisheries (Table 1.1 and Figure 1.1). In addition, 40 million tonnes of algae were produced in 2024, an increase of 5.8 percent from 2022. The majority of global algae production (97 percent) came from aquaculture.

The first sale value of the 2024 global production of aquatic animals was estimated at USD 545 billion, of which USD 371 billion for aquaculture.

TABLE 1.1 WORLD FISHERIES AND AQUACULTURE TRENDS AT A GLANCE

	1990s	2000s	2010s	2022	2023	2024
	Average per year					
	(million tonnes, live weight equivalent)					
Production						
Aquaculture						
Inland	12.6	25.6	44.9	59.2	61.6	64.3
Marine	9.4	18.0	26.8	35.5	37.2	38.3
Total aquaculture	**22.0**	**43.6**	**71.7**	**94.7**	**98.8**	**102.7**
Capture fisheries						
Inland	7.1	9.3	11.3	11.4	12.1	12.3
Marine	81.9	81.6	79.7	79.0	78.4	79.6
Total capture fisheries	**88.9**	**90.9**	**91.1**	**90.4**	**90.4**	**91.9**
Total world fisheries and aquaculture	**110.9**	**134.4**	**162.7**	**185.1**	**189.3**	**194.6**
Utilization*						
Food	82.0	109.6	143.4	165.6	170.5	173.7
Non-food	28.9	24.8	19.3	19.5	18.8	20.8
Food per capita (kg)	14.3	16.7	19.3	20.7	21.1	21.3
Trade**						
Exports – in quantity	39.7	51.7	61.6	69.7	66.7	70.1
Share of exports in total production	*35.5%*	*38.2%*	*37.6%*	*37.5%*	*35.1%*	*35.9%*
Exports – in value (USD billion)	46.6	76.4	142.0	189.6	182.7	184.0
Direct employment (millions of people)***						
Aquaculture	12.1	15.9	21.7	22.1	23.0	23.1
Capture fisheries	24.1	28.9	32.1	35.4	36.0	36.2
Unspecified	7.1	6.6	6.9	6.1	6.0	6.0
Fishing fleet (millions of vessels)****						
Fishing fleet	4.6	4.8	5.0	4.7	4.7	4.7

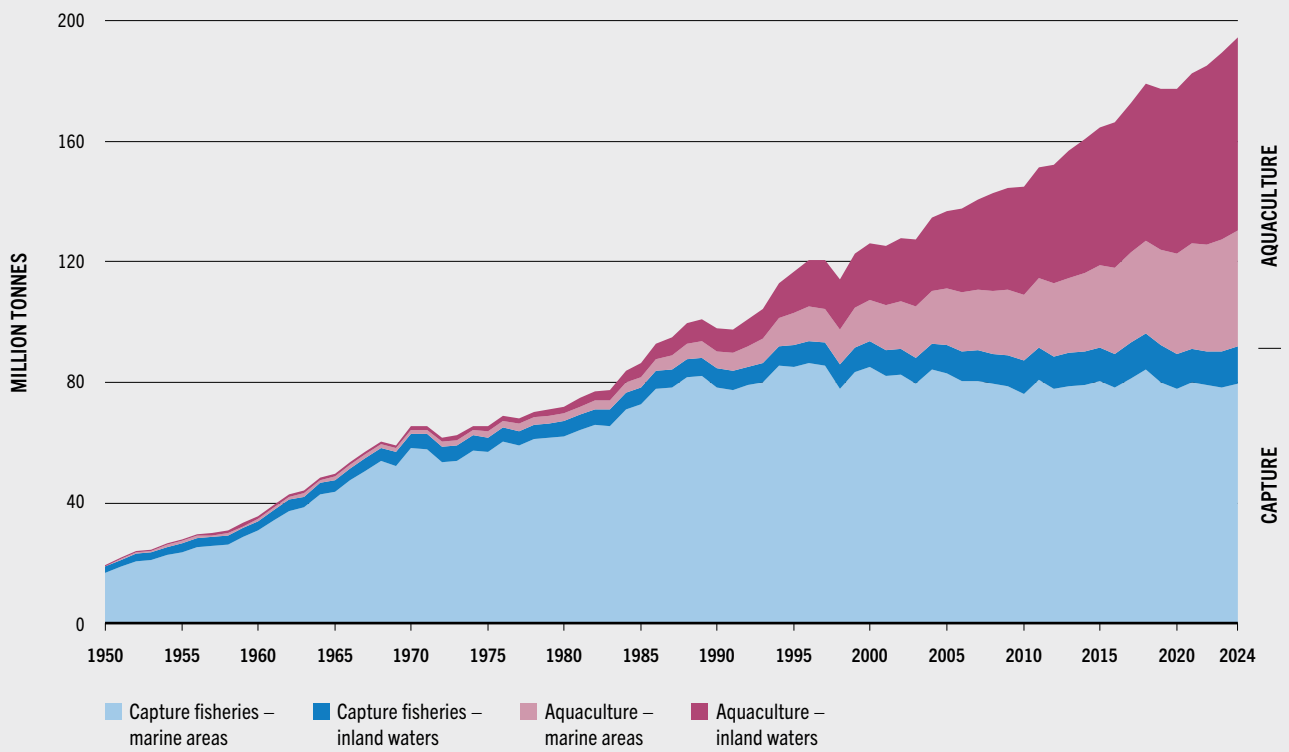
NOTES: Data on production, utilization and trade refer to aquatic animals, excluding aquatic mammals, crocodiles, alligators, caimans, aquatic products (corals, pearls, shells and sponges) and algae. Data may not match totals due to rounding. * Utilization data for 2022–2024 are provisional estimates. These data might differ from those presented in the aquatic food availability section as they do not take into account trade. ** Exports include re-exports. Share of exports in total production is calculated excluding re-exports. Trade data do not include frogs and turtles. *** Direct employment does not include the number of people engaged in the post-harvest sector. Figures for the 1990s are based on 1995–1999 data. **** Fishing fleet figures for the 1990s are based on 1995–1999 data.

SOURCES: For production: FAO. 2026. FishStat: Global production by production source 1950-2024. [Accessed on 28 March 2026]. In: *FishStatJ*. Available at: https://www.fao.org/fishery/en/statistics/software/fishstatj. Licence: CC-BY-4.0. For trade: Preliminary data. Final data will be available here: FAO. 2026. Global aquatic trade statistics. https://www.fao.org/fishery/en/collection/global_commodity_prod. Licence: CC-BY-4.0. For utilization, employment and fleet: Preliminary data. Final data will be available here: FAO. (forthcoming). *Fishery and Aquaculture Statistics – Yearbook 2024*. FAO Yearbook of Fishery and Aquaculture Statistics. Rome. https://www.fao.org/fishery/en/statistics/yearbook. Population data are based on UN DESA. 2024. World Population Prospects 2024. [Accessed on 10 October 2024]. https://population.un.org/wpp. Licence: CC-BY-3.0-IGO.

https://doi.org/10.4060/cd8357en-table1.1

Approximately 174 million tonnes (live weight equivalent), representing 89 percent of global aquatic animal production, were destined for direct human consumption in 2024. The remaining 11 percent (about 21 million tonnes) was for non-food uses, mainly fishmeal and fish oil (Figure 1.2). The volume of aquatic animal production available for direct human consumption worldwide continued to grow, driven by increasing demand for aquatic animal foods, together with technological developments enabling their increased availability for human consumption.

FIGURE 1.1 WORLD FISHERIES AND AQUACULTURE PRODUCTION OF AQUATIC ANIMALS



NOTES: Aquatic animals exclude aquatic mammals, crocodiles, alligators, caimans, aquatic products (corals, pearls, shells and sponges) and algae. Data are expressed in live weight equivalent.

SOURCE: FAO. 2026. FishStat: Global production by production source 1950-2024. [Accessed on 28 March 2026]. In: *FishStatJ*. Available at: https://www.fao.org/fishery/en/statistics/software/fishstatj. Licence: CC-BY-4.0.

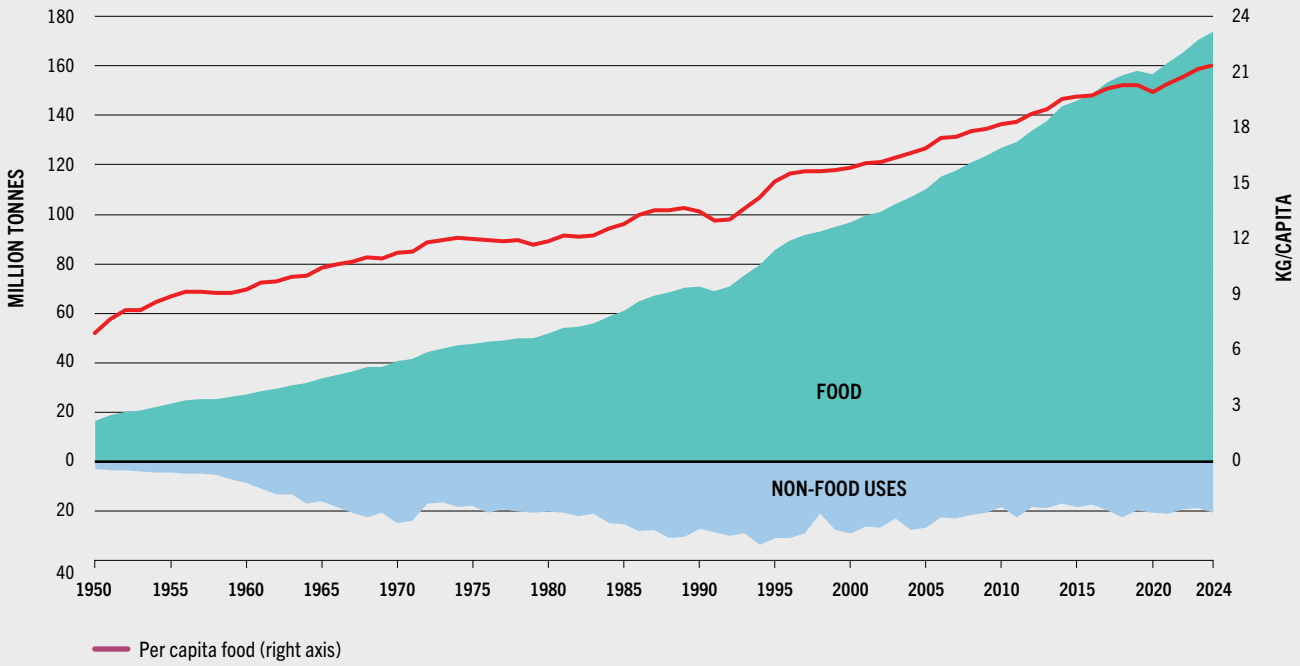
https://doi.org/10.4060/cd8357en-fig1.1

Globally, average per capita availability of aquatic animal foods was estimated at 21.1 kg (live weight equivalent) in 2023, with preliminary data indicating an increase to 21.3 kg in 2024, alongside pronounced regional variations and even more striking differences at country level. In 2023, average per capita aquatic animal food availability ranged from 9.1 kg in Africa to 26.3 kg in Asia. Northern America (22.1 kg), Europe (21.2 kg) and Oceania (20.6 kg) recorded similar levels, while Latin America and the Caribbean lagged behind with 10.1 kg per capita.

In 2023, aquatic animal foods contributed at least 20 percent of the per capita protein availability from all animal sources to 3.1 billion people, that is over 40 percent of the world's population. Globally, aquatic animal foods contributed 15 percent of animal protein availability and 6 percent of all protein availability. Together, these trends underscore the role of fisheries and aquaculture in supporting healthy diets and nutrition.

International trade in aquatic products reached USD 186 billion in 2024, involving 230 countries and territories, which traded mostly (USD 184 billion or 99 percent) in aquatic animal products. Approximately 36 percent of global aquatic animal production was traded in 2024; this underscores the sector's integration into global markets and its openness to international

FIGURE 1.2 UTILIZATION OF WORLD FISHERIES AND AQUACULTURE PRODUCTION OF AQUATIC ANIMALS



NOTES: Aquatic animals exclude aquatic mammals, crocodiles, alligators, caimans, aquatic products (corals, pearls, shells and sponges) and algae. Data are expressed in live weight equivalent.

SOURCES: Preliminary data. Final data will be available here: FAO. (forthcoming). *Fishery and Aquaculture Statistics – Yearbook 2024*. FAO Yearbook of Fishery and Aquaculture Statistics. Rome. https://www.fao.org/fishery/en/statistics/yearbook; population data based on UN DESA. 2024. World Population Prospects 2024. [Accessed on 10 October 2024]. https://population.un.org/wpp. Licence: CC-BY-3.0-IGO.

trade, as well as the contribution of aquatic animal products to global food security. Globally, the value of trade in aquatic products accounted for 9 percent of total agricultural trade (excluding forestry) and about 1 percent of total merchandise trade. The value of trade in aquatic animal products was similar in magnitude to that in terrestrial meats.

The world fishing fleet was estimated at 4.7 million vessels in 2024, close to its 1996 level (4.6 million), but much lower than the 2012 peak of 5.2 million. Since then, a consistent downward trend in the number of fishing vessels has been reported in the world. The number of motorized vessels has increased over time to represent over two-thirds of the global fishing fleet in 2024 (3.4 million vessels), at the expense of non-motorized vessels.

In 2024, an estimated 65.3 million people were engaged in the primary sector of fisheries and aquaculture, 35 percent in aquaculture and 56 percent in capture fisheries, while the remaining 9 percent could not be separated between the two sectors due to insufficient data. Employment in the sector has been increasing over time, from 0.7 percent of the global population in 1995 to a peak of 0.83 percent in 2012, followed by marginal fluctuations. In 2024, Asia accounted for the vast majority (85 percent) of workers involved in fisheries and aquaculture, followed by Africa (9 percent) and Latin America and the Caribbean (5 percent), while Europe, Oceania and Northern America combined accounted for just 1 percent. ■

TOTAL FISHERIES AND AQUACULTURE PRODUCTION

Total fisheries and aquaculture production, including algae, recorded an all-time high of approximately 235 million tonnes in 2024, representing an increase of 5.2 percent compared to 2022. Aquaculture accounted for 60 percent of this total, confirming its position as the primary source of global aquatic production since 2013. Asian countries produced 76 percent of the overall total, followed by Latin America and the Caribbean (8 percent), Europe (7 percent), Africa (6 percent), Northern America (2 percent) and Oceania (1 percent).

Total production of aquatic animals reached a new high of 195 million tonnes (live weight equivalent) in 2024. Capture fisheries contributed 92 million tonnes, while aquaculture reached a new production record of 103 million tonnes, surpassing 100 million tonnes for the first time, and confirming its role as the main driver of growth in total aquatic animal production. This represents the highest level ever recorded for either sector, exceeding the previous capture fisheries peak of 96 million tonnes in 2018.

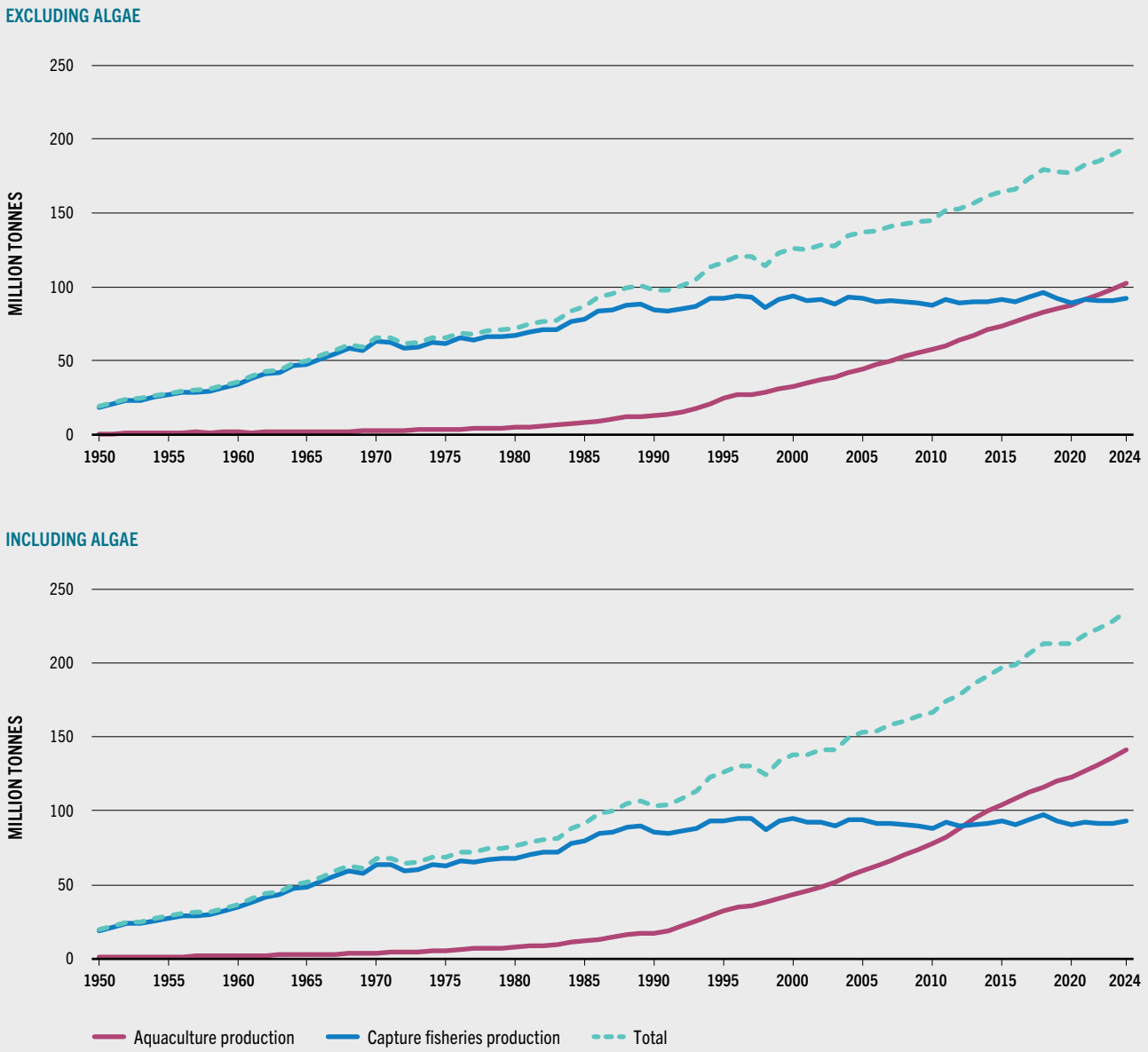
Global aquatic animal production continued the upward trajectory of the past 75 years. From just 19 million tonnes in 1950, production increased over tenfold, at an average annual growth rate of 3.2 percent. The total first sale value was estimated at USD 545 billion in 2024, of which USD 371 billion originated from aquaculture production.

This growth was punctuated by a few marginal declines. The most recent downturn occurred in 2019, when production was 0.8 percent lower than in 2018, and stagnated in 2020. These developments were mainly linked to a temporary decline in capture fisheries, driven by fluctuating catches of small pelagic species (particularly anchoveta, *Engraulis ringens*), reduced catches in China, and disruptions caused by the COVID-19 pandemic. From 2021 onwards, production growth resumed, reaching new highs for four consecutive years, albeit at a moderate pace, with annual increases of 3.1 percent in 2021, 1.3 percent in 2022, 2.2 percent in 2023 and 2.8 percent in 2024. These trends reflect a combination of relatively stable capture fisheries output, the continued expansion of aquaculture, and supply chains returning to normal following the COVID-19 pandemic. Interannual variations nevertheless result from environmental conditions, particularly in regions harvesting small pelagic species such as anchoveta.

Global capture fisheries production of aquatic animals has remained relatively stable since the late 1980s, generally ranging from 86 million tonnes to 94 million tonnes per year, except for an isolated peak of 96 million tonnes in 2018. This stability reflects both the biological limits of exploited stocks and the effects of fisheries management measures. Aquaculture, by contrast, has continued to expand, driving growth in total production during the same period, although at a moderate rate compared to earlier decades. The average annual growth rate of aquaculture production of aquatic animals declined from 9.8 percent in the 1990s to 6.1 percent in the 2000s, 4.4 percent in the 2010s and 4.0 percent in the early 2020s.[e] This deceleration reflects in part structural and policy orientations, including environmental protection measures in major producing countries (particularly China, the leading producer), as well as increasing competition with other users for land, water and suitable sites in traditional aquaculture regions. As a result, the relative contributions of capture fisheries and aquaculture to total aquatic production and total aquatic animal production have changed profoundly over time. Aquaculture accounted for only 4–5 percent of total aquatic animal production during the period 1950–1970. Its share rose rapidly from the 1990s, surpassing capture fisheries for the first time in 2021, having already surpassed capture fisheries in terms of total production (including algae) in 2013. In 2024, aquaculture accounted for 60 percent of total production (including algae) and 53 percent of total aquatic animal production (Figure 1.3).

e It is important to note that a lower growth rate does not imply declining production: percentage growth rates are typically higher at lower production levels and decrease as the production base expands.

FIGURE 1.3 WORLD FISHERIES AND AQUACULTURE PRODUCTION



NOTES: Aquatic animals exclude aquatic mammals, crocodiles, alligators, caimans, aquatic products (corals, pearls, shells and sponges) and algae. Data are expressed in live weight equivalent for aquatic animals and wet weight for algae.

SOURCE: FAO. 2026. FishStat: Global production by production source 1950-2024. [Accessed on 28 March 2026]. In: *FishStatJ*. Available at: https://www.fao.org/fishery/en/statistics/software/fishstatj. Licence: CC-BY-4.0.

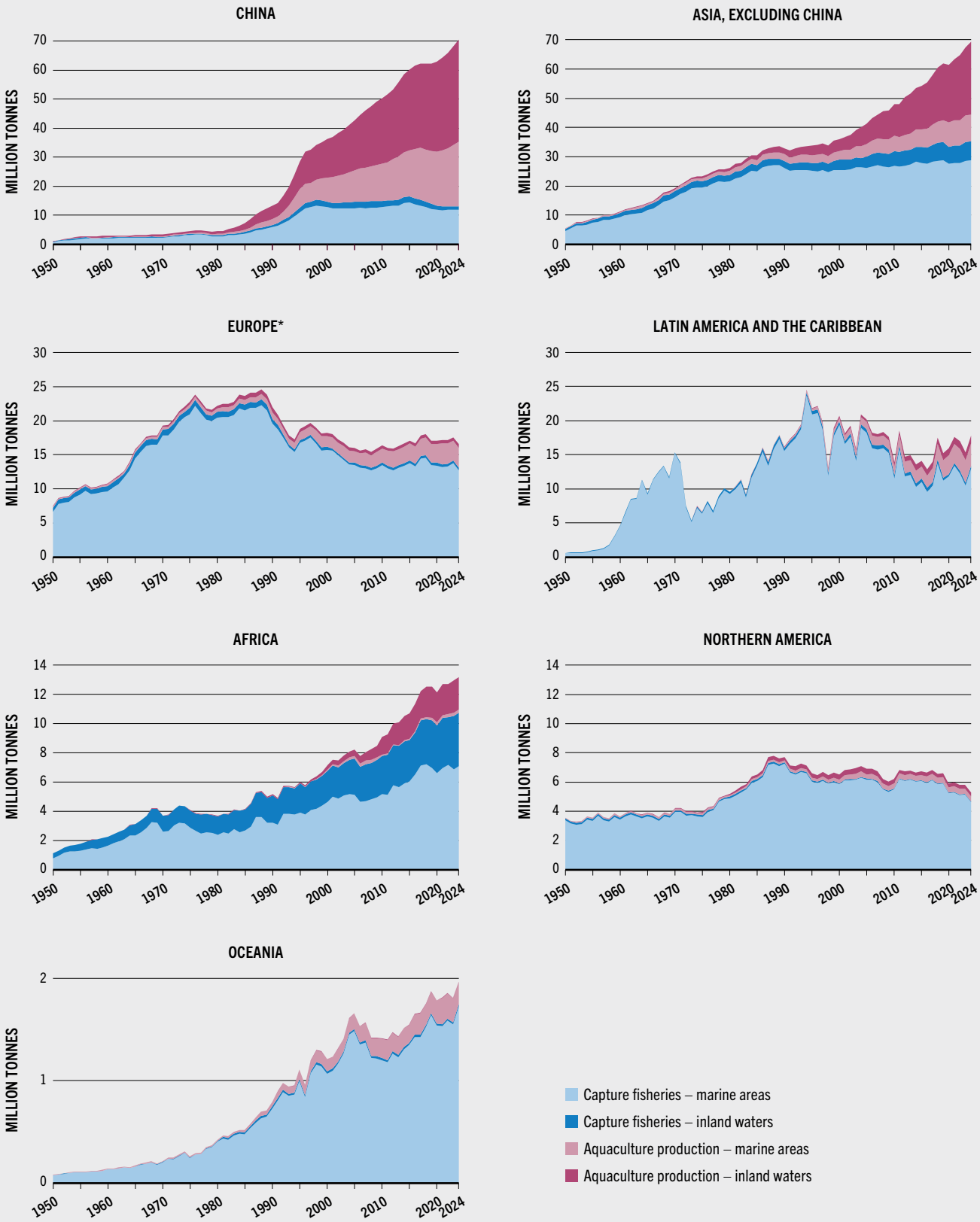
https://doi.org/10.4060/cd8357en-fig1.3

These global trends mask substantial variations across regions and countries (Figure 1.4). In 2024, Asian countries accounted for 72 percent of total aquatic animal production, followed by Latin America and the Caribbean (over 9 percent), Europe (about 9 percent), Africa (7 percent), Northern America (3 percent) and Oceania (1 percent).[f] Since 2000, total production has increased markedly in Asia and Africa, with, respectively, cumulative growth of 94 percent and 83 percent, corresponding to average annual growth rates of 2.8 percent and 2.6 percent. In contrast, production trends in Europe, Northern America, and Latin America and the Caribbean have been more variable, reflecting, in part, fluctuations in capture fisheries targeting highly variable stocks such as anchoveta in Latin America.

f The percentages do not add up to a total of 100 due to rounding.

»

FIGURE 1.4 WORLD FISHERIES AND AQUACULTURE PRODUCTION OF AQUATIC ANIMALS BY REGION, 1950–2024



NOTES: Aquatic animals exclude aquatic mammals, crocodiles, alligators, caimans, aquatic products (corals, pearls, shells and sponges) and algae. Data are expressed in live weight equivalent. Different scales are used to improve the readability of the trends. * Europe includes data for the former Soviet Union (USSR) for the years 1950–1991.

SOURCE: FAO. 2026. FishStat: Global production by production source 1950-2024. [Accessed on 28 March 2026]. In: *FishStatJ*. Available at: https://www.fao.org/fishery/en/statistics/software/fishstatj. Licence: CC-BY-4.0.

https://doi.org/10.4060/cd8357en-fig1.4

» In 2024, production remained concentrated among a limited number of countries, led by China with 36 percent of total aquatic animal production, followed by India (9 percent), Indonesia (7 percent), Viet Nam (5 percent) and Peru (3 percent). Together, these five countries accounted for 60 percent of global output. Over time, an increasing share of global production of aquatic animals has originated from non-high-income countries, rising from about one-third of the total in the 1950s to more than four-fifths in 2024. Upper-middle-income countries, including China, accounted for the largest share (54 percent) in 2024, followed by lower-middle-income (26 percent), high-income (18 percent) and low-income countries (2 percent).[g]

Production patterns differ markedly between marine areas and inland waters. Of total aquatic animal production in 2024, 61 percent (118 million tonnes) was harvested in marine areas and 39 percent (77 million tonnes) in inland waters. Marine production remained dominated by capture fisheries (67 percent), while inland production came overwhelmingly from aquaculture (84 percent). Aquaculture expansion over recent decades has been the main factor underpinning growth in inland waters production. Between the 1950s and the late 1980s, total production of aquatic animals in inland waters accounted for an average of around 12 percent of the total, rising to 18 percent in the 1990s, 26 percent in the 2000s and 34 percent in the 2010s.

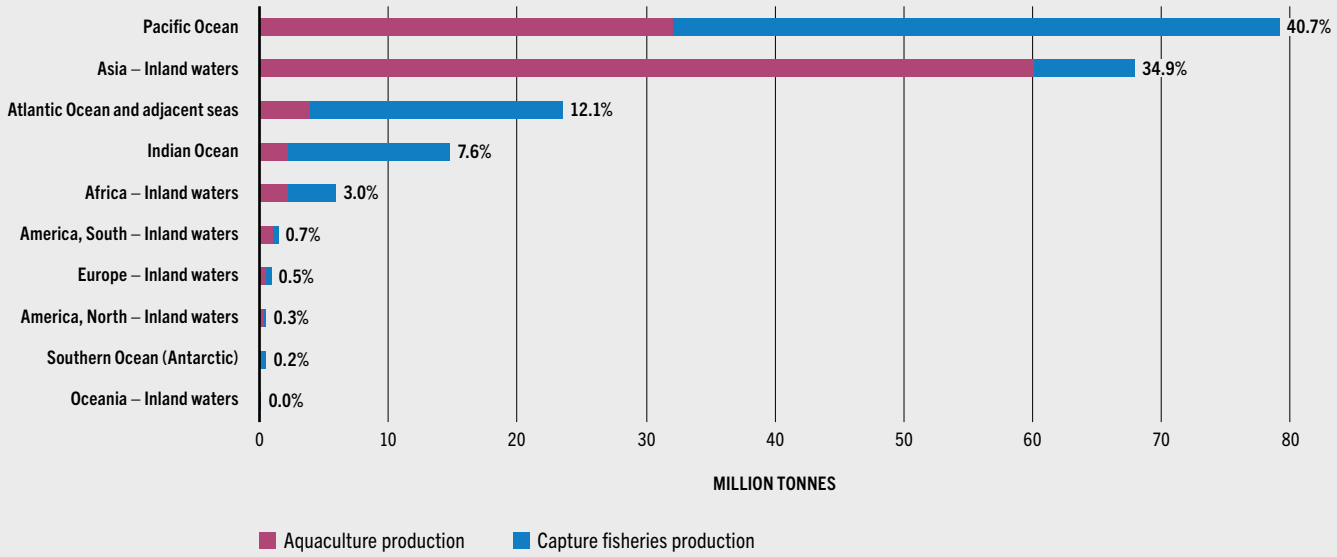
Despite this shift, marine capture fisheries remain the single largest source of production, accounting for 41 percent of total aquatic animal production in 2024, far below their 87 percent share during 1950–1980. Marine capture fisheries production has remained relatively stable since the late 1980s at around 80 million tonnes, with interannual fluctuations typically within a range of 3–4 million tonnes. Notably, capture fisheries production in inland waters reached its historical peak in 2024, at 12.3 million tonnes.

Marked differences also emerge depending on the FAO Major Fishing Area (Figure 1.5). Production levels vary widely across areas, reflecting differences in resource endowments, management regimes, fishing effort, the prevalence of illegal, unreported and unregulated (IUU) fishing, and species composition. Areas characterized by large stocks of small pelagic species continue to exhibit higher variability due to their sensitivity to climatic and environmental fluctuations, as for example illustrated by anchoveta fisheries in the Southeast Pacific (Area 87). In 2024, about 35 percent of total production originated from inland waters in Asia, 22 percent from the Northwest Pacific (Area 67) and 10 percent from the Western Central Pacific (Area 71). The Pacific Ocean accounted for the largest share of global production (41 percent), compared to 12 percent in the Atlantic Ocean and adjacent waters, reflecting a long-term shift from the Atlantic-dominated production patterns of the 1950s to the current predominance of the Pacific.

A wide diversity of aquatic animal species is harvested worldwide, with substantial regional differences and an evolving composition of species over time. Although finfish continue to dominate global output, their share has declined due to the rapid growth in aquaculture of molluscs and crustaceans. In 2024, finfish accounted for 75 percent of total aquatic animal production, compared to around 90 percent until the late 1970s. Marine fishes represented 49 percent of total finfish production and 36 percent of total aquatic animal production, whereas freshwater fishes accounted for, respectively, 46 percent and 34 percent. The rest of total aquatic animal production (5 percent) consisted of diadromous fishes. Among species groups, carps, barbels and other cyprinids remained dominant (19 percent), followed by miscellaneous freshwater species (12 percent), Clupeiformes, such as herrings, sardines and anchovies (9 percent), and marine shrimps and prawns (6 percent). The five leading aquatic animal species were whiteleg shrimp (*Penaeus vannamei*, 7.7 million tonnes), cupped oysters nei (*Crassostrea* spp., 7.3 million tonnes), grass carp (=White amur) (*Ctenopharyngodon idella*,

g Income group analysis in this publication follows the World Bank income classification (2026 revision), which groups economies into four categories: low, lower-middle, upper-middle and high income. Comparisons with historical periods have inherent limitations, as countries' income status evolves over time, and are therefore intended only to provide an indicative view of long-term trends. Additional information on the classification and country groupings is available at: https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups

FIGURE 1.5 WORLD FISHERIES AND AQUACULTURE PRODUCTION OF AQUATIC ANIMALS BY AREA AND RELATIVE SHARES OF WORLD PRODUCTION, 2024



NOTES: Aquatic animals exclude aquatic mammals, crocodiles, alligators, caimans, aquatic products (corals, pearls, shells and sponges) and algae. Data are expressed in live weight equivalent. Areas are based on FAO Major Fishing Areas.

SOURCE: FAO. 2026. FishStat: Global production by production source 1950-2024. [Accessed on 28 March 2026]. In: *FishStatJ*. Available at: https://www.fao.org/fishery/en/statistics/software/fishstatj. Licence: CC-BY-4.0.

https://doi.org/10.4060/cd8357en-fig1.5

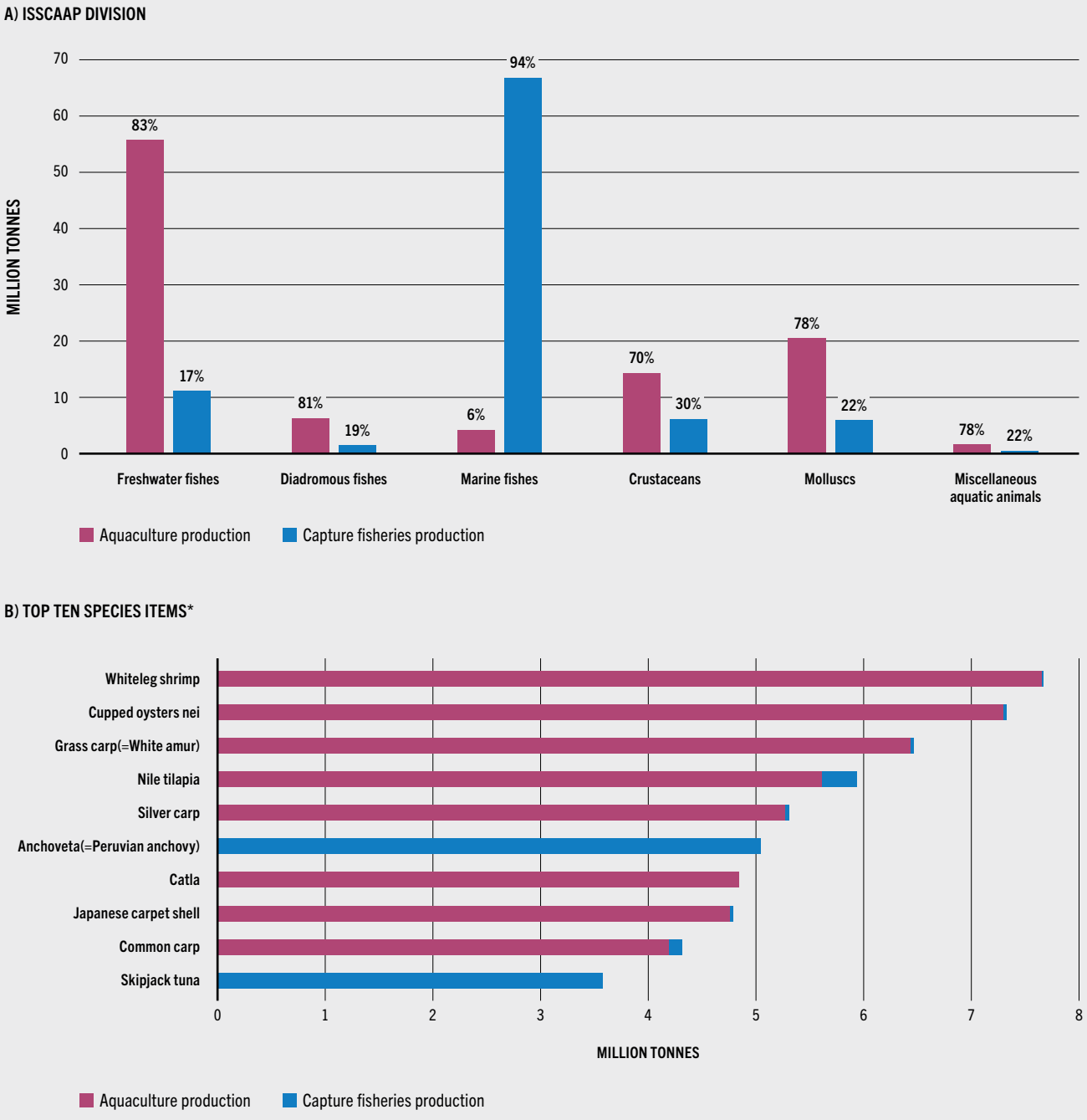
6.5 million tonnes), Nile tilapia (*Oreochromis niloticus*, 5.9 million tonnes) and silver carp (*Hypophthalmichthys molitrix*, 5.3 million tonnes). Aquaculture was the main source of production for most of these leading species, underscoring its increasing dominance in global supply and its key role in species diversification. At the same time, capture fisheries remain essential for the supply of certain species such as anchoveta (=Peruvian anchovy) (*Engraulis ringens*, 5.0 million tonnes), which is the largest wild caught species, ranking sixth in 2024 (Figure 1.6).

In addition to aquatic animals, global production of algae reached 40 million tonnes (wet weight) in 2024, produced mainly (97 percent) from aquaculture. This represents an increase of 5.8 percent compared to 2022, continuing the strong growth observed over the past decades. From less than 1 million tonnes in the 1950s, algae production rose to an average of 15 million tonnes in the 2000s and 30 million tonnes in the 2010s. Asian countries accounted for 97 percent of total algae production in 2024, with China alone producing about 25 million tonnes, 61 percent of the total, followed by Indonesia (25 percent), the Republic of Korea and the Philippines (4 percent each).

In 2024, approximately 17 900 tonnes of other aquatic products, including sponges, corals, shells and pearls, were harvested. In addition, production data were collected not by volume but by number of other aquatic species, such as crocodiles, alligators and aquatic mammals.

Overall, production data covering 75 years confirm the continued expansion and transformation of global fisheries and aquaculture (see Box 1.1). The sector is characterized by sustained growth, driven by aquaculture, with persistent regional and structural differences. While capture fisheries remain a vital component »

FIGURE 1.6 WORLD FISHERIES AND AQUACULTURE PRODUCTION OF AQUATIC ANIMALS BY ISSCAAP DIVISION AND TOP TEN SPECIES ITEMS, 2024



NOTES: ISSCAAP – International Standard Statistical Classification of Aquatic Animals and Plants; nei – not elsewhere included. Aquatic animals exclude aquatic mammals, crocodiles, alligators, caimans, aquatic products (corals, pearls, shells and sponges) and algae. Data are expressed in live weight equivalent. * Excluding species items "marine fishes nei" and "freshwater fishes nei".

SOURCE: FAO. 2026. FishStat: Global production by production source 1950-2024. [Accessed on 28 March 2026]. In: *FishStatJ*. Available at: https://www.fao.org/fishery/en/statistics/software/fishstatj. Licence: CC-BY-4.0.

https://doi.org/10.4060/cd8357en-fig1.6

BOX 1.1 SEVENTY-FIVE YEARS OF FAO FISHERIES AND AQUACULTURE STATISTICS

The release herein of the 2024 data marks 75 years of world fisheries and aquaculture statistics disseminated by FAO – a milestone reflecting the Organization's mandate to collect, compile, analyse and publish reliable data to support evidence-based policymaking on food security and sustainable resource management. Over time, this responsibility has evolved into the FishStat database, today recognized as the global reference for harmonized and comprehensive fisheries and aquaculture statistics, and the longest statistical time series in FAO.

Although the currently disseminated datasets start from 1950, FAO's statistical efforts began even earlier. The *Yearbook of Fisheries Statistics – 1947* was the first such yearbook published by FAO.* It covered data for a selection of countries from 1930 onwards on landings, trade, fishers and fleets. Its publication followed the recommendation of the First Session of the FAO Conference, asking FAO to publish a classified catalogue of fishery data, to be supplemented going forward.** That first yearbook already articulated challenges that remain central today: the necessity to compile statistics comparable across countries, using consistent definitions, and harmonized species names and fishing activities. The initial ambition became a reality through the years, with fully published records starting from 1950, providing a unique long-term perspective on the sector.

These FishStat time series reveal profound shifts in fisheries and aquaculture. Major growth in capture fisheries between the 1950s and the late 1980s was followed by an exponential rise in aquaculture. The ascent of aquaculture began in the 1980s, amid a geographical expansion of fishing effort, stabilization of fish landings, and growth in the sector's economic importance. Monitoring and reporting on these developments was possible thanks to sustained investments in statistical systems and international comparability.

In collaboration with Members and partners, FAO led the development of international statistical standards and classifications through the Coordinating Working Party on Fishery Statistics, established in 1960 and for which FAO serves as Secretariat. Key outputs include common classifications and statistical frameworks, such as the ASFIS species list with its three alpha codes and the FAO Major Fishing Areas, which have been essential for improving data consistency, ensuring comparability across countries and regions, and facilitating data exchange among national, regional and global institutions.

Over almost eight decades elaborating data, FAO fisheries and aquaculture statistics have expanded substantially in scope, depth and methodological robustness. FishStat today provides data for the full fisheries and aquaculture value chain, from production and utilization, to trade, employment and fishing fleets, as well as the FAO Fish Price Index. The availability of long, consistent time series has been critical not only for identifying structural changes and emerging trends, but also for highlighting persistent challenges related to data collection and quality.

The granularity of FAO fisheries and aquaculture statistics illustrates the progress achieved. Species coverage in production statistics has expanded from about 660 species items in the early 1950s to over 4 000 species items in 2024, including approximately 3 900 for capture fisheries and 770 for aquaculture. In parallel, FAO's validation procedures and metadata documentation have been progressively strengthened, improving transparency while also making remaining gaps and limitations more visible.

The quality of these global statistics ultimately hinges on national capacities. However, many countries continue to face difficulties in collecting basic data, particularly on inland, small-scale and recreational fisheries, employment, fleet and small-scale aquaculture. This highlights the need for investment in national statistical systems, training staff, improving survey designs and adopting cost-effective data collection methods. For decades, FAO has regularly supported Members in improving their capacity, developing methodologies for data collection and tailored fisheries information systems for the collection and analysis of the data. FAO's recently proposed global capacity building programme*** can provide structured and targeted support to Members. This is critical, since, first and foremost, countries need reliable statistics to adopt and enforce effective management and policy decisions.

FAO works closely with data providers using rigorous methods to validate country statistics; this strengthened engagement with Members has been central to continuous improvements. In 2022, FAO convened online regional meetings involving more than 700 national focal points for fisheries and

BOX 1.1 (Continued)

aquaculture statistics to better address national constraints. This dialogue was reinforced through regional training sessions on FAO fisheries and aquaculture questionnaires in September 2024, bringing together over 550 national correspondents. Reflecting sustained investments in methodology, data recovery and harmonization, FAO will, in 2026, disseminate for the first time a fully digitalized global dataset on employment in the primary sector of fisheries and aquaculture, significantly improving accessibility, consistency and analytical potential for this challenging statistical domain. In parallel, work is underway to develop a new generation of the FishStatJ platform, to further broaden access to fisheries and aquaculture statistics.

As FishStat marks its 75th anniversary, it is a moment for both reflection and reaffirmation. From a few tables compiled manually in the 1940s, FAO fisheries and aquaculture statistics have evolved into a multifaceted, digitally accessible knowledge base. This progress reflects FAO's continued commitment to working with Members and partners to produce accurate, reliable and transparent statistics, the dedication of countless national and regional statisticians, and a shared vision of global cooperation in support of sustainable fisheries and aquaculture governance and of the Blue Transformation agenda.



FAO Yearbooks of Fishery and Aquaculture Statistics

NOTES: * FAO. 1948. *Yearbook of Fisheries Statistics – 1947/Annuaire statistique des pêches – 1947*. Washington, DC. ** The report of the First Session of the FAO Conference is available at: https://www.fao.org/4/x5584e/x5584e00.htm. *** For further details, see: Committee on Fisheries: Sub-Committee on Fisheries Management. Second Session, 23–27 February 2026, Reykjavik, Iceland. Developing capacity for fisheries data collection and stock assessment: towards effective evidence-based fisheries management. Available at: https://openknowledge.fao.org/handle/20.500.14283/cd8071en

» of global production, their relatively stable output highlights the importance of accelerating their sustainable management. At the same time, aquaculture has significant opportunities to expand and intensify, particularly in regions such as Africa where the potential is still underexploited. To achieve this potential, appropriate policies, innovation, responsible practices and investment are essential to expand implementation of the Blue Transformation. ■

TABLE 1.2 WORLD AND REGIONAL AQUACULTURE PRODUCTION AND GROWTH, 2000–2024

	Africa	Asia	Europe	Latin America and the Caribbean	Northern America	Oceania	World
Aquatic animals*							
A. Production 2000 (tonnes)	400 623	28 542 330	2 050 808	839 279	584 495	121 824	32 539 359
B. Production 2024 (tonnes)	2 422 064	91 505 924	3 450 391	4 437 880	627 345	220 106	102 663 709
C. Overall growth 2000–2024 (tonnes)	2 021 441	62 963 593	1 399 583	3 598 601	42 850	98 282	70 124 350
D. Overall growth 2000–2024 (%)	504.6	220.6	68.2	428.8	7.3	80.7	215.5
E. Average annual growth rate 2000–2024	7.8	5.0	2.2	7.2	0.3	2.5	4.9
Algae**							
A. Production 2000 (tonnes)	51 642	10 489 062	6 040	33 582	0	16 424	10 596 750
B. Production 2024 (tonnes)	310 587	38 542 099	26 583	20 644	820	31 619	38 932 352
C. Overall growth 2000–2024 (tonnes)	258 945	28 053 037	20 543	–12 938	820	15 195	28 335 602
D. Overall growth 2000–2024 (%)	501.4	267.5	340.1	–38.5	n/a	92.5	267.4
E. Average annual growth rate 2000–2024	7.8	5.6	6.4	–2.0	n/a	2.8	5.6
Aquatic animals and algae combined							
A. Production 2000 (tonnes)	452 265	39 031 392	2 056 848	872 861	584 495	138 248	43 136 109
B. Production 2024 (tonnes)	2 732 651	130 048 023	3 476 974	4 458 524	628 165	251 725	141 596 061
C. Overall growth 2000–2024 (tonnes)	2 280 386	91 016 630	1 420 126	3 585 663	43 670	113 477	98 459 952
D. Overall growth 2000–2024 (%)	504.2	233.2	69.0	410.8	7.5	82.1	228.3
E. Average annual growth rate 2000–2024	7.8	5.1	2.2	7.0	0.3	2.5	5.1

NOTES: n/a – not applicable. * Aquatic animals exclude crocodiles, alligators, caimans, aquatic products (corals, pearls, shells and sponges) and algae. Data expressed in live weight equivalent. ** Algae include marine macroalgae (seaweeds), microalgae and cyanobacteria. Data are expressed in wet weight.

SOURCE: FAO. 2026. FishStat: Global production by production source 1950-2024. [Accessed on 28 March 2026]. In: *FishStatJ*. Available at: https://www.fao.org/fishery/en/statistics/software/fishstatj. Licence: CC-BY-4.0.

https://doi.org/10.4060/cd8357en-table1.2

AQUACULTURE PRODUCTION

Overall aquaculture production status and trends

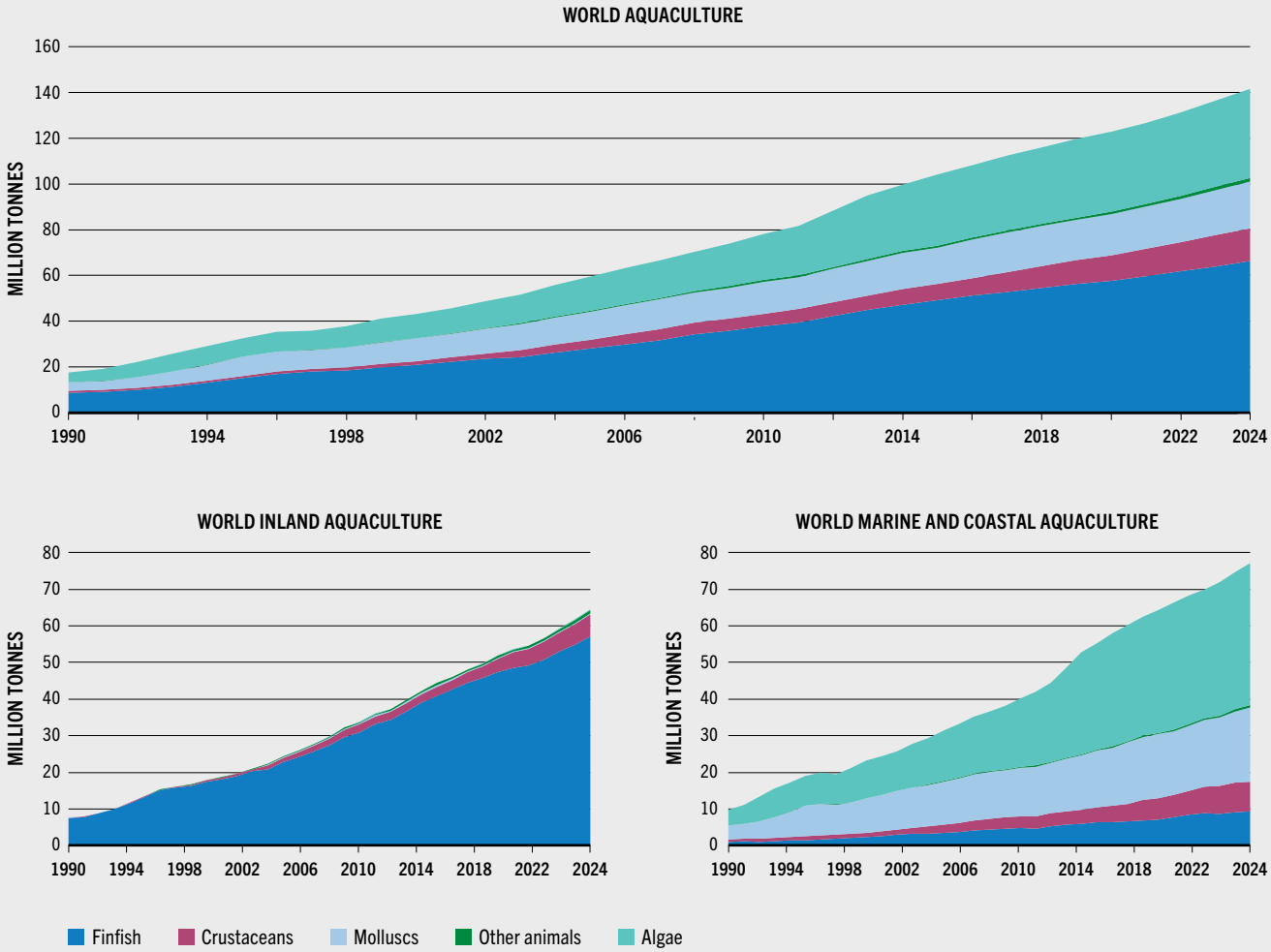
Global aquaculture production has expanded steadily since the start of this millennium, more than tripling from 43.1 million tonnes in 2000 to 141.6 million tonnes in 2024. This represents a total increase of 98.5 million tonnes, an overall gain of 228 percent and an average annual growth rate of 5.1 percent. Over the same period, the production of farmed aquatic animals grew by 70.1 million tonnes from 32.5 million tonnes, representing a 216 percent increase and an average yearly growth rate of 4.9 percent. Algae farming expanded even more rapidly, surging by 267 percent. However, there are significant regional disparities in both the scale of aquaculture production and the patterns of its development (Table 1.2).

The 2024 global aquaculture production of 141.6 million tonnes (live weight equivalent) had an estimated farm-gate value of USD 391.5 billion, an increase of 10.3 million tonnes and USD 39.8 billion from 2022.

In 2024, total aquaculture output comprised 102.7 million tonnes of aquatic animals (live weight equivalent), valued at USD 371.3 billion, and 38.9 million tonnes of algae (including seaweed and microalgae) (wet weight), valued at USD 19.9 billion, along with 11 000 tonnes of shells and pearls (USD 209.7 million).

Aquaculture production of aquatic animals increased by 7.9 million tonnes between 2022 and

FIGURE 1.7 WORLD AQUACULTURE PRODUCTION, 1990–2024



NOTES: Aquatic animals exclude aquatic mammals, crocodiles, alligators, caimans, sponges, corals, pearls and algae. Data are expressed in live weight equivalent for aquatic animals and wet weight for algae.

SOURCE: FAO. 2026. FishStat: Global aquaculture production 1950–2024. [Accessed on 28 March 2026]. In: *FishStatJ*. Available at: https://www.fao.org/fishery/en/statistics/software/fishstatj. Licence: CC-BY-4.0.

https://doi.org/10.4060/cd8357en-fig1.7

2024 – 5.1 million tonnes (64.4 percent) from inland aquaculture and 2.8 million tonnes (35.6 percent) from marine and coastal systems. Regionally, this expansion was driven mainly by Asia, which accounted for 7.8 million tonnes (97.7 percent) of the increase. Much smaller gains were recorded in Latin America and the Caribbean (125 900 tonnes, 1.6 percent), sub-Saharan Africa (104 800 tonnes, 1.3 percent) and Northern Africa (47 800 tonnes, 0.6 percent). In contrast, declines were observed in Europe (–52 500 tonnes, –0.7 percent), Oceania (–28 800 tonnes, –0.4 percent) and Northern America (–18 600 tonnes, –0.2 percent). By species group, the increase was led by finfish (4.5 million tonnes, 56.4 percent), followed by crustaceans (1.6 million tonnes, 19.7 percent), molluscs (1.5 million tonnes, 19.4 percent) and other aquatic animals (358 000 tonnes, 4.5 percent).

Global production of farmed algae, overwhelmingly dominated by seaweed, reached 38.9 million tonnes in 2024, an increase of 2.4 million tonnes from 2022. This growth was largely driven by China (1.9 million tonnes, 78.6 percent), followed by Indonesia (619 300 tonnes, 25.8 percent), the United Republic of Tanzania (132 200 tonnes, 5.5 percent) and Solomon Islands (18 600 tonnes, 0.8 percent). These gains more than offset declines (in descending order of magnitude) in the Philippines, Malaysia, Japan, the Republic of Korea and several smaller producers.

Figure 1.7 presents the distribution and production trends of the main farmed aquatic species groups with inland aquaculture separated from marine and coastal aquaculture since 1990.

Within each region, both the scale of production and the patterns of year-to-year variation vary across countries. Annual fluctuations at regional level shown in Figure 1.8 only cover the period 2001–2024.

Regional aquaculture production of aquatic animals and major producers

Global aquaculture production of aquatic animals remains highly concentrated, dominated by a small number of countries (Table 1.3). Within Asia, China alone accounted for 57.6 million tonnes, or 62.9 percent of the regional total in 2024, followed by India (13.2 percent), Indonesia (6.4 percent) and Viet Nam (6.2 percent), confirming the region's central role in global production. In the Americas, production totalled 5.1 million tonnes, led by Chile (27.8 percent), Ecuador (24.4 percent) and Brazil (17.4 percent). Europe produced 3.5 million tonnes, led by Norway (48.3 percent), far ahead of producers such as the Russian Federation or Spain. In Africa, production was heavily concentrated in Egypt (66.1 percent), while Nigeria, Ghana and Uganda played smaller but growing roles. Oceania remained a minor producer at 0.2 million tonnes, with output largely split between Australia and New Zealand.

In Africa, aquaculture production of aquatic animals shows a strong long-term upward trajectory, expanding more than sixfold from over 400 600 tonnes in 2000 to over 2.4 million tonnes in 2024. Growth accelerated, especially between 2005 and 2015, driven largely by rapid expansion in Northern and Western Africa, alongside a sharp rise in Eastern Africa. Northern Africa consistently dominated production throughout the period, while Western and Eastern Africa emerged as important growth regions. Starting from a low base, Middle Africa exhibited steady proportional increases, whereas Southern Africa remained relatively small with modest gains. Overall, the continent's growth reflects both intensification in established producers and gradual expansion across subregions.

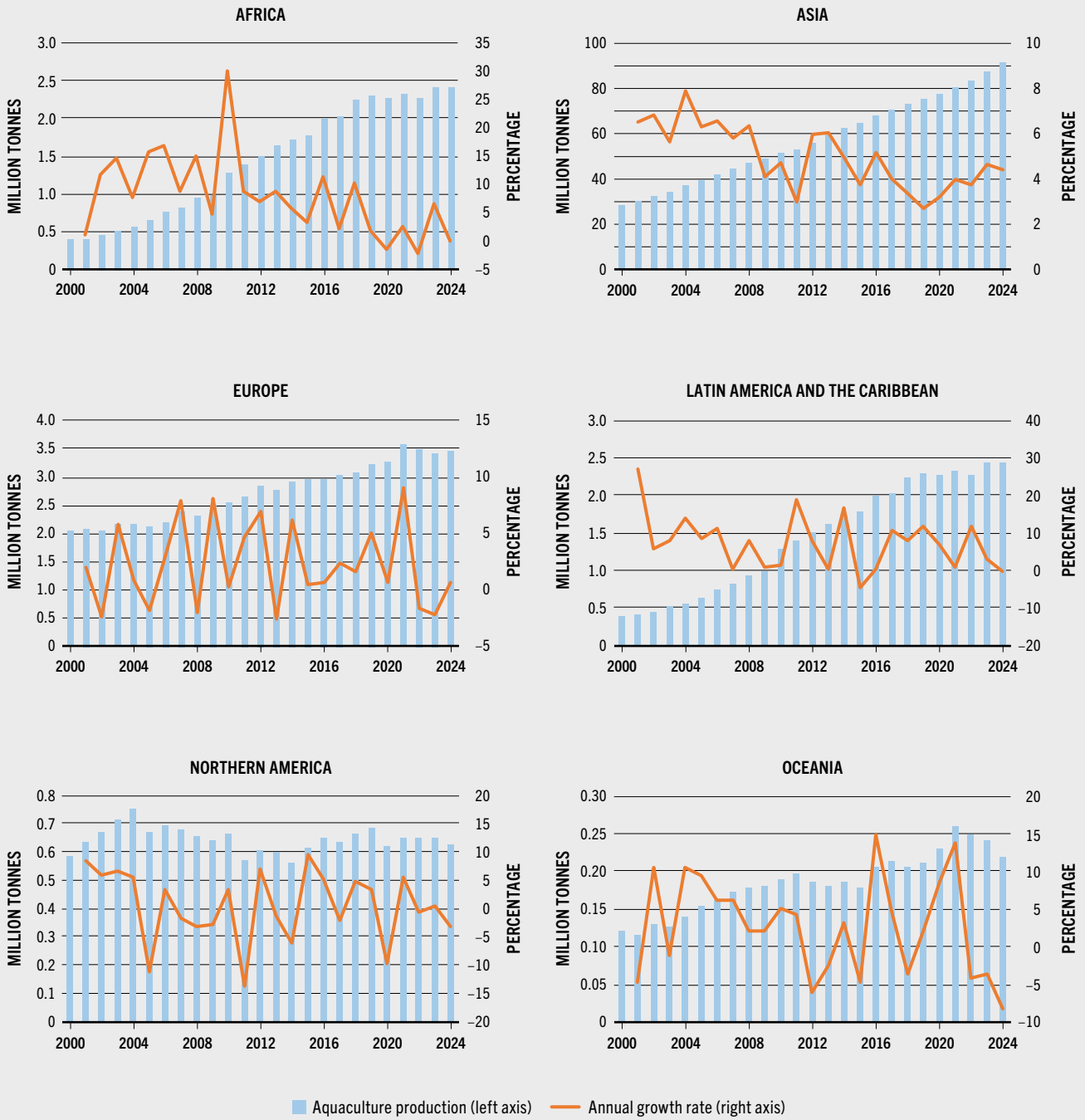
More recently, total African production slightly declined from 2.32 million tonnes in 2021 to 2.27 million tonnes in 2022, recovering subsequently in 2023, to reach 2.4 million tonnes, driven mainly by increases in Northern, Western, Eastern, and especially Middle Africa. In 2024, total production remained stable at 2.4 million tonnes amid subregional diverging trends. In Northern and Western Africa it continued to grow, Middle Africa sustained rapid growth, while Eastern Africa experienced a decline from its 2023 peak, and Southern Africa continued to experience a gradual fall.

Aquaculture in Latin America and the Caribbean expanded markedly, increasing more than fivefold from 839 300 tonnes in 2000 to 4.44 million tonnes in 2024. The most rapid expansion occurred between 2005 and 2020, followed by continued but slower growth. This increase was driven overwhelmingly by South America, which consistently accounted for the largest share and significant increases throughout the period. Central America also contributed significantly, particularly with strong growth between 2000 and 2020, and fluctuations thereafter. In contrast, the Caribbean remained a minor contributor, showing a declining and volatile trend.

Although relatively mature, aquaculture in Latin America and the Caribbean continued to expand, increasing from 4.3 million tonnes in 2022 to 4.4 million tonnes in 2023. The growth was dominated by South American production, led by Chile, Ecuador and Brazil, with modest gains in Central America, despite further decline in the Caribbean. In 2024, total output fell slightly because of a reduction in Central America, while South America continued to experience growth, albeit at a slower pace, and the Caribbean recovered slightly from its 2023 low. Overall, the recent trend indicates that while regional growth remains positive, it is increasingly uneven, with South America sustaining expansion and other subregions showing more variability.

Since 2000, Northern America has exhibited a relatively stable but fluctuating trend, increasing modestly from 584 500 tonnes in 2000 to 627 350 tonnes in 2024, peaking at 668 500 tonnes in 2005, followed by a gradual decline towards 2015, and then a moderate recovery and stabilization through the 2020s. The United States of America consistently accounted for the majority of production, showing mild variations, while Canada displayed more pronounced fluctuations, with growth up to 2015 followed by a general »

FIGURE 1.8 ANNUAL AQUACULTURE GROWTH RATE OF AQUATIC ANIMAL PRODUCTION BY REGION, 2000–2024



NOTES: Aquatic animals exclude aquatic mammals, crocodiles, alligators, caimans, sponges, corals, pearls and algae. Data are expressed in live weight equivalent.

SOURCE: FAO. 2026. FishStat: Global aquaculture production 1950–2024. [Accessed on 28 March 2026]. In: *FishStatJ*. Available at: https://www.fao.org/fishery/en/statistics/software/fishstatj. Licence: CC-BY-4.0.

https://doi.org/10.4060/cd8357en-fig1.8

TABLE 1.3 WORLD AQUACULTURE PRODUCTION OF AQUATIC ANIMALS BY REGION AND SELECTED MAJOR PRODUCERS, 2000–2024

	2000	2005	2010	2015	2020	2021	2022	2023	2024	Share of regional total, 2024 (%)	2022/2024 variation
	(thousand tonnes, live weight equivalent)										
Africa	**401**	**647**	**1 289**	**1 788**	**2 261**	**2 321**	**2 270**	**2 421**	**2 422**	**100**	↗
Egypt	340	540	920	1 175	1 592	1 576	1 552	1 595	1 600	66.1	↗
Nigeria	26	56	201	317	262	276	259	259	258	10.7	↘
Ghana	5	1	10	45	64	89	92	116	122	5.0	↗
Uganda	1	11	95	118	124	139	101	130	103	4.3	↗
Others	29	38	63	134	219	241	264	321	338	14.0	↗
Americas	**1 424**	**2 177**	**2 515**	**3 281**	**4 438**	**4 500**	**4 958**	**5 091**	**5 065**	**100**	↗
Chile	392	724	701	1 046	1 486	1 427	1 509	1 487	1 408	27.8	↘
Ecuador	61	139	273	427	775	904	1 125	1 237	1 236	24.4	↗
Brazil	172	258	411	578	630	650	738	792	882	17.4	↗
United States of America	457	514	497	426	448	461	478	502	467	9.2	↘
Others	342	543	634	805	1 100	1 058	1 108	1 073	1 073	21.2	↘
Asia	**28 542**	**39 361**	**51 451**	**64 816**	**77 652**	**80 732**	**83 755**	**87 642**	**91 506**	**100**	↗
China	21 522	28 121	35 513	43 748	49 620	51 221	52 930	55 212	57 557	62.9	↗
India	1 943	2 967	3 786	5 341	8 636	9 403	10 230	11 315	12 088	13.2	↗
Indonesia	789	1 197	2 305	4 342	5 173	5 578	5 533	5 600	5 892	6.4	↗
Viet Nam	499	1 437	2 683	3 462	4 668	4 736	5 103	5 389	5 635	6.2	↗
Bangladesh	657	882	1 309	2 060	2 584	2 639	2 731	2 852	2 978	3.3	↗
Myanmar	99	485	851	997	1 145	1 167	1 197	1 202	1 209	1.3	↗
Thailand	738	1 304	1 286	921	1 012	991	1 001	1 001	999	1.1	↘
Others	2 297	2 967	3 719	3 943	4 816	4 998	5 030	5 071	5 147	5.6	↗
Europe	**2 051**	**2 141**	**2 531**	**2 948**	**3 264**	**3 562**	**3 503**	**3 426**	**3 450**	**100**	↘
Norway	491	662	1 020	1 381	1 490	1 665	1 662	1 650	1 667	48.3	↗
Russian Federation	74	115	120	152	270	295	320	327	322	9.3	↗
Spain	309	222	254	294	274	277	273	243	246	7.1	↘
United Kingdom of Great Britain and Northern Ireland	152	173	201	212	220	239	201	186	226	6.5	↗
France	267	245	203	163	191	193	200	186	184	5.3	↘
Greece	95	106	121	107	132	144	142	142	128	3.7	↘
Faroe Islands	35	23	48	81	89	116	109	98	109	3.2	↗
Others	627	595	563	559	598	633	597	594	568	16.5	↘
Oceania	**122**	**154**	**190**	**178**	**229**	**260**	**249**	**240**	**220**	**100**	↘
Australia	32	45	76	83	106	140	139	128	118	53.4	↘
New Zealand	86	105	111	91	119	117	106	109	99	44.9	↘
Papua New Guinea	0	0	2	2	2	2	2	2	2	0.9	↗
New Caledonia	2	3	1	1	2	1	1	1	1	0.6	↘
Others	2	0	1	0	0	0	0	0	0	0.2	↘
World	**32 539**	**44 479**	**57 975**	**73 011**	**87 844**	**91 375**	**94 735**	**98 821**	**102 664**		

NOTE: Aquatic animals exclude aquatic mammals, crocodiles, alligators, caimans, aquatic products (corals, pearls, shells and sponges) and algae.

SOURCE: FAO.2026. FishStat: Global aquaculture production 1950-2024. [Accessed on 28 March 2026]. In: *FishStatJ*. Available at: https://www.fao.org/fishery/en/statistics/software/fishstatj. Licence: CC-BY-4.0.

https://doi.org/10.4060/cd8357en-table1.3

» decline. Overall, aquaculture in North America is relatively mature, with limited expansion compared to other regions and cyclical changes rather than sustained growth.

From 645 900 tonnes in 2022, Northern America aquaculture increased slightly to 648 250 tonnes in 2023, mainly in the United States of America, while in Canada production continued to decline. In 2024, however, production decreased in both countries, particularly in the United States, for a total of 627 350 tonnes. Canada's partial recovery from its 2023 low was insufficient to offset the regional decline. These recent changes indicate short-term volatility, reinforcing a pattern of stagnation and fluctuation in the region's aquaculture production.

Asia experienced significant expansion in aquaculture production, more than tripling from about 28.5 million tonnes in 2000 to over 91.5 million tonnes in 2024, reinforcing the region's overwhelming dominance. This sustained growth was driven primarily by Eastern Asia (led by China), which consistently accounted for the largest share and continuous increases throughout the period. South-Eastern (led by Indonesia and Viet Nam) and Southern Asia (led by India) also showed strong and steady expansion, particularly after 2010, contributing significantly to the region's overall growth. Western Asia (led by the Islamic Republic of Iran and Türkiye) and Central Asia (led by Uzbekistan), with much smaller volumes, exhibited upward trends, with rapid growth in Central Asia after 2015. Overall, Asia's aquaculture sector demonstrates persistent, broad-based expansion, with both intensification in major producing subregions and notable expansion in some areas.

Compared to its output of 83.76 million tonnes in 2022, Asian aquaculture rose substantially to 87.6 million tonnes in 2023 and 91.5 million tonnes in 2024, indicating continued strong upward momentum. This growth was driven largely by China in Eastern Asia, which recorded significant annual increases, alongside steady gains in South-Eastern and Southern Asia. In 2024, Southern Asia in particular showed a notable acceleration compared to 2023. Meanwhile, Central Asia experienced a decline due to a drop in Kyrgyzstan after rapid gains in 2023. The Islamic Republic of Iran and Türkiye drove continued increases in Western Asia. Overall, the recent period highlights sustained and widespread growth across most subregions, with Asia consolidating its leading position in global aquaculture.

Europe showed moderate growth in aquaculture production, increasing from 2.1 million tonnes to 3.5 million tonnes between 2000 and 2024. Growth was steady between 2000 and 2021, with production peaking at 3.6 million tonnes in 2021, followed by a slight decline and stabilization in subsequent years. Northern Europe, led by Norway, dominated throughout the period, driving much of the overall increase, while Eastern Europe exhibited consistent and gradual growth, particularly after 2015. In contrast, Southern Europe has shown relative stability with some fluctuations and a slight downward trend in recent years, while Western Europe is experiencing a gradual long-term decline. Overall, Europe's aquaculture sector reflects moderate expansion with diverging subregional patterns and signs of maturation in recent years.

European aquaculture declined to 3.4 million tonnes in 2023 from 3.5 million tonnes in 2022, largely due to contractions in Northern and Southern Europe, despite a continued increase in Eastern Europe. In 2024, production recovered slightly to 3.5 million tonnes, supported by renewed growth in Northern Europe and continued gains in Eastern Europe, while Southern and Western Europe continued to decline, partially offsetting these increases. These recent developments indicate a pattern of stabilization with mild fluctuations, where growth in some subregions is balancing declines in others, resulting in relatively stable overall production levels.

Oceania witnessed a modest overall increase followed by a recent decline in the new millennium, rising from 121 800 tonnes in 2000 to a peak of 260 100 tonnes in 2021, before falling to approximately 220 100 tonnes in 2024. Growth was relatively steady between 2000 and 2010, driven almost entirely by Australia and New Zealand, which consistently dominated regional production. After a slight decline in 2015, production expanded strongly until 2021,

followed by a downward trend through to 2024. In contrast, Pacific Island countries and territories contributed a very small and relatively stable share throughout the period, with minimal fluctuations. Overall, Oceania's aquaculture sector appears small in scale; growth is concentrated in its main producers and there have been signs of recent contraction following earlier expansion.

Regional production in Oceania declined successively from 248 900 tonnes in 2022, to 240 100 tonnes in 2023 and 220 100 tonnes in 2024. This decline was driven primarily by decreasing output in Australia and New Zealand, which more than offset minor fluctuations in Pacific Island countries and territories. While the islands showed a slight recovery in 2024 compared to 2023, their contribution, dominated by New Caledonia and Papua New Guinea, remained negligible at regional level. These changes highlight a recent contraction in Oceania's aquaculture production, following its peak in 2021, with no immediate signs of recovery at the aggregate level.

Differences in aquaculture production across regions reflect significant variations among producing countries and territories. Figure 1.9 shows how production is distributed among six selected species and subsectors, each generally led by a small group of dominant producers.

Aquaculture contribution to total fisheries and aquaculture production

Since 2021, aquaculture's share of aquatic animal production has exceeded that of capture fisheries; a total of 102.7 million tonnes of aquatic animals were farmed in 2024 – the first time either sector surpassed 100 million tonnes.

In 2024, aquaculture accounted for 52.8 percent of global production of aquatic animals, rising from 51.2 percent in 2022. China, the world's largest aquaculture producer, derived 81.6 percent of its national aquatic animal production from aquaculture, which is the case for other 47 countries where farmed aquatic animal production exceeded capture fisheries production. This group includes other major Asian producers such as India, Viet Nam and Bangladesh, as well as key regional producers including Egypt, Ecuador, Brazil, Türkiye, Colombia, Saudi Arabia and Uzbekistan. In all these countries, aquaculture shares represented 57 percent of total production or higher. In an additional 12 countries, aquaculture contribution ranged from 40 to 50 percent of their respective totals.

The contribution of aquaculture to total production of aquatic animals at regional level is presented in Figure 1.10. Seaweed farming and microalgae cultivation contributed over 95 percent of the global production of aquatic algae from 2010, reaching 96.8 percent of the 40.2 million tonnes of total algae production in 2024.

Inland aquaculture

In 2024, global inland aquaculture production of aquatic animals reached 64.3 million tonnes, accounting for 62.6 percent of total world aquaculture output. Finfish dominated production with an 88.7 percent share, followed by crustaceans (9.4 percent), aquatic turtles and frogs (1.5 percent), molluscs (0.3 percent) and other invertebrates (0.1 percent) (Table 1.4).

Inland aquaculture worldwide encompasses a diverse range of culture methods and technologies, differing substantially in input intensity, levels of technological and managerial sophistication, and the extent of integration with other agricultural and non-agricultural activities. Pond culture remains the predominant inland farming system. In recent years, however, producers have increasingly adopted innovations in pond-based systems to enhance productivity while reducing environmental impacts.

One notable example is the in-pond raceway system, which improves production efficiency and limits the accumulation of fish waste. This system has been widely adopted in several provinces of China and, to a lesser extent, in countries such as Viet Nam, Colombia, Mexico, Uzbekistan, Bangladesh and Egypt. Another innovation is the use of cluster-based effluent treatment systems, which integrate constructed wetlands with low-cost filtration technologies to support water recycling.

FIGURE 1.9 AQUACULTURE PRODUCTION OF SELECTED MAIN SPECIES GROUPS BY MAJOR PRODUCER, 2010–2024

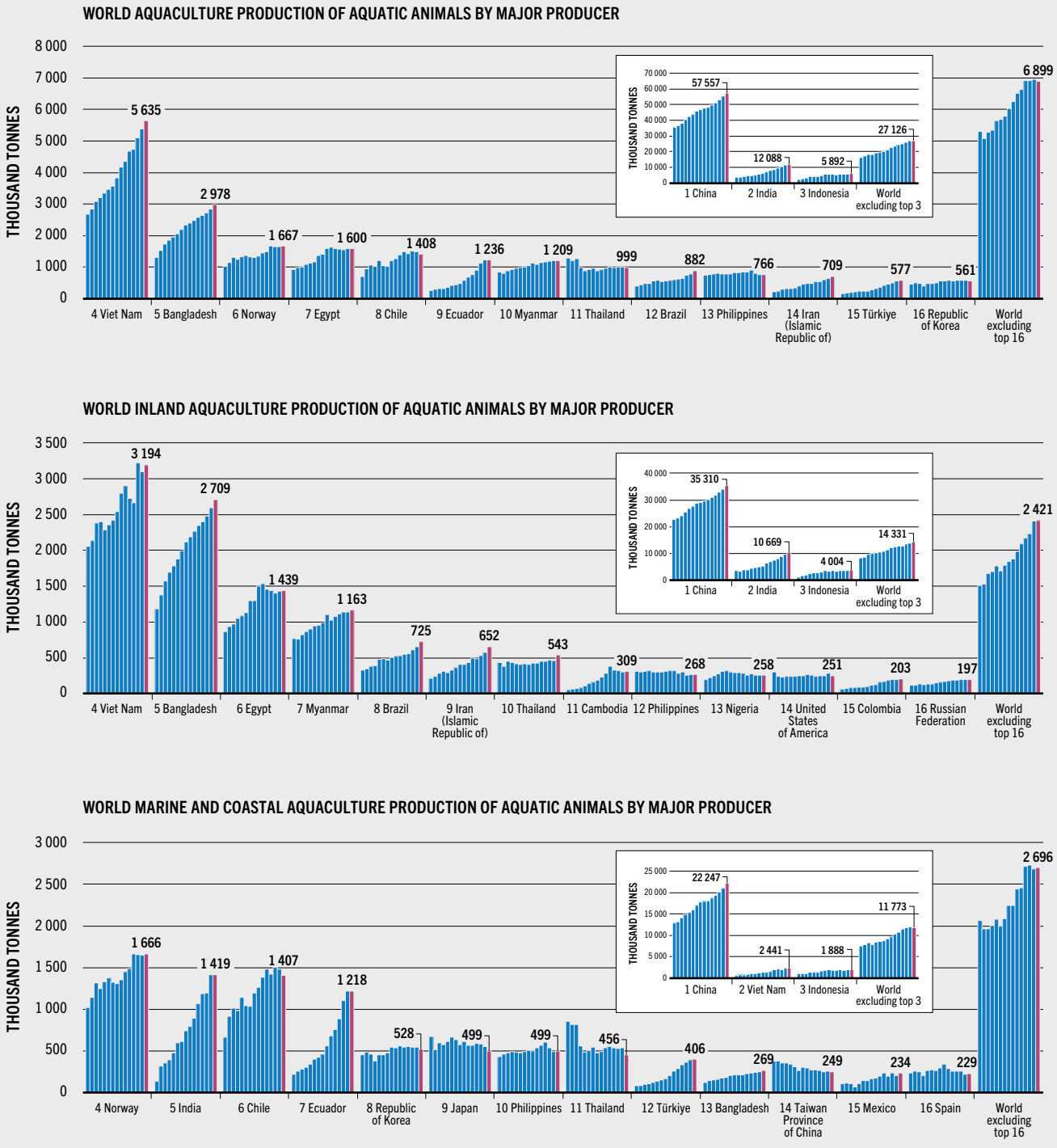
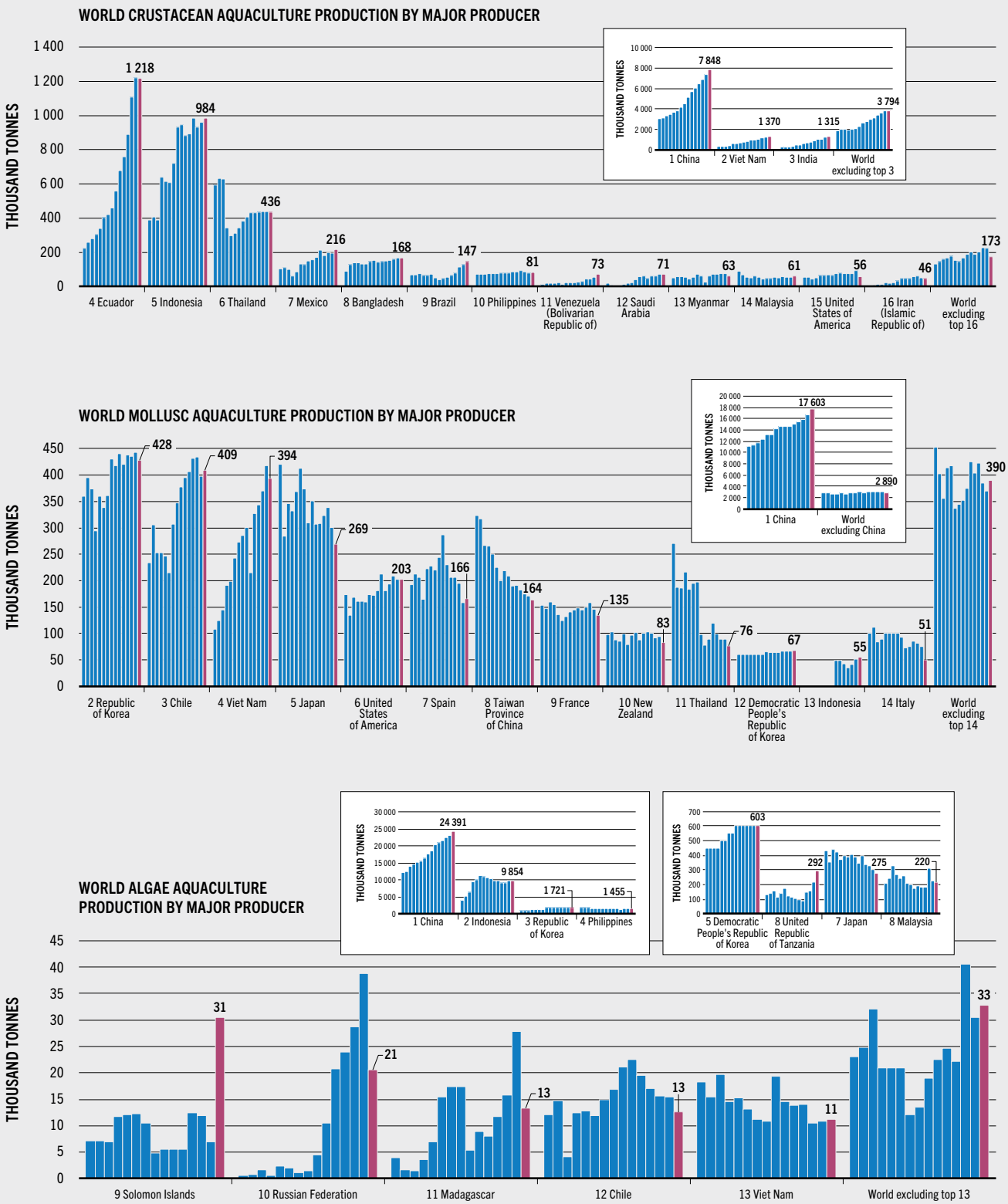


FIGURE 1.9 (Continued)

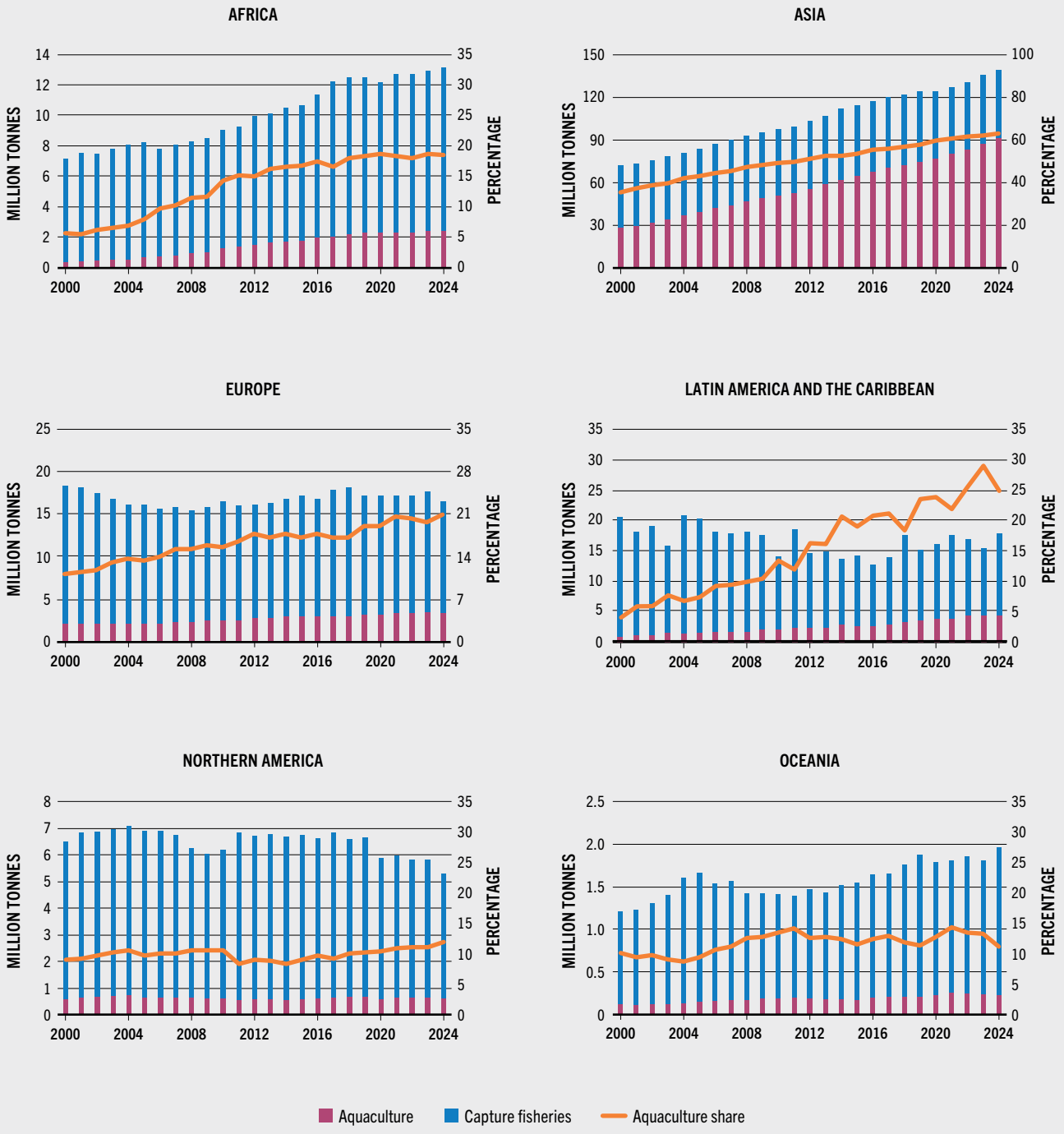


NOTES: Aquatic animals exclude aquatic mammals, crocodiles, alligators, caimans, sponges, corals, pearls and algae. Data are expressed in live weight equivalent for aquatic animals and wet weight for algae. Blue bars from left to right represent the years 2010–2023; red bars represent the year 2024. Different scales are used to improve the readability of the trends.

SOURCE: FAO. 2026. FishStat: Global aquaculture production 1950–2024. [Accessed on 28 March 2026]. In: *FishStatJ*. Available at: https://www.fao.org/fishery/en/statistics/software/fishstatj. Licence: CC-BY-4.0.

https://doi.org/10.4060/cd8357en-fig1.9

FIGURE 1.10 SHARE OF AQUACULTURE IN TOTAL FISHERIES AND AQUACULTURE PRODUCTION OF AQUATIC ANIMALS BY REGION, 2000–2024



NOTES: Aquatic animals exclude aquatic mammals, crocodiles, alligators, caimans, aquatic products (corals, pearls, shells and sponges) and algae. Data are expressed in live weight equivalent for aquatic animals and wet weight for algae. Different scales are used to improve the readability of the trends.

SOURCE: FAO. 2026. FishStat: Global production by production source 1950–2024. [Accessed on 28 March 2026]. In: *FishStatJ*. Available at: https://www.fao.org/fishery/en/statistics/software/fishstatj. Licence: CC-BY-4.0.

https://doi.org/10.4060/cd8357en-fig1.10

TABLE 1.4 WORLD INLAND AQUACULTURE AND MARINE AND COASTAL AQUACULTURE PRODUCTION BY REGION AND MAIN SPECIES GROUP, 2024

	Africa	Asia	Europe	Latin America and the Caribbean	Northern America	Oceania	World	Share of species group in total (%)
	(tonnes, live weight equivalent)							
Finfish	2 220 405	52 887 111	524 645	1 181 057	205 208	4 641	57 023 067	88.7
Crustaceans	14	6 009 982	557	256	55 005	89	6 065 902	9.4
Molluscs	n/a	219 745	n/a	0	n/a	n/a	219 745	0.3
Other aquatic animals	n/a	1 005 131	5	588	n/a	n/a	1 005 723	1.6
Inland aquaculture – all aquatic animals	**2 220 419**	**60 121 969**	**525 207**	**1 181 900**	**260 213**	**4 730**	**64 314 437**	**100**
Share of region (%)	*3.5*	*93.5*	*0.8*	*1.8*	*0.4*	*0.0*	*100*	
Finfish	185 583	5 408 795	2 395 955	1 013 121	125 220	105 597	9 234 271	24.1
Crustaceans	7 880	6 471 453	254	1 769 225	1 263	11 045	8 261 120	21.5
Molluscs	8 108	18 932 836	519 159	473 544	240 649	98 731	20 273 028	52.9
Other aquatic animals	74	570 872	9 815	90	n/a	3	580 853	1.5
Marine and coastal aquaculture – all aquatic animals	**201 645**	**31 383 955**	**2 925 184**	**3 255 980**	**367 132**	**215 376**	**38 349 272**	**100**
Share of region (%)	*0.5*	*81.8*	*7.6*	*8.5*	*1.0*	*0.6*	*100*	
Finfish	2 405 988	58 295 906	2 920 601	2 194 178	330 428	110 238	66 257 339	64.5
Crustaceans	7 894	12 481 435	811	1 769 480	56 268	11 134	14 327 022	14.0
Molluscs	8 108	19 152 580	519 159	473 544	240 649	98 731	20 492 772	20.0
Other aquatic animals	74	1 576 002	9 820	678	n/a	3	1 586 576	1.5
Total aquaculture – all aquatic animals	**2 422 064**	**91 505 924**	**3 450 391**	**4 437 880**	**627 345**	**220 106**	**102 663 709**	**100**
Share of region (%)	*2.4*	*89.1*	*3.4*	*4.3*	*0.6*	*0.2*	*100*	
Inland aquaculture – microalgae	189	126 901	4 763	1 346	n/a	n/a	133 199	0.3
Marine and coastal aquaculture – seaweeds	310 398	38 415 198	21 820	19 298	820	31 619	38 799 152	99.7
Algae – total aquaculture	**310 587**	**38 542 099**	**26 583**	**20 644**	**820**	**31 619**	**38 932 352**	**100**
Share of region (%)	*0.8*	*99.0*	*0.1*	*0.1*	*0.0*	*0.1*	*100*	
All species – Total aquaculture	**2 732 651**	**130 048 023**	**3 476 974**	**4 458 524**	**628 165**	**251 725**	**141 596 061**	
Share of world total (%)	***1.9***	***91.8***	***2.5***	***3.1***	***0.4***	***0.2***	***100***	

NOTES: n/a – no production or production data unavailable. Aquatic animals exclude aquatic mammals, crocodiles, alligators, caimans, aquatic products (corals, pearls, shells and sponges). Data on algae are expressed in wet weight. Data may not match totals due to rounding.

SOURCE: FAO. 2026. FishStat: Global aquaculture production 1950-2024. [Accessed on 28 March 2026]. In: *FishStatJ*. Available at: https://www.fao.org/fishery/en/statistics/software/fishstatj. Licence: CC-BY-4.0.

https://doi.org/10.4060/cd8357en-table1.4

Mariculture and coastal aquaculture

Mariculture – also known as marine aquaculture – takes place in the sea and may cover either the entire production cycle or only the grow-out phase. Full-cycle mariculture typically applies to species that rely on wild seed collected from the ocean, such as farming of oysters and sea mussels. In contrast, grow-out-only mariculture involves species that are initially produced in land-based hatcheries, sometimes even in freshwater, as is the case with Atlantic salmon.

Coastal aquaculture, usually carried out in constructed onshore ponds or intertidal areas, also plays a vital role by supporting livelihoods and employment and contributing to economic development in coastal communities across many countries, particularly in regions such as Asia and Latin America.

In 2024, global marine and coastal aquaculture produced 38.3 million tonnes of aquatic animals, with production dominated by molluscs (52.9 percent), followed by finfish (24.1 percent), crustaceans (21.5 percent) and marine invertebrates (1.5 percent). In addition to aquatic animals, 38.8 million tonnes of seaweed were produced in marine environments, while a small but unspecified amount was cultivated in ponds and tanks on coastal land. The breakdown of mariculture and coastal aquaculture production in 2024 by region and by species group is shown in Table 1.4.

Distinguishing mariculture production from that of coastal brackish water aquaculture is challenging within existing statistical data, as the two are often combined in national reports – especially in countries that farm finfish in both environments. Figure 1.11 provides an estimate of production by major species group, separating mariculture from coastal aquaculture using supplementary data and alternative sources. At the global level, seaweed farming and mollusc culture are overwhelmingly concentrated in marine environments, whereas crustaceans are mainly produced in coastal brackish water ponds and tanks. Available information also indicates that sea-based cage culture accounts for roughly 65 percent of total global finfish production within combined marine and coastal aquaculture systems.

Aquaculture production of animals with and without feeding

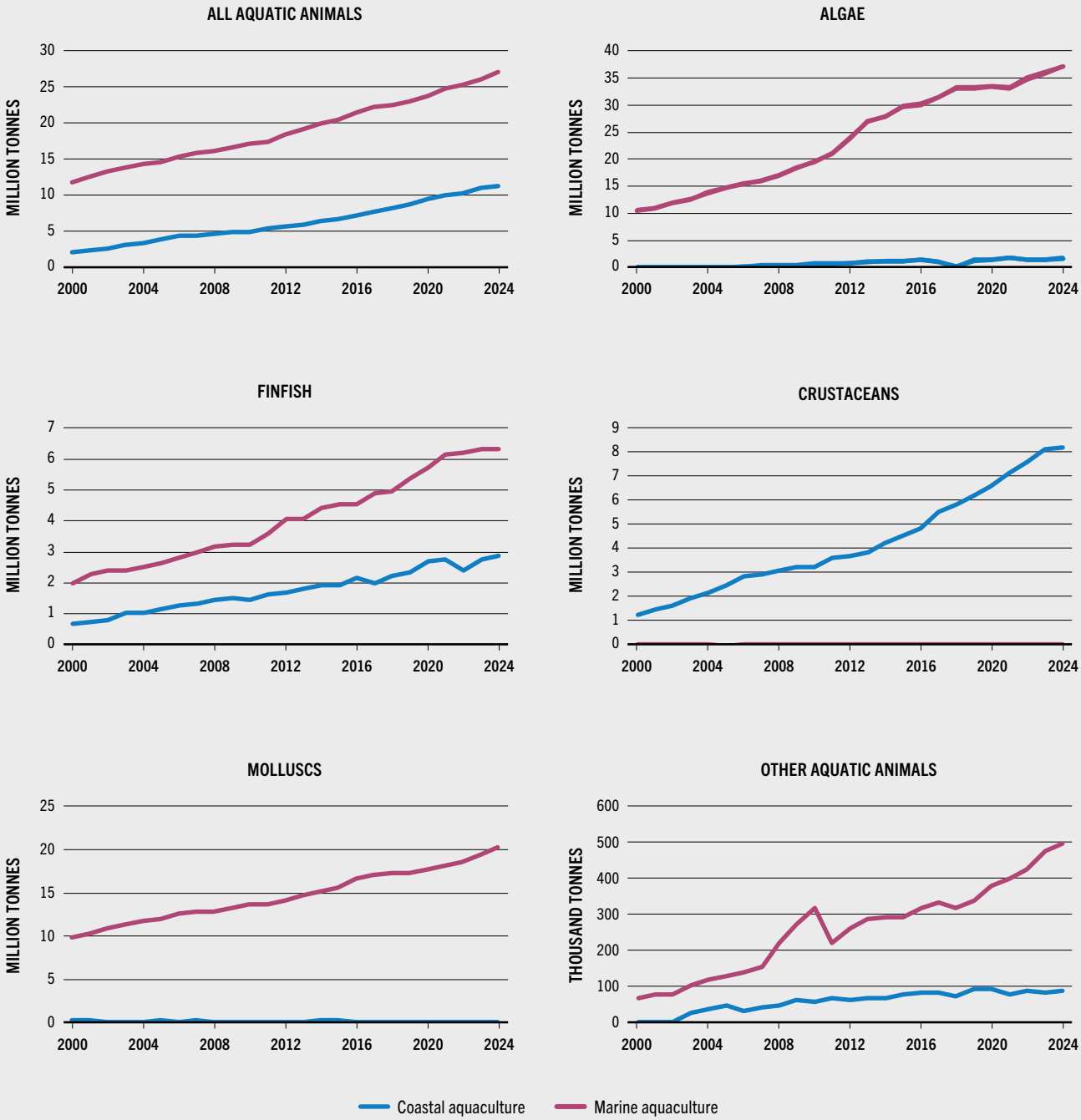
Non-fed aquaculture of aquatic animals refers to the cultivation of species that obtain nutrients from the surrounding environment, such as plankton and organic matter in the water, without artificial feeding. This category typically includes filter-feeding species, such as certain carps and bivalve molluscs, and is generally considered more environmentally sustainable due to its low input requirements, minimal waste generation and water filtering properties.

The share of fed aquaculture in global aquaculture production continued to increase in 2023 and 2024, resulting in a relative decline in the contribution of non-fed aquaculture, despite continued growth in its volumes. Consequently, the share of non-fed species in total farmed aquatic animal production fell from 28.3 percent in 2022 to 27.9 percent in 2023 and 2024 (Figure 1.12). In 2024, the share of non-fed production in Oceania (44.3 percent), Northern America (38.3 percent) and Europe (17.6 percent) was predominantly composed of marine bivalves. In Asia (29.8 percent) and Latin America and the Caribbean (10.9 percent), filter-feeding carps also contributed significantly to non-fed production. In contrast, non-fed aquaculture in Africa remained marginal, despite limited farming of marine bivalves and filter-feeding carps in a few countries.

Farmed aquatic species and diversity

FAO's Global aquaculture production (1950–2024) dataset comprises 770 statistical units, referred to as "species items", up from 731 in 2022. These include 601 aquatic organisms identified at the species level and 7 interspecific finfish hybrids, as well as 100 groups classified at the genus level and a further 62 groups defined at the family level or higher. Table 1.5 presents data on aquaculture production of major species groups and its evolution over the period 2000–2024. ■

FIGURE 1.11 COMPOSITION OF WORLD MARINE AND COASTAL AQUACULTURE BY MAIN SPECIES GROUP, 2000–2024

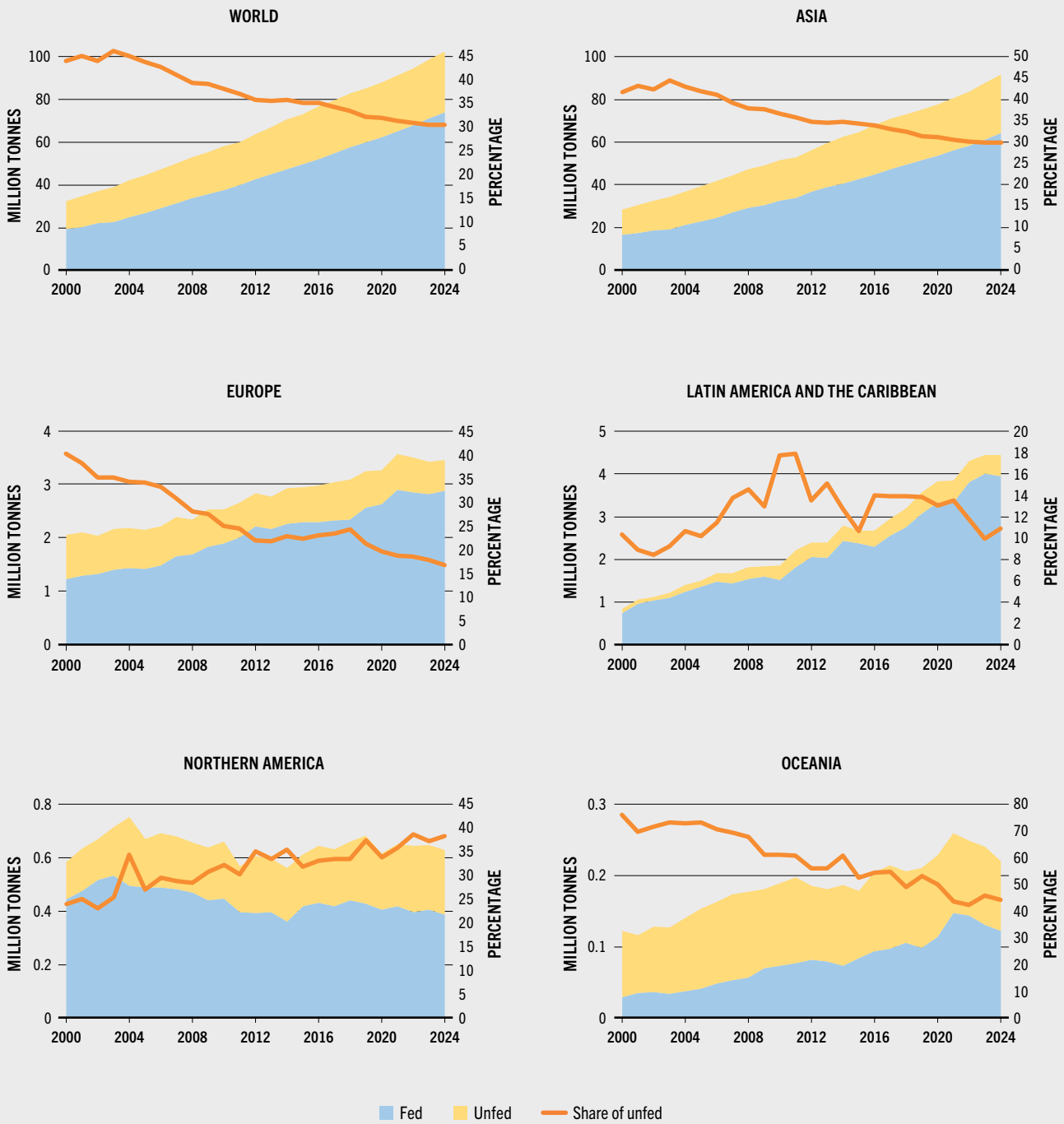


NOTES: Aquatic animals exclude aquatic mammals, crocodiles, alligators, caimans, aquatic products (corals, pearls, shells and sponges) and algae. Data are expressed in live weight equivalent for aquatic animals and wet weight for algae. Different scales are used to improve the readability of the trends.

SOURCE: FAO estimates based on FAO. 2026. FishStat: Global aquaculture production 1950–2024. [Accessed on 28 March 2026]. In: *FishStatJ*. Available at: https://www.fao.org/fishery/en/statistics/software/fishstatj. Licence: CC-BY-4.0.

https://doi.org/10.4060/cd8357en-fig1.11

FIGURE 1.12 FED AND NON-FED AQUACULTURE PRODUCTION OF ANIMAL SPECIES BY REGION, 2000–2024



NOTES: Aquatic animals exclude aquatic mammals, crocodiles, alligators, caimans, aquatic products (corals, pearls, shells and sponges) and algae. Data are expressed in live weight equivalent. Different scales are used to improve the readability of the trends.

SOURCE: FAO estimates based on FAO. 2026. FishStat: Global aquaculture production 1950–2024. [Accessed on 28 March 2026]. In: *FishStatJ*. Available at: https://www.fao.org/fishery/en/statistics/software/fishstatj. Licence: CC-BY-4.0.

TABLE 1.5 WORLD PRODUCTION OF MAJOR AQUACULTURE SPECIES AND MAIN SPECIES GROUPS

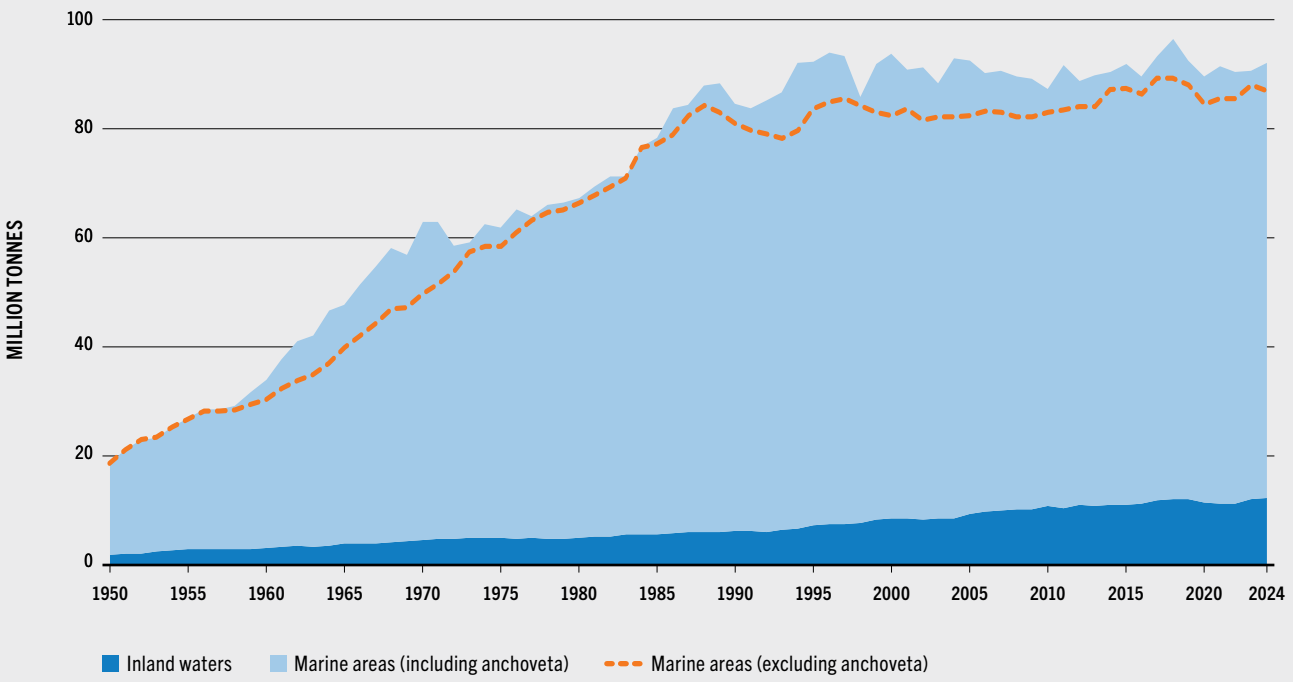
Species or species group	2000	2005	2010	2015	2020	2021	2022	2023	2024	Share of total, 2024 (%)
	(thousand tonnes, live weight equivalent)									
Finfish	**20 814**	**27 989**	**37 758**	**49 083**	**57 693**	**59 738**	**61 785**	**63 947**	**66 257**	**100**
Filter-feeding carps	4 474	5 649	6 486	7 830	8 094	8 215	8 399	8 539	8 814	13.3
Other carps	9 387	12 104	15 785	18 950	22 471	23 060	23 827	24 678	25 372	38.3
Tilapias and other cichlids	1 190	1 992	3 504	5 478	6 070	6 292	6 572	6 816	7 269	11.0
Salmodidae	1 538	1 976	2 387	3 346	3 989	4 192	4 272	4 271	4 294	6.5
Catfishes	530	1 500	3 673	4 958	6 096	6 213	6 654	6 953	7 284	11.0
Milk fish	468	595	809	1 115	1 284	1 278	1 226	1 189	1 213	1.8
Largemouth black bass	0	140	179	321	621	704	804	891	942	1.4
Snakehead fishes	89	300	418	531	660	695	650	738	720	1.1
Other finfish	3 139	3 733	4 518	6 552	8 408	9 089	9 383	9 871	10 349	15.6
Crustaceans	**1 692**	**3 778**	**5 479**	**7 116**	**11 104**	**11 959**	**12 768**	**13 756**	**14 327**	**100**
Marine shrimps	1 137	2 667	3 583	4 824	6 880	7 412	7 952	8 548	8 811	61.5
Caryfishes	8	111	596	720	2 466	2 707	2 964	3 251	3 503	24.4
Chinese mitten crab	203	378	572	747	776	808	815	889	894	6.2
Freshwater shrimps	218	424	465	467	553	590	600	639	690	4.8
Marine crabs	15	184	239	341	399	402	403	393	396	2.8
Other crustaceans	112	13	22	16	31	39	33	36	32	0.2
Molluscs	**9 877**	**12 284**	**13 945**	**15 966**	**17 981**	**18 534**	**18 953**	**19 645**	**20 493**	**100**
Oysters	3 731	4 326	4 582	5 252	6 383	6 782	7 181	7 608	8 193	40.0
Clams	1 562	2 660	3 594	3 980	4 349	4 425	4 510	4 588	4 843	23.6
Scallops	1 048	1 139	1 655	1 988	1 970	2 077	2 022	2 065	2 157	10.5
Sea mussels	1 307	1 719	1 779	1 820	2 045	2 027	1 928	1 867	1 828	8.9
Razor clams	488	624	693	760	860	860	848	851	893	4.4
Other molluscs	1 742	1 816	1 641	2 166	2 373	2 363	2 464	2 665	2 579	12.6
Miscellaneous aquatic animals	**156**	**429**	**794**	**846**	**1 065**	**1 144**	**1 229**	**1 473**	**1 587**	**100**
Chinese softshell turtle	85	163	261	314	334	366	375	499	543	34.2
Japanese sea cucumber	0	57	127	198	202	229	256	299	333	21.0
Frogs	0	71	80	82	149	186	227	297	332	20.9
Edible jellyfish	0	48	58	75	90	78	84	81	83	5.2
Other aquatic animals	71	89	269	176	290	285	286	298	296	18.7
Algae	**10 597**	**14 831**	**20 174**	**31 064**	**35 077**	**35 233**	**36 530**	**37 656**	**38 932**	**100**
Japanese kelp	5 382	5 699	6 526	10 314	12 470	13 095	10 861	13 254	13 747	35.3
Gracilaria seaweeds	56	933	1 657	3 767	5 180	5 934	7 581	7 022	7 854	20.2
Cottoni seaweed	649	1 284	1 884	1 745	7 651	6 231	7 490	7 231	7 723	19.8
Wakame	311	2 440	1 505	2 216	2 811	2 741	2 693	2 670	2 926	7.5
Other algae	4 199	4 476	8 602	13 024	6 964	7 232	7 905	7 479	6 682	17.2

NOTES: Aquatic animals exclude aquatic mammals, crocodiles, alligators, caimans, aquatic products (corals, pearls, shells and sponges). Data on algae are expressed in wet weight. Data may not match totals due to rounding.

SOURCE: FAO.2026. FishStat: Global aquaculture production 1950-2024. [Accessed on 28 March 2026]. In: *FishStatJ*. Available at: https://www.fao.org/fishery/en/statistics/software/fishstatj. Licence: CC-BY-4.0.

https://doi.org/10.4060/cd8357en-table1.5

FIGURE 1.13 WORLD CAPTURE FISHERIES PRODUCTION OF AQUATIC ANIMALS, 1950–2024



NOTES: Aquatic animals exclude aquatic mammals, crocodiles, alligators, caimans, aquatic products (corals, pearls, shells and sponges) and algae. Data are expressed in live weight equivalent.

SOURCE: FAO. 2026. FishStat: Global capture production 1950-2024. [Accessed on 28 March 2026]. In: *FishStatJ*. Available at: https://www.fao.org/fishery/en/statistics/software/fishstatj. Licence: CC-BY-4.0.

https://doi.org/10.4060/cd8357en-fig1.13

CAPTURE FISHERIES PRODUCTION

Overall fisheries production status and trends

In 2024, global capture production reached 93.2 million tonnes, comprising 91.9 million tonnes (live weight equivalent) of aquatic animals and 1.3 million tonnes (wet weight) of algae, in addition to about 6 900 tonnes of other aquatic products such as corals, pearls, shells and sponges. Production of aquatic animals increased by 1.3 percent compared to the average of the previous three years (Figure 1.13).

The relatively stable trend observed in global fisheries since the late 1980s continued in 2024, as the biological and ecological limits of a number of wild fish stocks had been reached. Despite rising demand and expanding fishing capacity, capture fisheries production of aquatic animals oscillated between 86 and 94 million tonnes, except for an isolated peak of around 96 million tonnes in 2018. Nevertheless, wild captures remain vital for food security, particularly in coastal and developing regions, where they provide livelihoods for millions of people.

China maintained its top position in 2024, accounting for 14.1 percent of global capture production, followed by Indonesia (8.4 percent) and India (6.8 percent). Peru ranked fourth (6.2 percent), with catches increasing by 64.8 percent from 3.5 million tonnes in 2023 to 5.7 million tonnes in 2024 (due to landings of anchoveta [*Engraulis ringens*] recovering from the exceptionally low levels of 2023).

Recent trends in marine and inland fisheries – accounting, respectively, for 86.6 percent and 13.4 percent of global capture fishery production – are discussed below.

Marine area capture production

In 2024, global marine captures of aquatic animals were 79.6 million tonnes, an increase of 0.7 percent compared to the average of the previous three years, but below the most recent peak of 84.2 million tonnes seen in 2018. The highest production of marine capture fisheries ever recorded was 86.4 million tonnes in 1996.

Global marine capture production trends are dominated by a relatively small number of countries. China has been the largest producer since the mid-1990s, due to abundant and diversified resources in the Northwest Pacific (FAO Major Fishing Area 61), as well as the expansion into offshore and distant water fishing grounds. In contrast, countries such as Chile and Peru, fishing in areas of upwelling, rank high, not necessarily due to their fleet sizes, but because of one very productive ecosystem and the importance of anchoveta that accounts for around 35 to 70 percent of total catches in Area 61 in recent decades. This makes Peru, and to a lesser extent Chile, more vulnerable to significant annual fluctuations, such as in 2023 when anchoveta catches were severely impacted by a coastal El Niño event that disrupted the highly productive Humboldt Current upwelling system. Other major producers such as Indonesia, with highly diversified catches, tend to exhibit more stable year-to-year production.

In 2024, the top seven producers together continued to account for over 50 percent of total marine captures of aquatic animals (Figure 1.14A and Figure 1.14B), led by China (14.8 percent of the global total), followed by Indonesia (9.1 percent), Peru (7.2 percent), the Russian Federation (6.0 percent), India (5.2 percent), the United States of America (4.7 percent) and Viet Nam (4.1 percent) (Table 1.6).

Top species in marine areas

Of the more than 2 900 species items included in the FAO Global marine capture database, a small number of species or species groups account for a large share of global marine captures – in terms of both volume and economic importance.

An overview of marine catch data by main species and by FAO Major Fishing Area in 2024 is shown in Figure 1.15. Finfish account for about 85 percent of total marine capture production of aquatic animals; they include the following groups of particular importance:

- Small pelagics (e.g. anchovies, sardines and herrings) are highly productive and fast-reproducing species that dominate global catches.
- Tuna and tuna-like species are a high-value commodity that makes an important contribution to the economic value of global fisheries, particularly in tropical regions.
- Groundfish (e.g. cod, hake and pollock) generally inhabit nutrient-rich continental shelf areas, making them more accessible than deep-sea or highly migratory species.

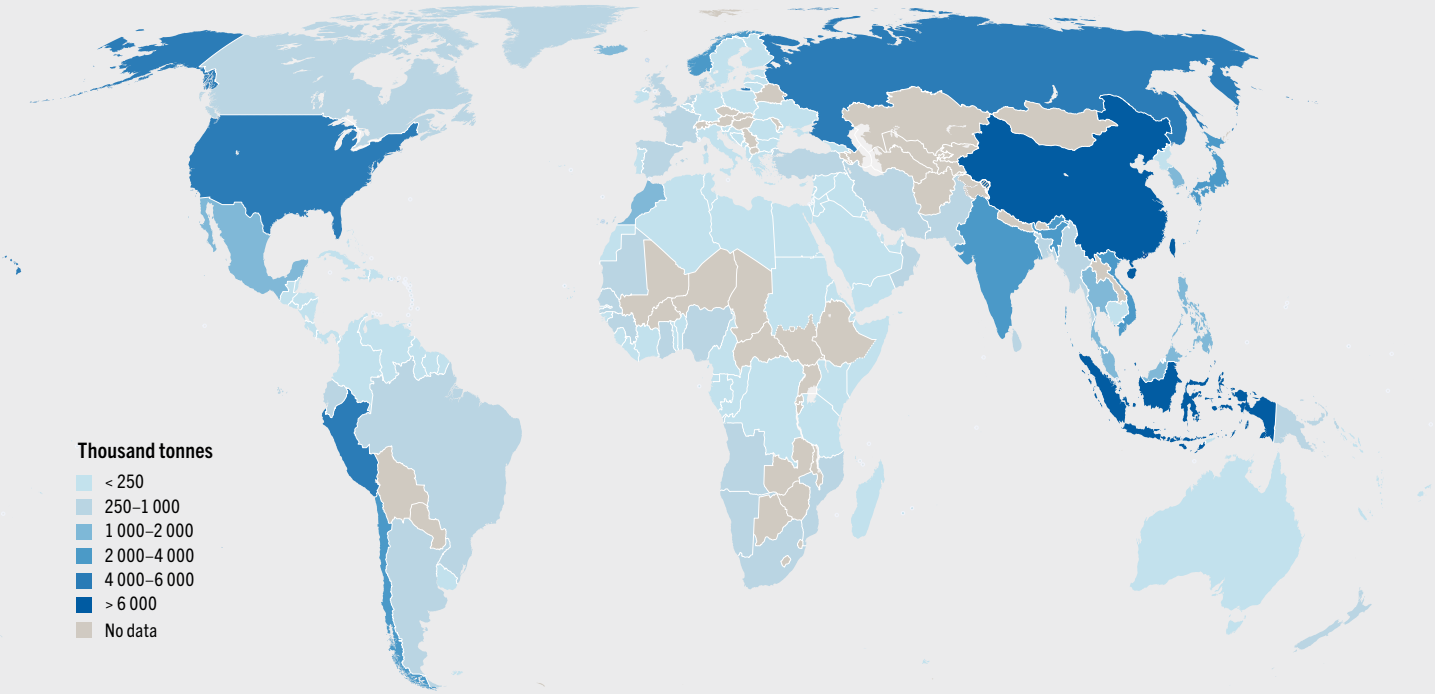
In 2024, anchoveta catches recovered to over 5.0 million tonnes from 2.4 million tonnes in 2023, the lowest level recorded since 1998. The 2024 catch was in line with most recent years, but still well below the most recent peak of over 7.0 million tonnes in 2018. The highest anchoveta catch ever recorded was 13.1 million tonnes in 1970. Skipjack tuna (*Katsuwonus pelamis*) was second at 3.6 million tonnes, while Alaska pollock (*Gadus chalcogrammus*) ranked third at 3.6 million tonnes (Table 1.7).

Catches of tunas, one of the most valuable groups, continued their year-on-year increase, with 2024 marking the third successive year of highest catches ever recorded at 9.3 million tonnes. Other valuable groups such as cephalopods, shrimps and lobsters also achieved or maintained some of their highest levels in 2024.

Since 2010, the top three marine capture species have remained unchanged, while the species composition and overall diversification of marine captures have somewhat evolved. New or previously underexploited species are increasingly more important in place of traditional long-lived, high-trophic species that have either plateaued or are in decline, whether from overfishing or due to the effects of climate change. The rise in cephalopod landings – particularly of jumbo flying squid (*Dosidicus gigas*), Argentine shortfin squid (*Illex argentinus*) and related taxa – has made them »

FIGURE 1.14 WORLD CAPTURE FISHERIES PRODUCTION OF AQUATIC ANIMALS IN MARINE AREAS

A) COUNTRIES AND TERRITORIES, AVERAGE 2022–2024

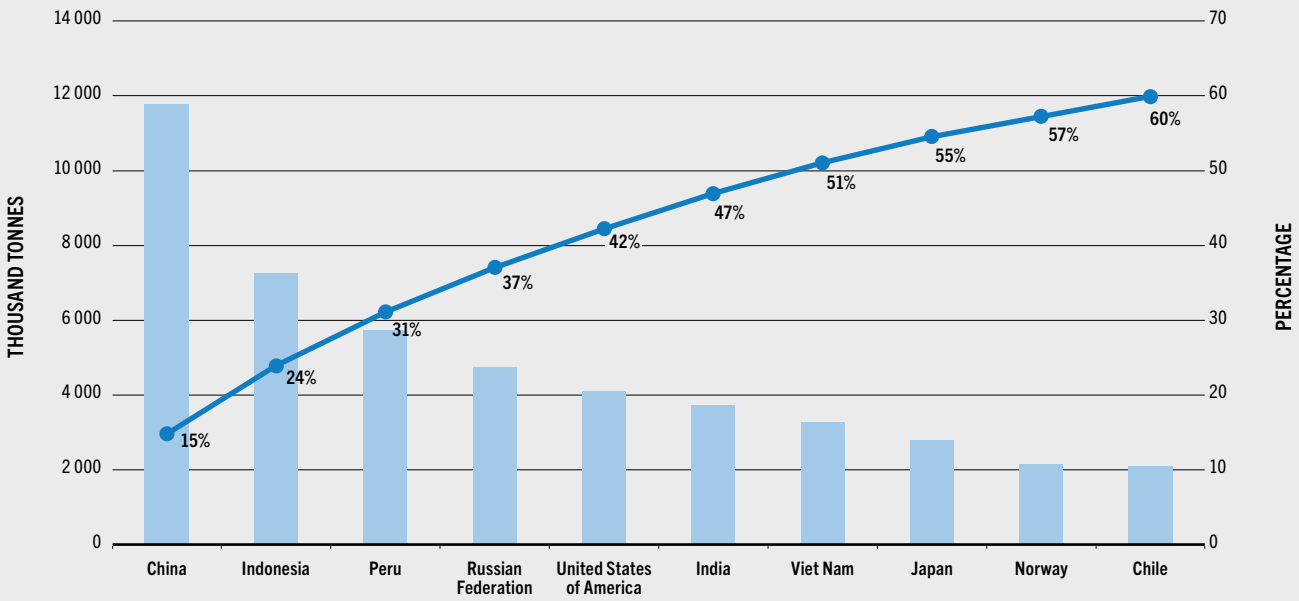


Refer to the disclaimer on the copyright page for the names and boundaries used in this map. Dotted line represents approximately the Line of Control in Jammu and Kashmir agreed upon by India and Pakistan. The final status of Jammu and Kashmir has not yet been agreed upon by the parties. Final boundary between the Republic of Sudan and the Republic of South Sudan has not yet been determined. Final status of the Abyei area is not yet determined.

NOTES: Aquatic animals exclude aquatic mammals, crocodiles, alligators, caimans, sponges, corals, pearls and algae. Data are expressed in live weight equivalent.

SOURCES: FAO. 2026. FishStat: Global capture production 1950-2024. [Accessed on 28 March 2026]. In: *FishStatJ*. Available at: https://www.fao.org/fishery/en/statistics/software/fishstatj. Licence: CC-BY-4.0; United Nations Geospatial. 2020. Map geodata.

B) TOP TEN PRODUCERS, 2024



NOTES: Aquatic animals exclude aquatic mammals, crocodiles, alligators, caimans, aquatic products (corals, pearls, shells and sponges) and algae. Data are expressed in live weight equivalent.

SOURCE: FAO. 2026. FishStat: Global capture production 1950-2024. [Accessed on 28 March 2026]. In: *FishStatJ*. Available at: https://www.fao.org/fishery/en/statistics/software/fishstatj. Licence: CC-BY-4.0.

https://doi.org/10.4060/cd8357en-fig1.14a https://doi.org/10.4060/cd8357en-fig1.14b

TABLE 1.6 CAPTURE FISHERIES PRODUCTION OF AQUATIC ANIMALS IN MARINE AREAS BY MAJOR PRODUCER

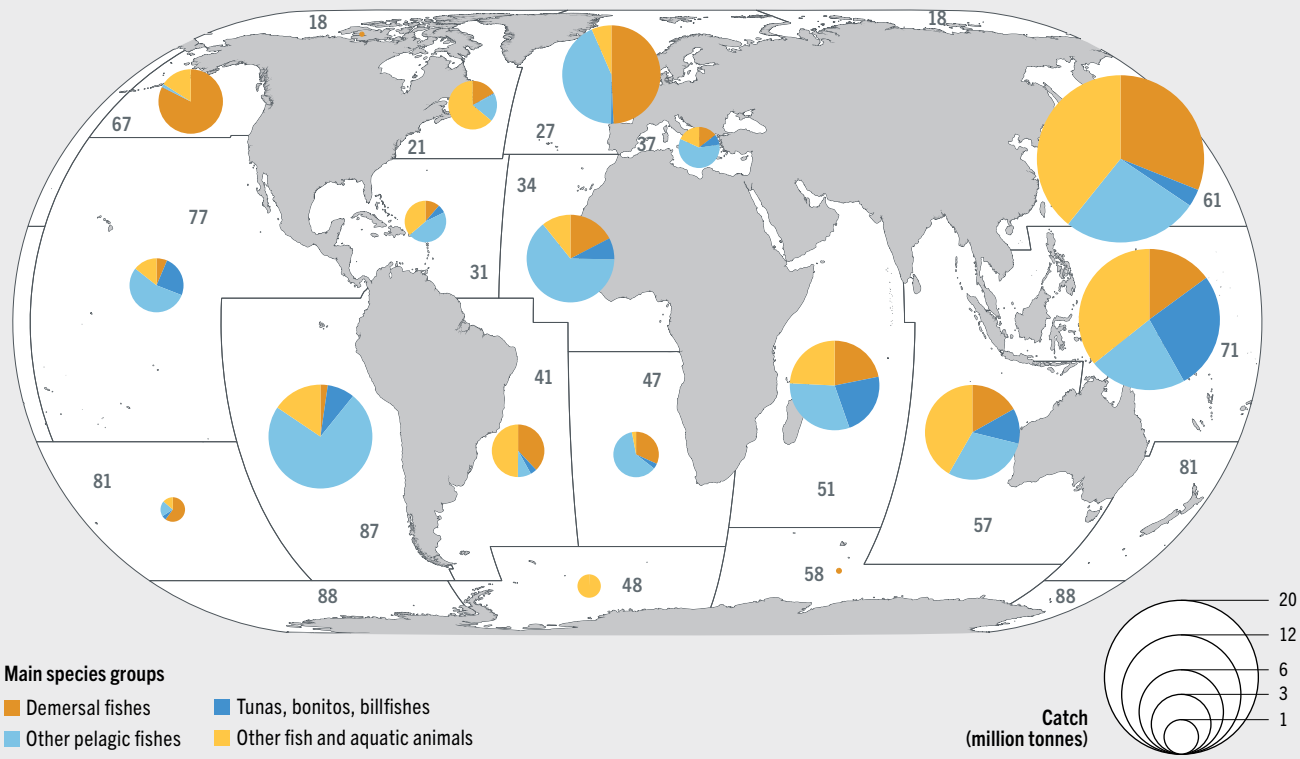
	Production (average per year)				Production				Share of total, 2024 (%)
	1980s	1990s	2000s	2010s	2021	2022	2023	2024	
	(thousand tonnes, live weight equivalent)								
By country or territory									
China	3 819	9 963	12 425	13 238	11 741	11 819	11 875	11 780	14.8
Indonesia	1 742	3 030	4 369	5 933	6 675	6 933	7 286	7 265	9.1
Peru (total)	4 136	8 099	8 066	5 130	6 508	5 289	3 460	5 725	7.2
(excluding anchoveta)	*2 504*	*2 541*	*952*	*1 013*	*1 239*	*1 171*	*1 412*	*993*	*0.0*
Russian Federation*	n/a	3 377	3 201	4 278	4 888	4 717	5 173	4 741	6.0
India	1 685	2 602	2 947	3 549	3 145	3 597	3 981	4 106	5.2
United States of America	4 531	5 147	4 746	4 882	4 291	4 121	4 159	3 745	4.7
Viet Nam	533	943	1 720	2 698	3 391	3 310	3 284	3 278	4.1
Japan	10 592	6 718	4 412	3 485	3 159	2 900	2 902	2 789	3.5
Norway	2 206	2 435	2 519	2 303	2 419	2 455	2 353	2 156	2.7
Chile (total)	4 517	5 948	4 022	2 156	1 996	2 227	2 145	2 100	2.6
(excluding anchoveta)	*4 002*	*4 447*	*2 745*	*1 399*	*1 389*	*1 486*	*1 792*	*1 794*	*0.0*
Mexico	1 206	1 175	1 308	1 431	1 618	1 660	1 817	1 844	2.3
Philippines	1 320	1 677	2 101	1 924	1 638	1 595	1 542	1 459	1.8
Thailand	2 076	2 698	2 385	1 460	1 300	1 280	1 352	1 435	1.8
Malaysia	756	1 080	1 306	1 465	1 329	1 310	1 273	1 395	1.8
Morocco	463	680	971	1 274	1 396	1 543	1 377	1 389	1.7
Republic of Korea	2 175	2 253	1 776	1 556	1 349	1 275	1 373	1 260	1.6
Iceland	1 434	1 669	1 664	1 199	1 155	1 416	1 377	995	1.2
Argentina	412	985	936	793	835	835	815	871	1.1
Ecuador	696	403	460	575	863	689	695	784	1.0
Taiwan Province of China	831	1 050	1 020	859	688	602	613	773	1.0
Myanmar	496	611	1 098	1 144	756	815	721	771	1.0
Spain	1 214	1 134	915	957	800	805	763	761	1.0
United Kingdom of Great Britain and Northern Ireland	859	851	663	667	635	621	717	755	0.9
Oman	111	117	146	295	922	748	707	727	0.9
Iran (Islamic Republic of)	114	232	314	550	672	652	664	679	0.9
Total 25 major producers	**47 925**	**64 874**	**65 491**	**63 800**	**64 169**	**63 213**	**62 423**	**63 583**	**79.9**
Total all other producers	**24 160**	**16 983**	**16 098**	**15 928**	**15 758**	**15 778**	**15 950**	**16 037**	**20.1**
All producers	**72 085**	**81 857**	**81 589**	**79 728**	**79 927**	**78 991**	**78 373**	**79 620**	**100.0**
By region**									
Asia	28 682	35 296	38 637	40 960	39 539	39 595	40 481	40 482	50.8
Africa	2 879	3 798	4 901	6 145	6 957	7 147	6 859	7 072	8.9
Europe	11 721	15 286	13 950	13 515	13 235	13 292	13 809	12 707	16.0
Latin America and the Caribbean	12 560	18 203	16 758	11 732	13 345	12 224	10 501	12 961	16.3
Nothern America	6064	6372	5972	5985	5284	5107	5137	4626	5.8
Oceania	508	934	1 268	1 354	1 529	1 585	1 548	1 723	2.2
Others***	9 672	1 969	102	37	37	40	38	48	0.1
World total	**72 085**	**81 857**	**81 589**	**79 728**	**79 927**	**78 991**	**78 373**	**79 620**	**100.0**

NOTES: n/a - not applicable. Aquatic animals exclude aquatic mammals, crocodiles, alligators, caimans, aquatic products (corals, pearls, shells and sponges) and algae. * Data for Russian Federation are from 1992 onwards. **Refers to the quantities caught and retained by all countries of that region, irrespective of the marine fishing area where they fished, rather than the quantities caught and retained in marine waters surrounding that region. *** Includes the former Soviet Union (USSR) up to 1991 and data on not indentified countries (others nei).

SOURCE: FAO. 2026. FishStat: Global capture production 1950-2024. [Accessed on 28 March 2026]. In: *FishStatJ*. Available at: https://www.fao.org/fishery/en/statistics/software/fishstatj. Licence: CC-BY-4.0.

https://doi.org/10.4060/cd8357en-table1.6

FIGURE 1.15 WORLD CAPTURE FISHERIES PRODUCTION OF AQUATIC ANIMALS IN MARINE AREAS BY FAO MAJOR FISHING AREA, AVERAGE 2022–2024



Refer to the disclaimer on the copyright page for the names and boundaries used in this map.

NOTES: Aquatic animals exclude aquatic mammals, crocodiles, alligators, caimans, aquatic products (corals, pearls, shells and sponges) and algae. Data are expressed in live weight equivalent.

SOURCES: FAO. 2026. FishStat: Global capture production 1950-2024. [Accessed on 28 March 2026]. In: FishStatJ. Available at: https://www.fao.org/fishery/en/statistics/software/fishstatj. Licence: CC-BY-4.0. United Nations Geospatial. 2020. Map geodata.

» some of the most commercially significant species in this group. Meanwhile, other previously less-targeted squid and cephalopod species are gaining value as traditional fish stocks decline and market demand grows. Many squid species have fast growth and high reproductive rates, making them more resilient to fishing pressure and suitable for expansion under good management.

The number of individual species (i.e. not species items) reported in marine landings rose from around 1 400 in 2000 to over 2 900 in 2024. The apparent increase in diversification, however, may also be the result of improved fisheries coverage and the increased capacity of countries to collect and report species-specific landing data.

Geographical distribution in marine areas

While global capture production has remained stable since the late-1980s, the geographical distribution of production is more dynamic, showing signs of shifting production. Statistics by FAO Major Fishing Area for the period 2021–2024 as well as marine production in recent decades, are presented in Table 1.8 for the following categories: »

TABLE 1.7 CAPTURE FISHERIES PRODUCTION OF AQUATIC ANIMALS IN MARINE AREAS BY MAIN SPECIES AND GENUS

Species item	Average per year 2011–2020	2021	2022	2023	2024	Share of total, 2024 (%)
	(thousand tonnes, live weight equivalent)					
Finfish						
Anchoveta, *Engraulis ringens*	4 944	5 876	4 859	2 416	5 037	7.4
Skipjack tuna, *Katsuwonus pelamis*	2 885	3 017	3 120	3 044	3 575	5.3
Alaska pollock, *Gadus chalcogrammus*	3 375	3 484	3 380	3 544	3 573	5.3
Blue whiting, *Micromesistius poutassou*	1 115	1 147	1 044	1 740	1 835	2.7
Pacific sardine, *Sardinops sagax*	902	1 412	1 406	1 730	1 810	2.7
Yellowfin tuna, *Thunnus albacares*	1 454	1 578	1 550	1 630	1 710	2.5
Scads nei, *Decapterus* spp.	1 221	1 231	1 295	1 347	1 379	2.0
Chilean jack mackerel, *Trachurus murphyi*	514	828	1 049	1 207	1 377	2.0
Atlantic herring, *Clupea harengus*	1 716	1 628	1 650	1 510	1 319	1.9
Pacific chub mackerel, *Scomber japonicus*	1 421	1 708	1 402	1 211	1 202	1.8
Largehead hairtail, *Trichiurus lepturus*	1 216	1 127	1 098	1 141	1 128	1.7
European pilchard, *Sardina pilchardus*	1 260	1 359	1 504	1 147	971	1.4
Atlantic mackerel, *Scomber scombrus*	1 085	1 141	1 098	1 117	940	1.4
Japanese anchovy, *Engraulis japonicus*	1 172	878	857	893	854	1.3
Others	42 900	41 246	41 539	42 339	41 018	60.6
Total finfish	**67 179**	**67 661**	**66 853**	**66 015**	**67 728**	**100.0**
Crustaceans						
Natantian decapods nei, Natantia	822	686	679	692	708	12.2
Gazami crab, *Portunus trituberculatus*	494	476	482	490	475	8.2
Antarctic krill, *Euphausia superba*	274	368	421	414	465	8.0
Marine crabs nei, Brachyura	320	327	354	390	353	6.1
Akiami paste shrimp, *Acetes japonicus*	486	380	387	361	343	5.9
Blue swimming crab, *Portunus pelagicus*	254	245	245	268	274	4.7
Northern prawn, *Pandalus borealis*	270	248	259	252	260	4.5
Southern rough shrimp, *Trachysalambria curvirostris*	290	242	245	252	253	4.4
Others	2 668	2 643	2 615	2 738	2 657	45.9
Total crustaceans	**5 878**	**5 617**	**5 686**	**5 857**	**5 788**	**100.0**
Molluscs						
Jumbo flying squid, *Dosidicus gigas*	908	997	1 076	1 226	610	10.7
Argentine shortfin squid, *Illex argentinus*	415	491	393	401	481	8.5
Cephalopods nei, Cephalopoda	424	421	401	405	420	7.4
Cuttlefish, bobtail squids nei, Sepiidae, Sepiolidae	334	328	323	358	347	6.1
Yesso scallop, *Mizuhopecten yessoensis*	308	367	349	340	327	5.8
Octopuses, etc., nei, Octopodidae	307	314	310	310	307	5.4

TABLE 1.7 (Continued)

Species item	Average per year 2011–2020	2021	2022	2023	2024	Share of total, 2024 (%)
	(thousand tonnes, live weight equivalent)					
Common squids nei, *Loligo* spp.	326	331	337	369	232	4.1
Others	3 281	2 951	2 850	2 718	2 952	52.0
Total molluscs	**6 304**	**6 199**	**6 041**	**6 127**	**5 676**	**100.0**
Other animals						
Jellyfishes nei, *Rhopilema* spp.	291	217	193	216	204	47.6
Cannonball jellyfish, *Stomolophus meleagris*	44	78	55	3	83	19.4
Sea cucumbers nei, Holothuroidea	36	41	42	42	39	9.1
Aquatic invertebrates nei, Invertebrata	68	41	48	43	38	8.9
Chilean sea urchin, *Loxechinus albus*	33	27	28	25	23	5.3
Sea urchins nei, *Strongylocentrotus* spp.	30	21	21	21	20	4.7
Others	26	24	25	24	21	4.9
Total other animals	**529**	**450**	**411**	**373**	**428**	**100.0**
Total all species	**79 889**	**79 927**	**78 991**	**78 373**	**79 620**	

NOTES: nei – not elsewhere included. Aquatic animals exclude aquatic mammals, crocodiles, alligators, caimans, aquatic products (corals, pearls, shells and sponges) and algae. Data are expressed in live weight equivalent.

SOURCE: FAO. 2026. FishStat: Global capture production 1950-2024. [Accessed on 28 March 2026]. In: *FishStatJ*. Available at: https://www.fao.org/fishery/en/statistics/software/fishstatj. Licence: CC-BY-4.0.

https://doi.org/10.4060/cd8357en-table1.7

- temperate areas (Areas 21, 27, 37, 41, 61, 67 and 81);
- tropical areas (Areas 31, 51, 57 and 71);
- upwelling areas (Areas 34, 47, 77 and 87); and
- Arctic and Antarctic areas (Areas 18, 48, 58 and 88).

Temperate areas have been characterized by long-term plateaus or declines in production in recent decades, signalling long-term exploitation of most major stocks and limited scope for further production increases in these fishing areas. In contrast, tropical and subtropical areas continue to show growth – with production in the Western Indian Ocean (Area 51), Eastern Central Pacific (Area 77) and Western Central Pacific (Area 71) reaching new highs in 2024. Upwelling areas (in particular, Southeast Pacific, Area 87) represent some of the most productive marine ecosystems globally. These areas contribute a disproportionately large share of global marine production relative to their geographical extent and are characterized by high, but variable, productivity and are one of the main sources of volatility in interannual global marine capture production.

Within this broad context, marine capture trends continue to be shaped by a relatively small number of FAO Major Fishing Areas. In 2024, as in previous years, over half of global marine production was accounted for by three Major Fishing Areas:

- The Northwest Pacific (Area 61) continues to dominate with the highest production, accounting for around 23 percent of global marine captures driven by China, Japan and the Russian Federation targeting a diversified composition of species.
- The Western Central Pacific (Area 71) ranks second; catches have risen steadily to 18 percent of global marine production, reflecting the growth of tropical multispecies fisheries and the expansion of Southeast Asian fleets targeting tuna and tuna-like species.
- The Southeast Pacific (Area 87) ranks third, contributing 11 percent of global marine

TABLE 1.8 CAPTURE FISHERIES PRODUCTION OF AQUATIC ANIMALS BY FAO MAJOR FISHING AREA

Fishing area code	Fishing area name	Production (average per year)				Production				Share of total, 2024 (%)
		1980s	1990s	2000s	2010s	2021	2022	2023	2024	
		(thousand tonnes, live weight equivalent)								
Capture fisheries in inland waters										
01	Africa – Inland waters	1 465	1 892	2 334	2 887	3 423	3 295	3 662	3 657	29.7
02	America, North – Inland waters	234	213	182	195	96	68	74	118	1.0
03	America, South – Inland waters	321	327	393	361	338	353	353	337	2.7
04	Asia – Inland waters	2 827	4 133	5 995	7 476	7 123	7 265	7 614	7 786	63.3
05	Europe – Inland waters	184	361	350	391	400	389	339	386	3.1
06	Oceania – Inland waters	18	20	19	21	21	20	20	21	0.2
07	Former USSR area* – Inland waters	646	106	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Inland waters total	**5 697**	**7 052**	**9 273**	**11 331**	**11 399**	**11 391**	**12 062**	**12 304**	**100.0**
Capture fisheries in marine areas										
21	Atlantic, Northwest	2 908	2 333	2 219	1 847	1 632	1 500	1 471	1 386	7.1
27	Atlantic, Northeast	10 439	10 391	9 814	8 650	8 082	8 208	8 396	7 562	38.6
31	Atlantic, Western Central	2 014	1 825	1 553	1 342	1 119	1 184	1 162	1 077	5.5
34	Atlantic, Eastern Central	3 199	3 557	3 758	4 758	5 188	5 316	4 978	5 077	25.9
37	Mediterranean and Black Sea	1 841	1 499	1 536	1 317	1 098	1 092	1 172	1 025	5.2
41	Atlantic, Southwest	1 783	2 250	2 146	1 846	1 788	1 719	1 859	1 970	10.1
47	Atlantic, Southeast	2 318	1 556	1 543	1 537	1 402	1 404	1 363	1 468	7.5
	Atlantic Ocean and Mediterranean total	**24 501**	**23 411**	**22 568**	**21 297**	**20 308**	**20 423**	**20 401**	**19 566**	**100.0**
51	Indian Ocean, Western	2 369	3 675	4 236	4 900	5 536	5 688	5 967	6 141	49.1
57	Indian Ocean, Eastern	2 672	4 131	5 481	6 365	5 771	5 998	6 042	6 369	50.9
	Indian Ocean total	**5 042**	**7 806**	**9 717**	**11 264**	**11 308**	**11 686**	**12 009**	**12 510**	**100.0**
61	Pacific, Northwest	20 955	21 797	19 969	20 606	19 065	18 619	19 277	18 696	39.7
67	Pacific, Northeast	2 743	2 982	2 790	3 052	2 913	2 692	2 841	2 551	5.4
71	Pacific, Western Central	5 941	8 511	10 800	12 509	13 548	13 677	13 880	14 067	29.9
77	Pacific, Eastern Central	1 622	1 441	1 811	1 872	1 965	1 992	2 204	2 348	5.0
81	Pacific, Southwest	568	820	689	535	393	403	384	381	0.8
87	Pacific, Southeast	10 232	14 897	13 104	8 324	10 033	9 038	6 924	9 004	19.1
	Pacific Ocean total	**42 062**	**50 449**	**49 162**	**46 898**	**47 917**	**46 421**	**45 509**	**47 046**	**100.0**
18, 48, 58, 88	**Arctic and Antarctic areas total**	**481**	**191**	**141**	**269**	**394**	**462**	**454**	**497**	
	Marine areas total	**72 085**	**81 857**	**81 589**	**79 728**	**79 927**	**78 991**	**78 373**	**79 620**	
Captures fisheries in marine areas by type of marine area										
	Temperate areas	41 237	42 073	39 162	37 852	34 970	34 232	35 400	33 572	42.2
	Tropical areas	12 996	18 141	22 070	25 116	25 974	26 547	27 050	27 654	34.7
	Upwelling areas	17 371	21 452	20 216	16 491	18 589	17 751	15 468	17 896	22.5
	Arctic and Antarctic areas	481	191	141	269	394	462	454	497	0.6
	Marine areas total	**72 085**	**81 857**	**81 589**	**79 728**	**79 927**	**78 991**	**78 373**	**79 620**	**100.0**

NOTES: n/a – not applicable. Aquatic animals exclude aquatic mammals, crocodiles, alligators, caimans, aquatic products (corals, pearls, shells and sponges) and algae. FAO Major Fishing Areas defined as: temperate areas (Areas 21, 27, 37, 41, 61, 67 and 81); tropical areas (Areas 31, 51, 57 and 71); upwelling areas (Areas 34, 47, 77 and 87); Arctic and Antarctic areas (Areas 18, 48, 58 and 88).
* Data for the former Soviet Union (USSR) are available up to 1991.

SOURCE: FAO. 2026. FishStat: Global capture production 1950-2024. [Accessed on 28 March 2026]. In: *FishStatJ*. Available at: https://www.fao.org/fishery/en/statistics/software/fishstatj. Licence: CC-BY-4.0.

https://doi.org/10.4060/cd8357en-table1.8

» production, despite high annual variability associated with upwelling areas. The anchoveta fishery, which in recent years contributed up to 71 percent of total catches in the region, drove regional and global marine production highs in 2011 and 2018. Total production in Area 87 can fluctuate by several million tonnes, depending on El Niño conditions, highlighting this area as the most climate-sensitive contributor to global capture production.

Inland waters capture production

In 2024, global catches of aquatic animals in inland waters recorded their highest level at 12.3 million tonnes (Table 1.9), an increase of 5.9 percent compared to the average of the previous three years.

This modest growth in global inland water production in recent years has been driven partly by increases in several major producing countries – notably India, Bangladesh and the United Republic of Tanzania – where inland fisheries are highly relevant for national food security and domestic consumption. This increase is also partially attributed to improvements in data collection and reporting, in particular for small-scale inland fishing, as well as to reclassification and improvements in separating official aquaculture and capture fisheries statistics. The ecological evidence suggests that many inland systems are already heavily exploited, or in decline, with limited scope for large increases in the future. Issues concerning the overall data quality and uncertainty in official inland water statistics are discussed in more detail in the sections below.

In 2024, India and Bangladesh again ranked first and second for inland water production with catches of 2.2 million tonnes and 1.4 million tonnes, respectively. China ranked third, reporting a decrease in inland catches of almost 47 percent, from 2.2 million tonnes in 2017 to 1.2 million tonnes in 2024 as a result of China's management-driven policies that include a ten-year fishing ban in the waters of the Yangtze River, while increasing reliance on aquaculture and culture-based fisheries instead of wild inland captures.

Top species in inland waters

Despite the large number of freshwater species harvested, data resolution at species level in inland fisheries remains low, with nearly half of the global inland water production in 2024 recorded as "freshwater fishes nei", complicating efforts to track biodiversity change, including changes in ecosytems and shifts in the species composition of catches. Of the landings that are reported at species or family level, over 80 percent are concentrated in three major groups.

The largest group, carps, barbels and other cyprinids, has exhibited sustained growth, increasing from approximately 0.7 million tonnes per year in the mid-2000s to nearly 2.0 million tonnes in 2024. This group also accounts for most of the recent expansion in inland capture production and provides evidence of the shift towards catches of small-bodied, fast-growing and more resilient species. Likewise, landings of the second-largest group, tilapias and other cichlids, have also increased in recent years, from about 0.7 million tonnes to approximately 0.9 million tonnes per year. Landings of the third-largest group, freshwater crustaceans, were relatively stable over much of the same period (between 0.4 and 0.45 million tonnes annually); however, there has been a recent decline to below 0.3 million tonnes, largely reflecting the reduction in China's inland fisheries.

Geographical distribution in inland waters

In 2024, similarly to previous years, almost two thirds of global inland water capture production were accounted for by 9 countries, compared to 13 countries for marine captures. Inland water catches are by their nature more geographically concentrated than marine catches, as they are harvested in major river basins and significant freshwater bodies (Figure 1.16A).

Since the mid-2000s, Asia has consistently contributed over 60 percent of global inland capture production of aquatic animals, reaching 7.8 million tonnes in 2024. Indeed, the top three producing countries – all located in Asia – accounted for almost 40 percent of global inland fisheries (Figure 1.16B). Despite this dominance, inland fisheries in Asia remain far smaller than the freshwater aquaculture sector, which produced over 60 million tonnes in 2024. »

TABLE 1.9 CAPTURE FISHERIES PRODUCTION OF AQUATIC ANIMALS IN INLAND WATERS BY MAJOR PRODUCER AND REGION

	Production (average per year)				Production				Share of total, 2024 (%)
	1980s	1990s	2000s	2010s	2021	2022	2023	2024	
	(thousand tonnes, live weight equivalent)								
By country or territory									
India	495	584	837	1 434	1 847	1 890	2 125	2 176	17.7
Bangladesh	441	502	859	1 078	1 301	1 322	1 383	1 412	11.5
China	537	1 457	2 111	2 027	1 198	1 166	1 168	1 163	9.5
Myanmar	142	146	478	855	786	899	902	966	7.8
Uganda	187	223	331	435	635	445	717	538	4.4
Indonesia	272	311	307	471	459	465	474	483	3.9
Cambodia	54	86	344	493	383	406	427	467	3.8
United Republic of Tanzania	252	289	301	314	414	403	412	441	3.6
Nigeria	101	104	211	350	363	355	362	387	3.1
Egypt	123	228	267	255	330	343	328	329	2.7
Russian Federation*	n/a	197	222	267	272	267	213	265	2.2
Democratic Republic of the Congo	133	170	231	228	253	266	253	257	2.1
Ethiopia**	n/a	6	13	44	73	101	131	255	2.1
Brazil	200	182	237	232	225	225	225	225	1.8
Malawi	68	59	58	141	171	187	213	190	1.5
Philippines	261	193	153	183	201	173	172	164	1.3
Viet Nam	111	137	207	160	150	147	152	156	1.3
Pakistan	67	132	115	130	150	151	152	150	1.2
Mozambique	3	9	24	86	117	129	141	147	1.2
Iran (Islamic Republic of)	11	92	72	90	108	99	114	111	0.9
Chad	54	76	78	106	103	107	109	109	0.9
Zambia	58	68	69	89	105	109	102	108	0.9
Thailand	103	178	208	187	113	106	115	108	0.9
Mali	65	88	101	96	105	110	113	104	0.8
Kenya	95	179	141	138	114	108	90	87	0.7
Top 25 producers	3 834	5 696	7 977	9 886	9 974	9 979	10 592	10 797	87.8
Total all other producers	1 862	1 356	1 297	1 445	1 425	1 411	1 470	1 507	12.2
All producers	**5 697**	**7 052**	**9 273**	**11 331**	**11 399**	**11 391**	**12 062**	**12 304**	**100.0**
By region									
Asia	2 827	4 133	5 995	7 476	7 123	7 265	7 614	7 786	63.3
Africa	1 465	1 892	2 334	2 887	3 423	3 295	3 662	3 657	29.7
Europe	184	361	350	391	400	389	339	386	3.1
Latin America and the Caribbean	440	459	512	506	394	381	388	421	3.4
Nothern America	116	80	63	50	40	41	39	34	0.3
Oceania	18	20	19	21	21	20	20	21	0.2
Others***	646	106	n/a	n/a	n/a	n/a	n/a	n/a	n/a
World total	**5 697**	**7 052**	**9 273**	**11 331**	**11 399**	**11 391**	**12 062**	**12 304**	**100.0**

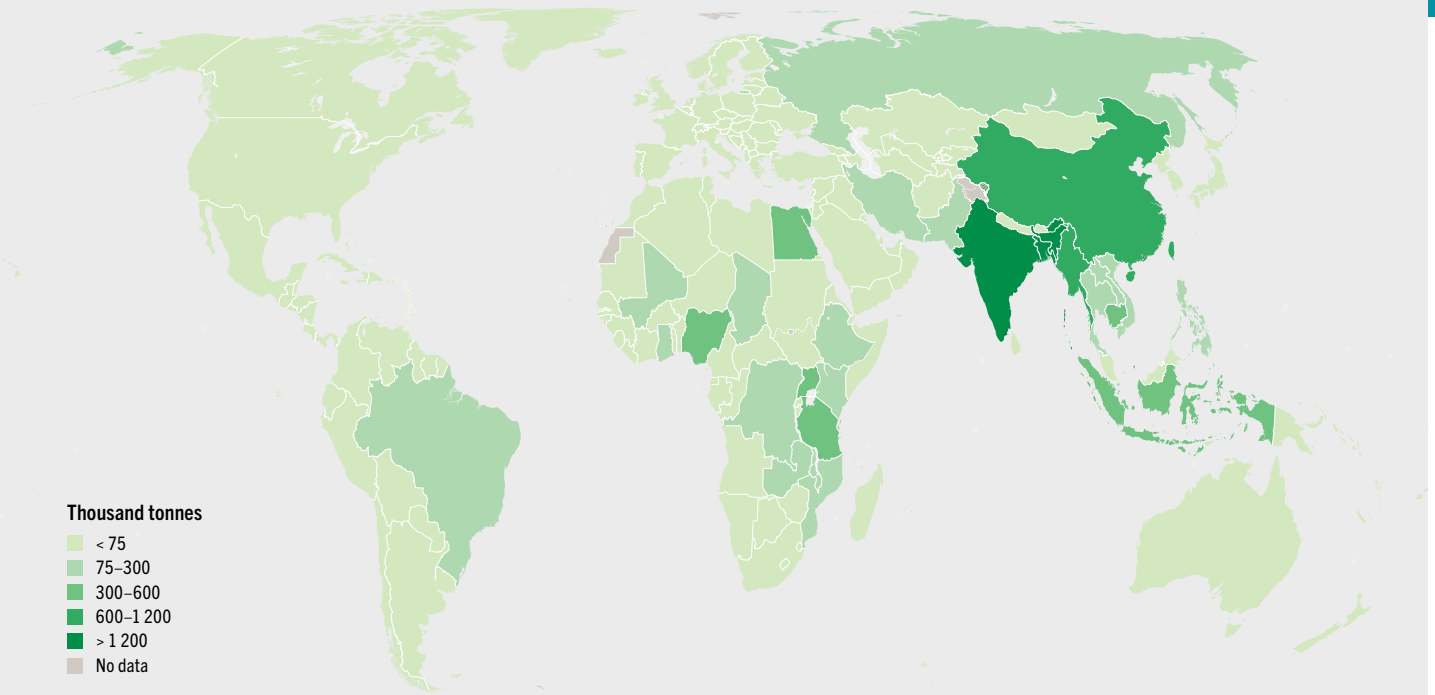
NOTES: n/a - not applicable. Aquatic animals exclude aquatic mammals, crocodiles, alligators, caimans, aquatic products (corals, pearls, shells and sponges) and algae. * Data for Russian Federation are from 1992 onwards. ** Data for Ethiopia are from 1993 onwards. *** Includes the former Soviet Union (USSR) up to 1991.

SOURCE: FAO. 2026. FishStat: Global capture production 1950-2024. [Accessed on 28 March 2026]. In: *FishStatJ*. Available at: https://www.fao.org/fishery/en/statistics/software/fishstatj. Licence: CC-BY-4.0.

https://doi.org/10.4060/cd8357en-table1.9

FIGURE 1.16 WORLD CAPTURE FISHERIES PRODUCTION OF AQUATIC ANIMALS IN INLAND WATERS

A) COUNTRIES AND TERRITORIES, AVERAGE 2022–2024

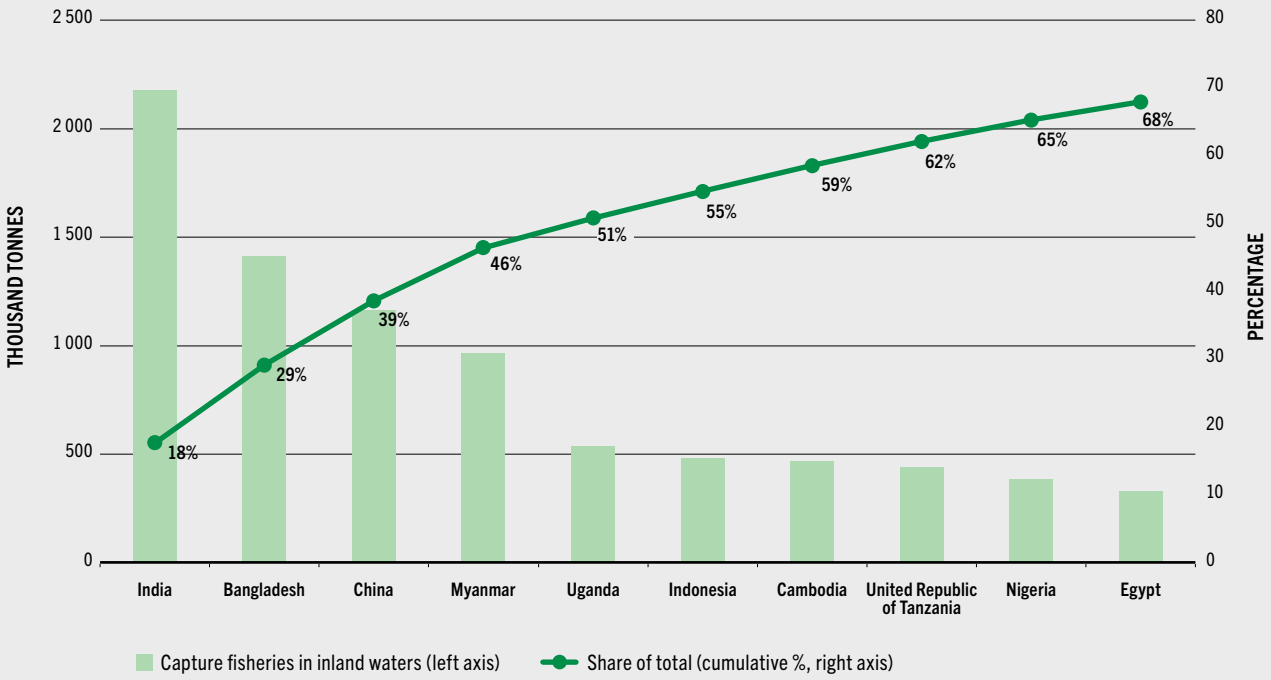


Refer to the disclaimer on the copyright page for the names and boundaries used in this map. Dotted line represents approximately the Line of Control in Jammu and Kashmir agreed upon by India and Pakistan. The final status of Jammu and Kashmir has not yet been agreed upon by the parties. Final boundary between the Republic of Sudan and the Republic of South Sudan has not yet been determined. Final status of the Abyei area is not yet determined.

NOTES: Aquatic animals exclude aquatic mammals, crocodiles, alligators, caimans, sponges, corals, pearls and algae. Data are expressed in live weight equivalent.

SOURCES: FAO. 2026. FishStat: Global capture production 1950-2024. [Accessed on 28 March 2026]. In: *FishStatJ*. Available at: https://www.fao.org/fishery/en/statistics/software/fishstatj. Licence: CC-BY-4.0; United Nations Geospatial. 2020. Map geodata.

B) TOP TEN PRODUCERS, 2024

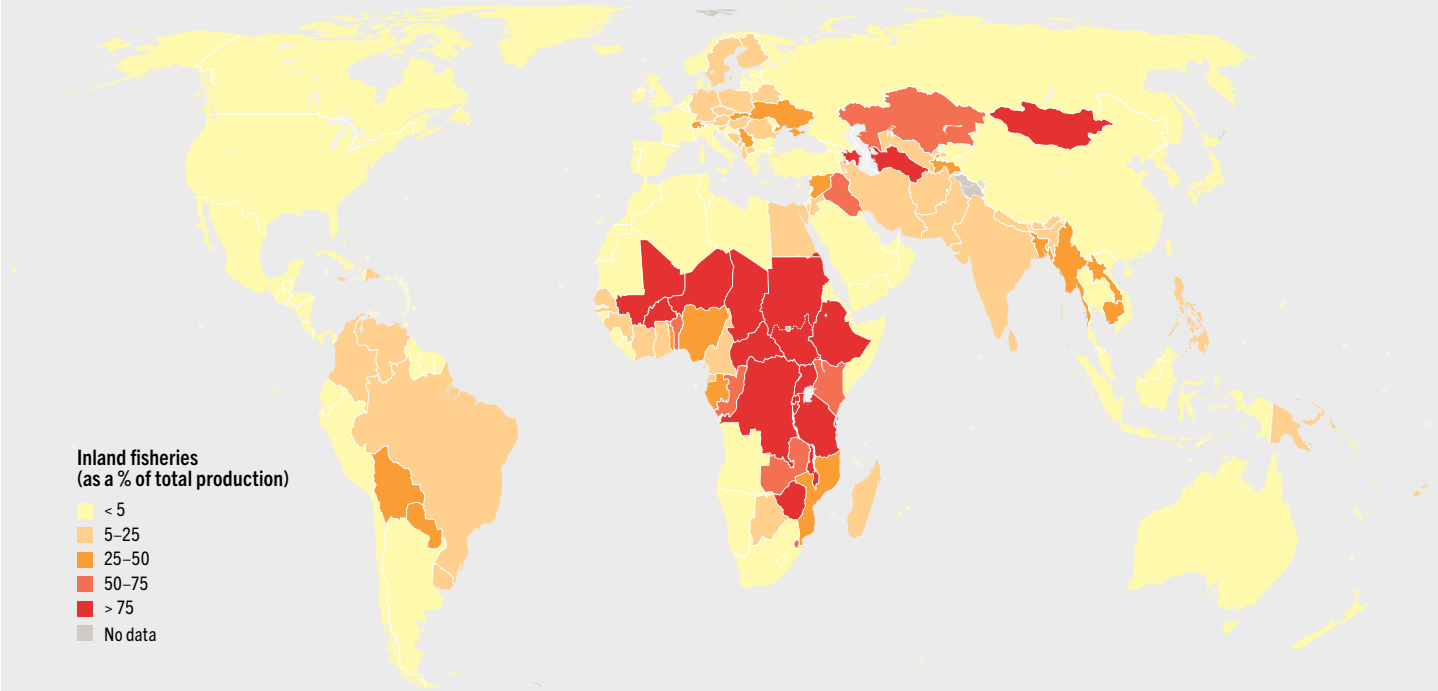


NOTES: Aquatic animals exclude aquatic mammals, crocodiles, alligators, caimans, aquatic products (corals, pearls, shells and sponges) and algae. Data are expressed in live weight equivalent.

SOURCE: FAO. 2026. FishStat: Global capture production 1950–2024. [Accessed on 28 March 2026]. In: *FishStatJ*. Available at: https://www.fao.org/fishery/en/statistics/software/fishstatj. Licence: CC-BY-4.0.

https://doi.org/10.4060/cd8357en-fig1.16a https://doi.org/10.4060/cd8357en-fig1.16b

FIGURE 1.17 SHARE OF CAPTURE FISHERIES IN INLAND WATERS IN TOTAL FISHERIES AND AQUACULTURE PRODUCTION OF AQUATIC ANIMALS BY VOLUME, AVERAGE 2022–2024



Refer to the disclaimer on the copyright page for the names and boundaries used in this map. Dotted line represents approximately the Line of Control in Jammu and Kashmir agreed upon by India and Pakistan. The final status of Jammu and Kashmir has not yet been agreed upon by the parties. Final boundary between the Republic of Sudan and the Republic of South Sudan has not yet been determined. Final status of the Abyei area is not yet determined.

NOTES: Aquatic animals exclude aquatic mammals, crocodiles, alligators, caimans, aquatic products (corals, pearls, shells and sponges) and algae. Data are expressed in live weight equivalent.

SOURCES: FAO. 2026. FishStat: Global capture production 1950-2024. [Accessed on 28 March 2026]. In: *FishStatJ*. Available at: https://www.fao.org/fishery/en/statistics/software/fishstatj. Licence: CC-BY-4.0; United Nations Geospatial. 2020. Map geodata.

https://doi.org/10.4060/cd8357en-fig1.17

» In the case of Africa, inland fisheries are a vital source of food security, especially for landlocked and low-income countries, with the continent contributing almost 30 percent of global inland catches in 2024 (3.7 million tonnes). However, production among African countries is highly variable: major river basins (e.g. in Chad and Nigeria) and the Great Lakes (e.g. in the Democratic Republic of the Congo) support very high inland water catches, while Northern Africa and the Red Sea region contribute minimally. However, despite the relative importance of inland waters to total production in Africa, non-reporting and under-reporting of inland fishery statistics persist. The sector also faces challenges including overfishing, habitat degradation, and limited monitoring, underscoring the need for effective management, investment in data collection, and ecosystem-based approaches to sustain their critical role.

The importance of inland water fisheries is also often understated in national fisheries management policies, and in many cases insufficient resources are allocated to monitor and effectively manage these fisheries. While inland fisheries accounted for around 6 percent of global fisheries and aquaculture production of aquatic animals in 2024, the proportion varies significantly at the national level (Figure 1.17).

For many landlocked countries in Central Africa and Central Asia, inland water fisheries account for between 50 percent and 100 percent of total fisheries and aquaculture production. Meanwhile, countries such as Bangladesh, Cambodia and Viet Nam host some of the world's most productive inland fisheries, supporting millions of small-scale fishers, underscoring the vital role of inland waters in local economies, livelihoods and nutrition, where they provide a key source of food for many communities.

Data quality of official capture statistics

While inland water production reached its highest ever recorded level in 2024, interpretation of the long-term trend – specifically the year-on-year increase in global production – should be treated with caution.

Official statistics used to describe the status of inland fisheries are often unreliable or incomplete. This is partly due to the challenges of monitoring fisheries that are located in less developed economies. They are typically small-scale, highly dispersed, complex in operation and frequently located in remote areas. National systems often lack the capacity or resources to monitor all forms of inland waterbodies, leading to partial coverage and a high reliance on extrapolations from limited sampling or use of proxies such as fisher numbers, gear counts, or assumed productivity factors. Non-reporting or under-reporting of inland fisheries statistics to FAO continues to persist, particularly among low-income countries, including some Landlocked Developing Countries in Africa where inland water fisheries are a critical source of nutrition and food security.

Subsistence and recreational retained catches are also often missing from official statistics. Consequently, inland water official fisheries statistics reported to FAO can be subject to periodic revisions and abrupt breaks in time series. Alternatively, smoothing of natural interannual and seasonal fluctuations symptomatic of inland water fisheries is often missing from catch statistics that exhibit little year-to-year variability (see Box 1.2).

Marine capture statistics too have complications; they also exhibit difficulties in effectively monitoring small-scale fisheries, and there are data gaps for selected fisheries and underestimated harvests from illegal or unreported catches. However, the presence of established monitoring systems – particularly for large-scale and industrialized fisheries – including vessel licensing, paper or electronic logbook reporting, on-board observers, and landing site surveys, makes the levels of accuracy of marine capture statistics, especially for large producers, much more reliable in terms of volume and long-term trends.

To help improve reporting of official statistics by Members, FAO organized in September 2024 dedicated online training sessions on each of the annual FAO Fisheries and Aquaculture questionnaires. The training aimed to shed light on the causes of insufficient reporting, and improve capacity, communication and collaboration with Members. These sessions, assessed as highly effective, resulted in the submission of data by a greater number countries. ■

THE STATUS OF FISHERY RESOURCES

Marine fisheries

Status of resources

The 2025 edition of the *Review of the state of world marine fishery resources* introduced important improvements to FAO's framework for state of stocks assessment and reporting.[1] These methodological upgrades, described in Box 1.3, include the expansion and disaggregation of the reference list of stocks and the introduction of a structured tier system. As a result, the 531 aggregated stocks reported in the previous edition of *The State of World Fisheries and Aquaculture*[2] increased to 2 570 disaggregated stocks in the above-mentioned 2025 review[1] based on assessments with input data until 2021.

These methodological upgrades have been used also in the present updated review, based on a total of 2 665 assessed stocks, covering 998 species. The latest update differs from the 2025 report for

BOX 1.2 SHIFTING BASELINES IN THE CONTEXT OF GLOBAL INLAND WATER CATCHES

FAO has compiled annual national reports of inland capture fisheries production since 1950. Developments in these data reflect both changes in actual production and the evolution of monitoring systems, reporting practices and estimation methods. Systematic revisions or discontinuities in historical time series create a shifting baseline, complicating the assessment of long-term trends and the true state of inland fisheries.

Collecting data for inland fisheries is inherently more challenging than for marine fisheries or aquaculture, because these fisheries are often small-scale, remotely located and dispersed, seasonal and locally traded. Structural limitations frequently result in small year-to-year variations in catch statistics, despite the strong influence of hydrology, climate, land use and fishing effort on these aquatic ecosystems. Environmental and anthropogenic factors, including droughts, floods, dam construction, irrigation and water abstraction, land use change, pollution and overfishing, should in principle leave detectable signals in national catch data. In practice, such signals rarely appear. Large events, such as El Niño-related droughts, warming in major lakes, or extreme flooding in South Asia, are often not reflected in national datasets. Only in countries dominated by a single inland fishery, such as Ghana's Lake Volta or Egypt's Lake Nasser, do environmental or management changes clearly appear in national catch statistics.

Conversely, abrupt shifts in catch series often result from developments in data collection and analysis systems. Examples include the addition of previously unmonitored fisheries (e.g. Cambodia's inclusion of dispersed subsistence fisheries in 1999), improved catch assessment surveys (e.g. Uganda's stepwise increases following enhanced coverage and inclusion of illegal catches [Figure A]) and revisions following household or agricultural censuses (e.g. China's revision of 1997–2005 and 2012–2016 catches). The introduction of new sampling frames, raising factors or estimation methods can also alter national catch figures instantly. In many cases, these methodological changes are reported without retrospective adjustment, so apparent "trends" often reflect evolving data systems rather than actual production changes.

National policies can also distort statistics. In some countries, administrative incentives have encouraged alignment of reported figures to catch targets. Conversely, policies to reduce fishing effort – such as China's fishing bans, including the Yangtze River moratorium – have driven sharp declines in national and global totals.

The FAO global time series of inland capture fisheries is based on over 150 national datasets, some of which exhibit single or periodic substantial shifts, causing the global baseline to shift over time as retroactive adjustment and national revisions alter past values (Figure B). Despite these developments, the FAO data historically showed steady growth until around 2018, largely driven by a small number of major producers whose increases compensated declines elsewhere. Nevertheless, the FAO dataset remains the only global, annually updated source for inland capture fisheries.

Reporting will continue to evolve as countries improve methods, expand or reduce coverage, or revise estimates. This requires greater transparency, retrospective correction, and investment in robust national monitoring and reporting – especially for dispersed, subsistence and recreational fisheries. Otherwise, shifting baselines will remain an inherent feature of global inland fisheries reporting. Recognizing these limitations is essential for interpreting global trends, informing management and avoiding "shifting baseline syndrome", in which declines or structural changes go unnoticed as each new baseline obscures the previous one.

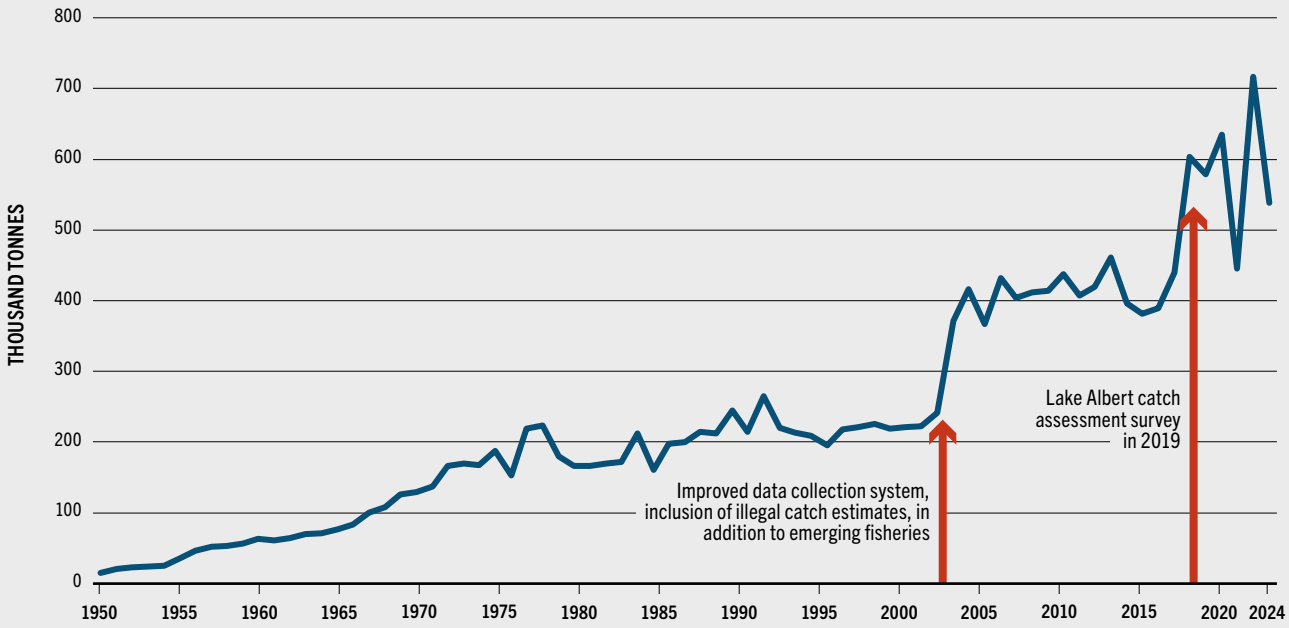
approximately 50 percent of the stocks that have new assessments reported for the 2023 catch year.[h] The remainder of the stocks use the same status as reported in the 2025 report, as no new assessments were reported for these stocks.

In FAO's assessments, a stock is classified as biologically sustainable when biomass is at or above a level that can produce maximum »

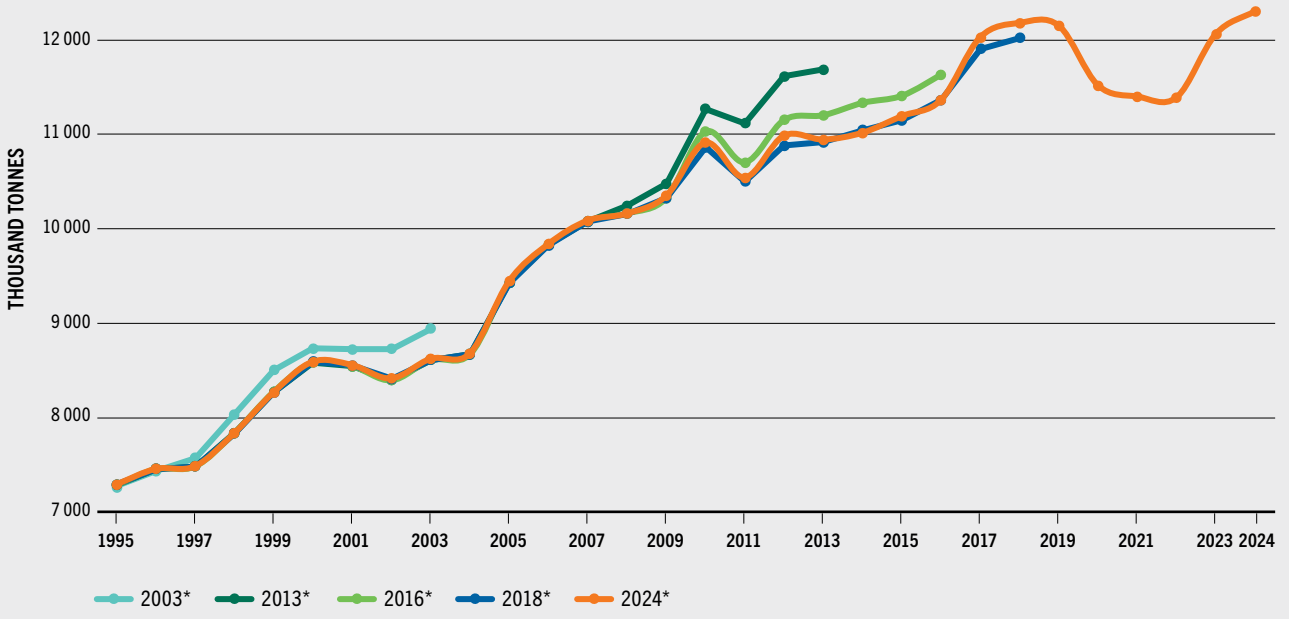
h Data were sourced from FAO capture fisheries production statistics released in 2025.[3]

BOX 1.2 (Continued)

A UGANDA: INLAND WATER PRODUCTION, 1950–2024



B REVISIONS TO FISHSTAT INLAND WATER GLOBAL PRODUCTION DATASET



NOTES: Aquatic animals exclude aquatic mammals, crocodiles, alligators, caimans, aquatic products (corals, pearls, shells and sponges) and algae. Data are expressed in live weight equivalent. * Data refer to the reference data year of the respective FishStat database releases.

SOURCES: FAO. 2026. FishStat: Global capture production 1950-2024. [Accessed on 28 March 2026]. In: *FishStatJ*. Available at: https://www.fao.org/fishery/en/statistics/software/fishstatj. Licence: CC-BY-4.0; FishStat Global capture production selected historical datasets.

BOX 1.3 UPDATED METHODOLOGY TO ASSESS AND REPORT ON THE STATE OF WORLD MARINE FISHERY RESOURCES

Since the first global review of marine fishery stocks was published in 1971,[5] FAO has regularly assessed and reported on the state of the world's marine fishery resources to support policy formulation and decision-making for the long-term sustainability of fisheries.

Between 2022 and 2024, FAO undertook a periodic review with a major update of its methodology for assessing and reporting on the state of exploited marine fishery stocks. This process was participatory, decentralized and inclusive, involving extensive engagement with national and regional fisheries institutions, regional fishery bodies, and independent experts. Nineteen regional workshops and online consultations were convened, bringing together approximately 650 experts from around 90 countries and more than 200 organizations. The updated methodology was formally presented in FAO's *Review of world marine fishery resources*,[1] launched in June 2025 at the third United Nations Ocean Conference.

A key outcome of this collaborative process was a substantial revision and expansion of the reference list of stocks used in FAO's global assessment. The list increased from fewer than 500 aggregated units in 2011 to 2 570 stock-specific assessment units.[1] The 2026 analysis uses 2 665 units, including both Pacific salmons and Atlantic salmon stocks, together with global groupings of highly migratory tunas, billfishes and sharks.

A major methodological innovation in this update is the introduction of a transparent three-tier approach to classifying stock status, designed to accommodate wide differences in data availability and quality across regions. The figure summarizes the main assessment tools available to scientists worldwide and illustrates how they align with the FAO tier framework.

Tier 1 relies on the most data-rich approaches, including age- or length-based integrated assessments and/or state-space Bayesian biomass dynamic models, typically supported by a formal peer review process. **Tier 2** applies biomass dynamic models to stocks with reliable catch time series and supporting auxiliary data and information, commonly implemented using Stock Reduction Analysis plus (SRA+) or Just Another Bayesian Biomass Assessment (JABBA). **Tier 3**, the broadest category, includes a range of approaches designed for more data-limited situations, such as catch maximum sustainable yield plus-plus (CMSY++), length-based methods (e.g. Electronic Length Frequency Analysis [ELEFAN], Length-Based Spawning Potential Ratio [LBSPR] and other length-based indicators) and weight-of-evidence frameworks.

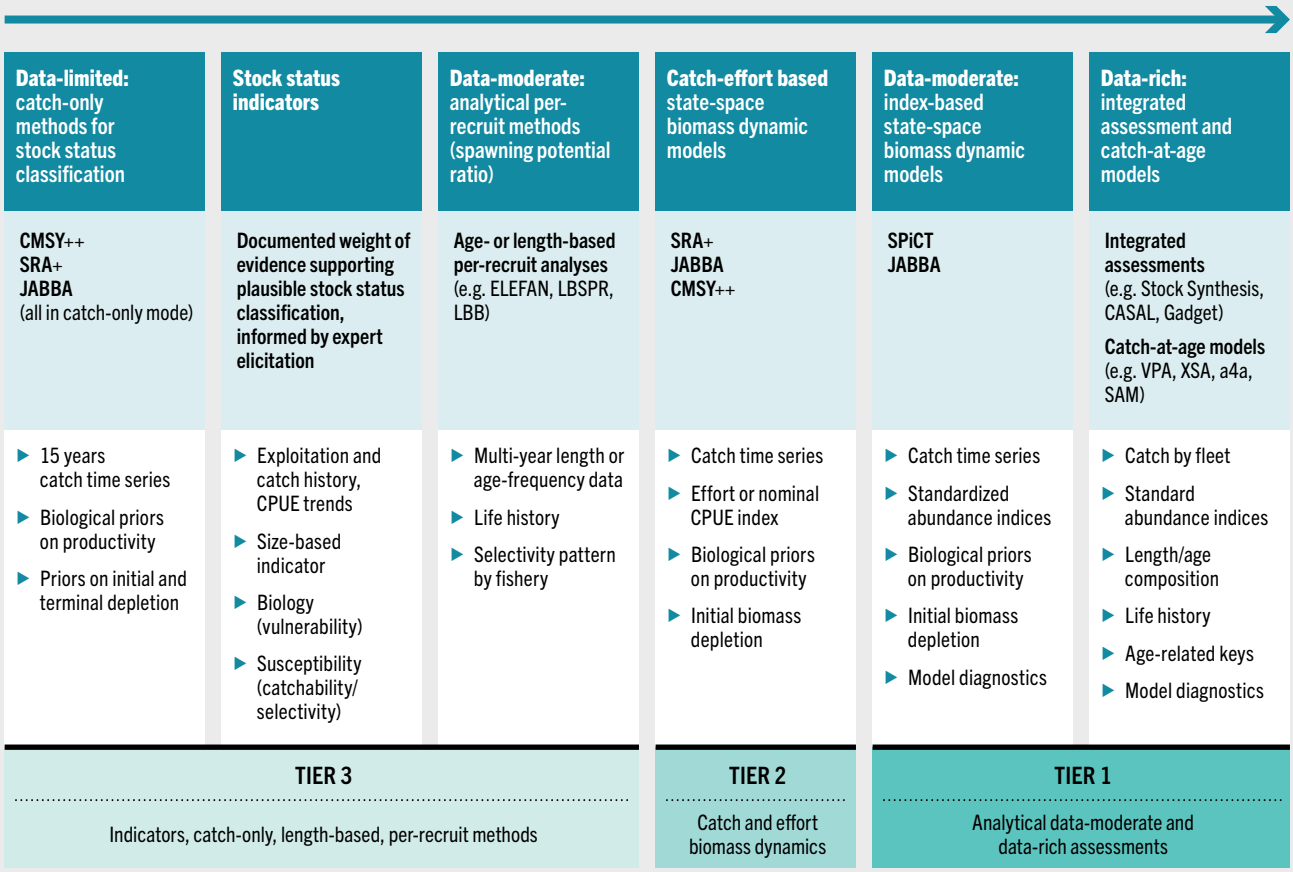
The updated methodology continues to rely on the proportion of stocks classified as *underfished*, *maximally sustainably fished* or *overfished*, based on a comparison of their biomass with maximum sustainable yield biomass (B_{MSY}). Where biomass reference points were not available, fishing mortality at maximum sustainable yield (F_{MSY}) proxies were used. Stocks assessed using Tier 2 and Tier 3 methods were limited to being classified as maximally sustainably fished or overfished to account for higher uncertainty and reduced precision in their analysis. Consequently, only Tier 1 assessed stocks for which the estimate of this ratio B/B_{MSY} is above 1.2 were classified as underfished.

The updated methodology is a significant advancement that uses a transparent assessment framework. The workflow described above enables practitioners in the field to identify which methods to use and apply, based on the quality and quantity of available data. In addition, the new analysis is archived with a clear replicable workflow identifying which stock was analysed, as well as the method used to do this, in order that future practitioners can replicate the global analysis.

» sustainable yield (MSY). Under the MSY paradigm described by Mace[4], maintaining fishing mortality at or below MSY fishing mortality (F_{MSY}) implies biomass will fluctuate around the biomass corresponding to maximum sustainable yield (B_{MSY}). FAO defines a stock as "maximally sustainably fished" when its biomass is 0.8–1.2 B_{MSY}, to account for natural fluctuations. The proportion of biologically sustainable stocks among those assessed is computed by adding together those stocks that are maximally sustainably fished and those classified as underfished stocks.

BOX 1.3 (Continued)

TIERS IN FISH STOCK ASSESSMENT



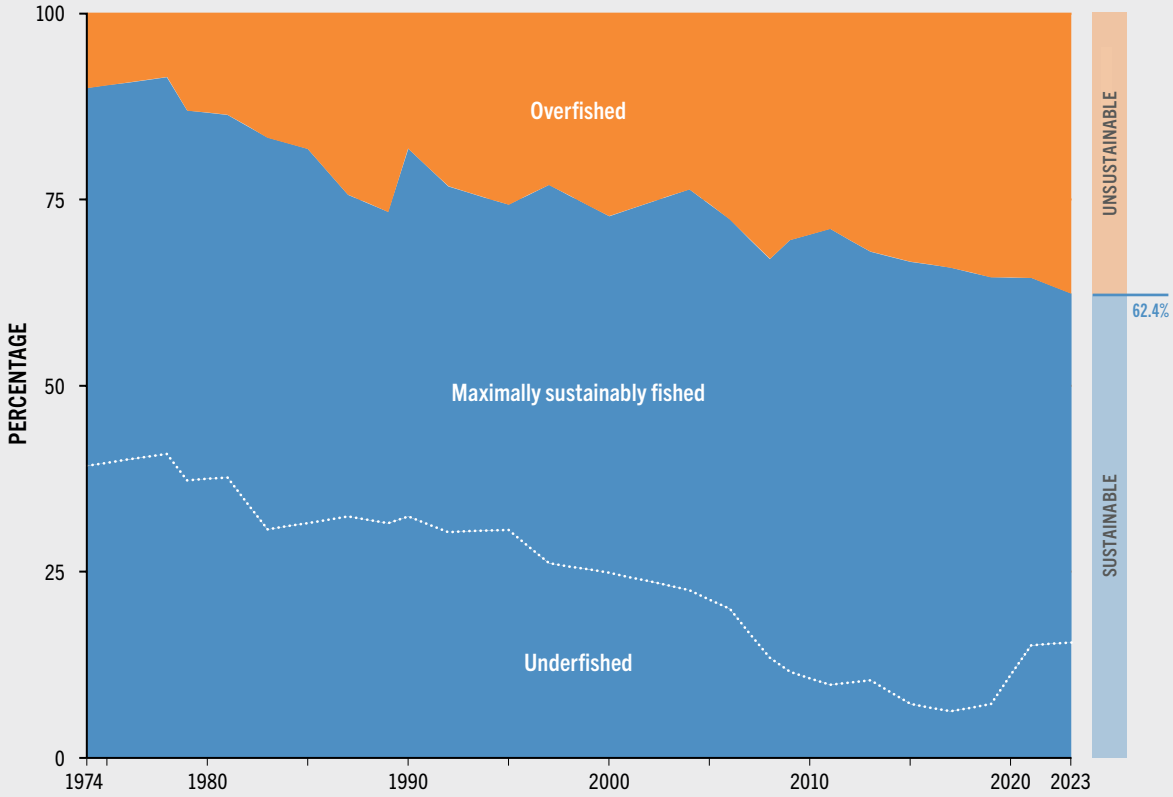
NOTES: CMSY++ – Catch Maximum Sustainable Yield plus-plus; SRA+ – Stock Reduction Analysis plus; JABBA – Just Another Bayesian Biomass Assessment; ELEFAN – Electronic Length Frequency Analysis; LBSPR – Length-Based Spawning Potential Ratio; LBB – Length-based Bayesian Biomass estimator; SPiCT – Surplus Production model in Continuous Time; CASAL – C++ Algorithmic Stock Assessment Laboratory; Gadget – Globally applicable Area-Disaggregated General Ecosystem Toolbox; VPA – virtual population analysis; XSA – extended survivors analysis; a4a – Assessment for All; SAM – State-Space Assessment Model; CPUE – catch per unit effort. For further details, see: https://doi.org/10.4060/cd5538en

SOURCE: Authors' own elaboration.

Around 62.4 percent of assessed stocks were classified as biologically sustainable in 2023, compared with 64.5 percent in 2021 (Figure 1.18). The decline reflects both assessment revisions and the inclusion of new records. Among the biologically sustainable stocks in 2023, 46.2 percent were classified as maximally sustainably fished and 15.9 percent as underfished.

When weighted by volume, it is estimated that 72.6 percent of landings of assessed stocks monitored by FAO originated from sustainably fished stocks, a slight reduction from previous

FIGURE 1.18 GLOBAL TRENDS IN THE STATE OF THE WORLD'S MARINE FISHERY STOCKS, 1974–2023



NOTE: Salmon stocks are not included in this analysis due to their distinct diadromous nature.
SOURCE: FAO estimates.

https://doi.org/10.4060/cd8357en-fig1.18

estimates,[1] which can be attributed to two factors: sustainability declines of four Major Fishing Areas, and methodological adjustments in the weighting of landings. These results reinforce previous statements that larger and more productive stocks tend to be more sustainable as a result of more effective management actions. However, sustainability levels vary substantially across regions and by species group (see Box 1.4).

The substantial heterogeneity in sustainability values characterizing FAO Major Fishing Areas continued in 2023 (Figure 1.19). Several areas maintained high proportions of sustainable stocks, reflecting the continuous implementation of science-based management systems and precautionary harvest strategies. Conversely, areas subject to high fishing pressure, strong environmental variability, and/or limited assessment and management capacity continued to face persistent challenges. For example, 73.6 percent of the stocks of the top ten species (by volume of landings) were fished within biologically sustainable levels in 2023, significantly higher than the global average, while complex taxonomic groups such as miscellaneous coastal fisheries showed lower proportions of sustainable exploitation.

In 2023, the highest proportions of biologically sustainable stocks were observed in the **Antarctic Areas** (Areas 48, 58, 88) with 100 percent of stocks classified as biologically sustainable, followed by »

BOX 1.4 SMALL-SCALE FISHERIES SUSTAINABILITY: A TARGETED SNAPSHOT FROM THE FIELD

Small-scale fisheries (SSF), both marine and inland, are vital for global food security, nutrition and livelihoods, directly employing 60 million people and supporting the livelihoods of 490 million, mostly in developing countries.[6] They supply at least 40 percent of global catches of aquatic animals, with 68 percent harvested from marine areas and 32 percent from inland waters, providing affordable, nutrient-rich food for coastal and inland communities. They sustain local economies, preserve traditional knowledge, and underpin the social fabric of communities. Yet, their contribution often remains undervalued and under-represented in national statistics and policy and management frameworks.

Defining small-scale fisheries in universal terms is challenging due to their diversity in terms of vessel size, technology, labour and markets. The Illuminating Hidden Harvests study,[7] covering 2 632 fisheries in 50 countries, used a multidimensional matrix approach to classify the degree of "small-scaleness". While most countries (over 80 percent) define small-scale fisheries using technological criteria such as vessel size or gear type, very few include social or economic attributes such as ownership, local consumption, or dependence, resulting in fragmented reporting and inconsistent policy support.

A 2021 snapshot of the FAO State of Stocks Index and SDG Indicator 14.4.1 (Proportion of fish stocks within biologically sustainable levels) sheds light on the sustainability of marine SSF resources. Of 521 SSF-targeted stocks, 57 percent were classified as biologically sustainable, compared to 60 percent of those targeted by large-scale fleets. These findings should be interpreted with caution due to limited data on global SSF coverage, particularly on small coastal stocks in remote areas. In addition, small-scale fisheries are often multispecies and multigear, which makes assessing the state of individual stocks more challenging. In fact, nearly 45 percent of monitored stocks targeted by small-scale fisheries and reported in 2024 remain of unknown status. In particular, inland small-scale fisheries lack stock metrics, though basin threat assessments indicate that over 65 percent of inland water habitats (and their fish stocks) are under threat.

Designing and implementing policies and laws suitable for small-scale fisheries is an imperative. Additionally, fishers need greater capacity to engage in decision-making and implement the subsector policies and laws. Improving the sustainability of small-scale fisheries requires closing data and management gaps. Investments in evidence-based, inclusive and adaptive co-management systems are urgently needed. Such systems combine formal assessments with traditional knowledge, enabling the generation of management advice that compensates for the scarcity of scientific data. These community-based data collection programmes have already enabled the transformation from data-poor to information-rich fisheries in a cost-efficient way.[8] This requires governments to strengthen institutional capacity for monitoring, control and surveillance systems that are suitable for small-scale fisheries, in line with the Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries in the Context of Food Security and Poverty Eradication and related instruments. For inland small-scale fisheries, FAO promotes situating fisheries within basin governance, using intersectoral tools that address external pressures (hydropower, agriculture, mining, pollution), applying co-management and including nutrition-sensitive objectives. Finally, integrating climate and biodiversity considerations into SSF management is essential to ensure resilience in the face of degrading habitats, shifting productivity and species distributions.

Overall, evidence points to the need for continued technical and institutional transformation to better capture SSF realities in assessment and management systems. Expanding data coverage, refining SSF-appropriate indicators, and embedding participatory monitoring will strengthen decision-making and ensure that the contribution of small-scale fisheries is adequately reflected in SDG 14 reporting frameworks.

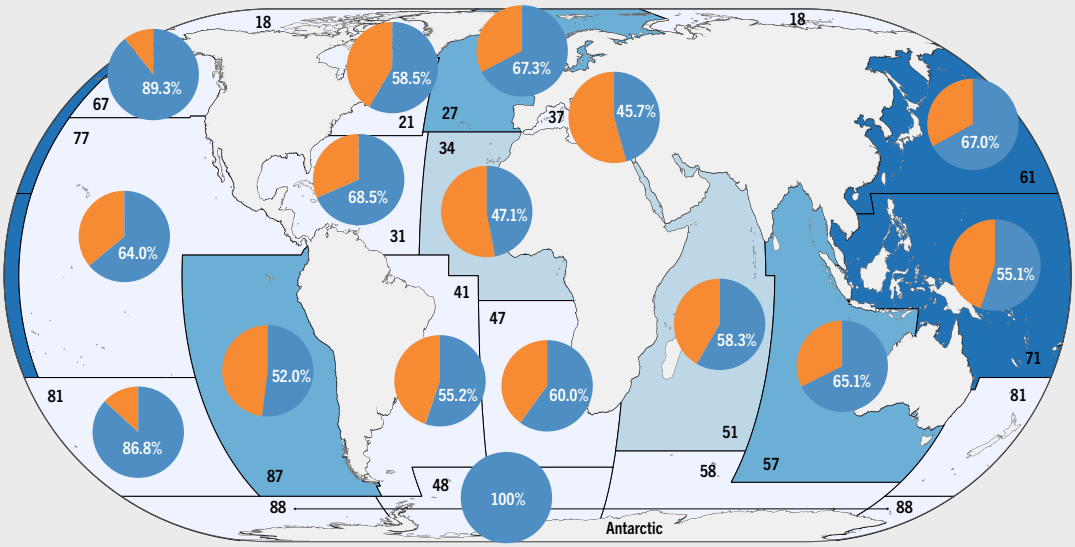


Small-scale fisheries in Andrevo, Madagascar
© FAO/Alexander Joe



Casting nets from small fishing vessels in Nazirhat, Bangladesh
© FAO/GMB Akash

FIGURE 1.19 PERCENTAGE OF BIOLOGICALLY SUSTAINABLE AND UNSUSTAINABLE FISHERY STOCKS BY FAO MAJOR FISHING AREA AND SELECTED SPECIES GROUP, 2023



Refer to the disclaimer on the copyright page for the names and boundaries used in this map.

SOURCES: FAO estimates; United Nations Geospatial. 2020. Map geodata.

FISHING AREA BY OCEAN	LANDINGS Million tonnes	STOCKS Total assessed	SUSTAINABILITY Reported landings		
Atlantic Ocean, Mediterranean and Black Sea					
Area 21, Atlantic, Northwest	~1.5	142	41.6%	58.5%	↘
Area 27, Atlantic, Northeast	~8.3	168	32.7%	67.3%	↘
Area 31, Atlantic, Western Central	~1.2	108	31.5%	68.5%	↗
Area 34, Atlantic, Eastern Central	~5.1	138	52.9%	47.1%	•
Area 37, Mediterranean and Black Sea	~1.2	127	54.3%	45.7%	↗
Area 41, Atlantic, Southwest	~2.0	67	44.8%	55.2%	↘
Area 47, Atlantic, Southeast	~1.4	80	40.0%	60.0%	↗
Indian Ocean					
Area 51, Indian Ocean, Western	~5.8	484	41.7%	58.3%	↘
Area 57, Indian Ocean, Eastern	~6.0	318	34.9%	65.1%	↘
Pacific Ocean					
Area 61, Pacific, Northwest	~19.3	97	33.0%	67.0%	↗
Area 67, Pacific, Northeast	~2.8	112	10.7%	89.3%	↘
Area 71, Pacific, Western Central	~13.8	265	44.9%	55.1%	↗
Area 77, Pacific, Eastern Central	~2.2	86	36.1%	64.0%	↘
Area 81, Pacific, Southwest	~0.4	144	13.2%	86.8%	↗
Area 87, Pacific, Southeast	~6.9	98	48.0%	52.0%	↗
Antarctic Areas					
Areas 48, 58, 88	~0.4	15	0.0%	100.0%	○

SPECIES	LANDINGS Million tonnes, global	STOCKS Total assessed	SUSTAINABILITY Reported landings		
Highly migratory tunas	~5.1	23	8.7%	91.3%	↗
Highly migratory billfishes	~0.3	13	46.2%	53.8%	○
Highly migratory sharks	~0.012	23	39.1%	60.9%	↗
Atlantic salmon	~0.001	68	63.2%	36.8%	○
Pacific salmons	~1.1	89	29.2%	70.8%	↗

Stock status

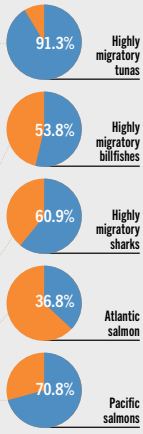
Unsustainable — Sustainable

Landings

- ≤ 3 million tonnes
- 3–6 million tonnes
- 6–12 million tonnes
- > 12 million tonnes

Sustainability trend

- ↗ Increasing
- • Stable (≤ 1% change)
- ↘ Decreasing
- ○ Not available



NOTES: The percentages represent the proportion of sustainable stocks. Landings are expressed in live weight equivalent. Notwithstanding the widespread consultation and efforts to standardize the methodology, there are still differences in the quality and coverage of information across regions, as well as in some of the assumptions made. Caution should therefore be exercised when attempting to compare stock status across regions using this methodology. Highly migratory sharks and tunas, as well as salmons, are excluded in the regional representation. There is high uncertainty in the landings data of highly migratory sharks due to poor reporting rates.

SOURCE: FAO estimates.

» the **Pacific Ocean**, particularly in the Northeast Pacific (Area 67) and Southwest Pacific (Area 81) with, respectively, 89.3 percent and 86.8 percent of stocks classified as biologically sustainable. By contrast, the Western Central Pacific (Area 71) recorded 55.1 percent of biologically sustainable stocks, while the Eastern Central Pacific (Area 77) reported 64.0 percent and the Northwest Pacific (Area 61) 67.0 percent. The Southeast Pacific (Area 87) showed the lowest proportion in the basin, with 52.0 percent of biologically sustainable stocks.

In the **Atlantic Ocean**, sustainability levels in 2023 ranged from 58.5 percent in the Northwest Atlantic (Area 21) to 68.5 percent in the Western Central Atlantic or Caribbean (Area 31). The Northeast Atlantic (Area 27) reported 67.3 percent of biologically sustainable stocks, while the Southeast Atlantic (Area 47) presented 60.0 percent. In the Southwest Atlantic (Area 41), 55.2 percent of stocks were classified as biologically sustainable, whereas the Eastern Central Atlantic (Area 34) showed a lower proportion at 47.1 percent. While the Mediterranean and Black Sea (Area 37) had the lowest sustainability level (45.7 percent), it also reported the highest improvement in sustainability (11 percentage points since 2021) of all FAO Major Fishing Areas.

In the **Indian Ocean**, sustainability levels in 2023 reached 58.3 percent in the western region (Area 51) and 65.1 percent in the eastern region (Area 57). All assessed fish stocks from the Antarctic (Areas 48, 58 and 88) were classified as 100 percent biologically sustainable.

Overall, high-latitude regions continue to maintain high sustainability levels due to well-functioning management systems. At the same time, improvements observed in certain areas, notably the Mediterranean and Black Sea (Area 37), Western Central Atlantic (Area 31), Northwest Pacific (Area 61) and Southeast Pacific (Area 87), confirm how science-based management can yield measurable recovery progress.

Reported landings of aquatic species[i] vary greatly among fishing areas and oceans and across decades (Figure 1.20), indicating that fisheries dynamics differ by ocean over time and space.

Capture fisheries production in the **Pacific Ocean** peaked at 54.7 million tonnes in 1994 and has since stabilized around 45 million tonnes. Since 2018, around 41 percent of this production has come from the Northwest Pacific (Area 61), dominated primarily by Alaska pollock (*Gadus chalcogrammus*) and small pelagic species such as Japanese pilchard/Pacific sardine (*Sardinops sagax*). The Western Central Pacific (Area 71) also accounts for a significant share (roughly 30 percent) of Pacific landings, driven primarily by tuna fisheries. The Southeast Pacific (Area 87) is another major contributor (19.1 percent), though its landings show strong annual variability driven largely by the Peruvian anchoveta fishery (*Engraulis ringens*). Other areas, including the Northeast Pacific (Area 67), have remained relatively stable and operate under total allowable catch management approaches. By contrast, the Eastern Central Pacific (Area 77) and Southwest Pacific (Area 81) contribute, respectively, around 5 percent and 1 percent, a small and stable share over time of regional landings.

Landings harvested in the **Atlantic Ocean and adjacent seas** increased rapidly from the early 1950s, reaching 26 million tonnes, before stabilizing in the early 2000s at around 24 million tonnes. Since then, landings have experienced a decline to around 20.5 million tonnes in 2023, reflecting fully mature and developed fisheries. The Northeast Atlantic (Area 27) continues to be the largest contributor, averaging 8.2 million tonnes in recent years. Landings in this area peaked in the 1970s at 13 million tonnes; a local peak (12 million tonnes) occurred in the 1990s and has since decreased and stabilized, largely as a result of management interventions. The Eastern Central Atlantic (Area 34) remains stable, producing around 5.2 million tonnes during each of the past three years. Similar to the Southeast Pacific (Area 87), production in the Eastern Central Atlantic (Area 34) is largely driven by year-to-year fluctuations in small pelagic production. Other regions, including the Northwest Atlantic (Area 21) and the Mediterranean and Black Sea (Area 37), experienced peak landings in the early 1970s and mid-1980s, respectively, »

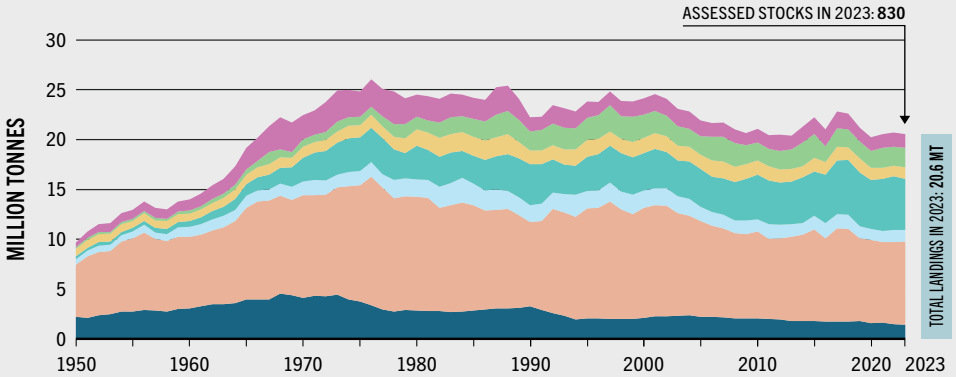
i The term "landings" in this section refers to capture fisheries production of aquatic animals in marine areas.

FIGURE 1.20 FISHERIES LANDINGS BY OCEAN, 1950–2023

ATLANTIC OCEAN, MEDITERRANEAN AND BLACK SEA

- Area 21, Atlantic, Northwest
- Area 27, Atlantic, Northeast
- Area 31, Atlantic, Western Central
- Area 34, Atlantic, Eastern Central
- Area 37, Mediterranean and Black Sea
- Area 41, Atlantic, Southwest
- Area 47, Atlantic, Southeast

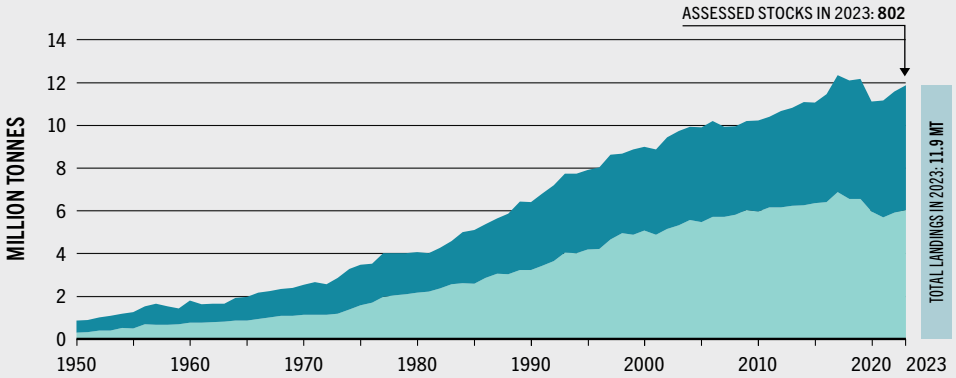
SUSTAINABLE STOCKS 57.4%



INDIAN OCEAN

- Area 51, Indian Ocean, Western
- Area 57, Indian Ocean, Eastern

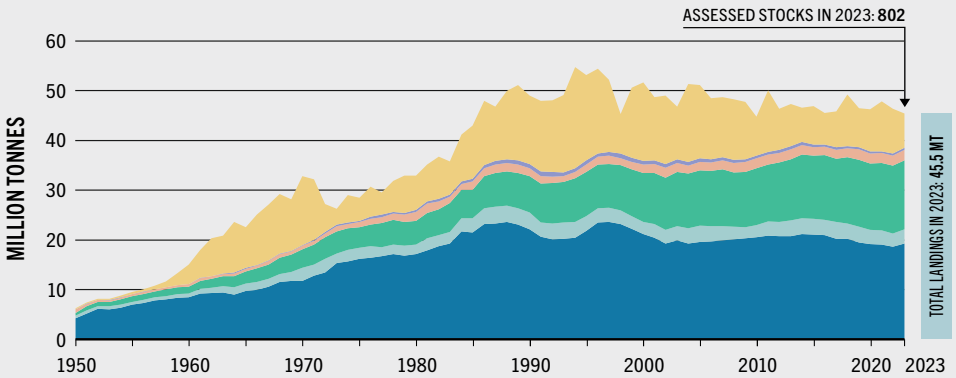
SUSTAINABLE STOCKS 61.7%



PACIFIC OCEAN

- Area 61, Pacific, Northwest
- Area 67, Pacific, Northeast
- Area 71, Pacific, Western Central
- Area 77, Pacific, Eastern Central
- Area 81, Pacific, Southwest
- Area 87, Pacific, Southeast

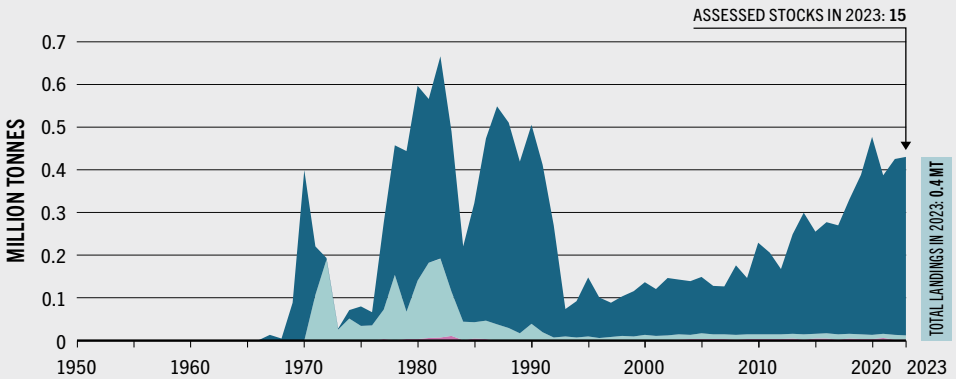
SUSTAINABLE STOCKS 69.0%



ANTARCTIC AREAS

- Area 48, Atlantic, Antarctic
- Area 58, Antarctic and Southern Indian Ocean
- Area 88, Pacific, Antarctic

SUSTAINABLE STOCKS 100%



NOTES: Aquatic animals exclude aquatic mammals, crocodiles, alligators, caimans, aquatic products (corals, pearls, shells and sponges) and algae. Data are expressed in live weight equivalent.

SOURCES: FAO estimates; FAO. 2025. FishStat: Global capture production 1950-2023. [Accessed on 28 March 2025]. In: *FishStatJ*. Available at: https://www.fao.org/fishery/en/statistics/software/fishstatj. Licence: CC-BY-4.0.

https://doi.org/10.4060/cd8357en-fig1.20

» and both now remain at comparatively low production levels (around 1.5 million tonnes and 1.2 million tonnes, respectively). Areas 41 and 47 in the Southern Atlantic have low and stable production, averaging around 2 million tonnes and 1.4 million tonnes, respectively. The Western Central Atlantic (Area 31) remains stable at approximately 1.2 million tonnes.

Landings caught in the **Indian Ocean** have shown a long-term pattern of growth, peaking at around 12.3 million tonnes in 2017 and remaining around 12 million tonnes since then. The Eastern Indian Ocean (Area 57) shows signs of plateauing, while the Western Indian Ocean (Area 51) continues to display an increasing trend. In the last three years, Areas 51 and 57 have contributed averages of 5.7 million tonnes and 5.9 million tonnes, respectively. The Indian Ocean has been among the world's major expansion regions, with rapid increases in reported landings over the past 30–40 years; however, the recent stabilization of declared catches indicates a production plateau.

The **Antarctic Areas** (Areas 48, 58 and 88) presented sporadic catches until the early 1990s, and since then highly regulated fisheries have occurred, with catches gradually increasing to reach 0.4 million tonnes in 2023.

Overall, the Pacific Ocean performed better in terms of sustainability outcomes than the Atlantic and Indian oceans, with 68 percent of stocks classified as biologically sustainable in 2023, compared to 61 percent in the Indian Ocean and 56 percent in the Atlantic Ocean. Areas with longstanding, well-established management systems, such as the Northeast Pacific (Area 67) and Southwest Pacific (Area 81), as well as the Antarctic Areas (Areas 48, 58 and 88), showed substantially higher sustainability levels, above 87 percent in 2023.

Status and trends by major species

The ten species with the largest landings in 2023 were Alaska pollock (*Gadus chalcogrammus*), skipjack tuna (*Katsuwonus pelamis*), Peruvian anchoveta (*Engraulis ringens*), blue whiting (*Micromesistius poutassou*), Pacific sardine (*Sardinops sagax*), yellowfin tuna (*Thunnus albacares*), Atlantic herring (*Clupea harengus*), European pilchard (*Sardina pilchardus*), jumbo flying squid (*Dosidicus gigas*) and Chilean jack mackerel (*Trachurus murphyi*) (see **Capture fisheries production** for 2024 data). Together, these species accounted for 21 percent of global production in 2023. Overall, 73.6 percent of these stocks (by stock number) or 76.5 percent (by volume of landings) were fished within biologically sustainable levels in 2023. This is higher than the global sustainability for all stocks in 2023. This further suggests that larger stocks tend to be better managed, with effective fisheries management yielding positive outcomes in terms of biological sustainability. However, the majority of stocks of Atlantic herring and European pilchard were classified as overfished.

Highly migratory tunas

The seven highly migratory tunas constitute the major commercial stocks that are assessed by tuna regional fisheries management organizations (RFMOs). In 2023, global capture production for highly migratory tunas reached approximately 5.2 million tonnes, with skipjack (*Katsuwonus pelamis*) accounting for 57 percent of landings, followed by 31 percent for yellowfin (*T. albacares*), 7 percent for bigeye (*T. obesus*) and 4 percent for albacore (*T. alalunga*), with the remaining 1 percent accounted for by the combined landings of bluefin tunas in the Atlantic Ocean (*T. thynnus*), the Pacific Ocean (*T. orientalis*) and the Antarctic Areas (*T. maccoyii*). Overall, 91.3 percent of assessed tuna stocks were classified as biologically sustainable in 2023, and more than 99 percent of catches originated from biologically sustainable stocks. Globally, tuna RFMOs have made concerted efforts to apply precautionary management approaches, with positive outcomes. However, many small tuna stocks remain severely data-limited, which presents significant challenges for assessment and effective management by tuna RFMOs.

Highly migratory sharks

A large proportion of highly migratory sharks landed are caught incidentally (bycatch) in tuna and swordfish longline fisheries and – with the exception of the blue shark (*Prionace glauca*) – they are highly vulnerable to overfishing. Of the stocks assessed, 60 percent were classified as biologically sustainable in 2023. The most assessed species, blue shark, had 83.3 percent of assessed stocks classified as sustainable in 2023,

followed by shortfin mako (*Isurus oxyrinchus*), silky shark (*Carcharhinus falciformis*) and porbeagle shark (*Lamna nasus*). All stocks of porbeagle shark were classified as overfished in 2023. The abundance trends of several large pelagic sharks have declined sharply in response to increasing fishing pressure since the 1970s,[9] yet their stock status was either unknown or highly uncertain in 2023, including longfin mako (*I. paucus*), oceanic whitetip (*C. longimanus*), pelagic thresher (*Alopias pelagicus*) and bigeye thresher (*A. superciliosus*). A precautionary science-based management strategy for these key species is urgently needed.[9] In response, several tuna RFMOs have introduced management measures targeting blue shark, mako shark and silky shark.

Highly migratory billfishes

This group includes highly migratory species like marlins, swordfish, sailfish and spearfish, which are caught in both coastal gillnets and longline fisheries operating in the open ocean. All are managed by tuna RFMOs, and most are assessed on three-year cycles across the different oceans. Almost all striped marlins (*Kajikia audax*) in different oceans were classified as overfished in 2023, whereas blue, black and white marlins were in comparatively better condition. Swordfish (*Xiphius gladius*) were generally considered sustainable in most oceans, reflecting their high resilience. Sailfish performed better in terms of sustainability than marlins. As a group, however, these species fared worse than highly migratory sharks, with only 53.8 percent of assessed stocks classified as biologically sustainable in 2023. To address these concerns, several tuna RFMOs have developed management measures for swordfish and striped marlin.

Salmons

In 2023, the stocks of 89 species of Pacific salmon were assessed; 29.2 percent were classified as overfished, mainly due to anthropogenic pressures other than fishing. Stream-type chinook stocks (*Oncorhynchus tschawatcha*) were overfished as they spend more than a year in freshwater environments, where their survival is greatly affected by climate change and anthropogenic activities (dams, irrigation, etc.); they exhibited well below spawning stock biomass at maximum sustainable yield (S_{MSY}) ranges.[10] Other salmon species, such as coho (*O. kisutch*), sockeye (*O. nerka*), chum (*O. keta*) or pinks (*O. nerka*) generally performed better than Chinook (*O. tschawatcha*).

Climate variability is more likely to affect salmon species distributed in the south, which exhibit lower survival rates than those farther north. Indeed, the latitudinal survival gradient increases from the southern to the northern end of each of the species' distribution range, with stocks in Alaska (United States of America) doing better than stocks in both British Columbia (Canada) and California, Oregon and Washington (United States of America).

Atlantic salmon (*Salmo salar*) is incorporated as a separate unit in the reference list for the first time, using the same framework as that applied to Pacific salmons. The updated list includes 68 assessment units, replacing the eight aggregated Atlantic salmon complexes used in earlier FAO assessments and allowing the inclusion of Baltic Sea salmon stocks. Under the earlier classification, 25 percent were considered biologically sustainable in 2021, whereas the updated stock-level assessment indicates that 36.8 percent were biologically sustainable in 2023.

Status and trends by FAO Major Fishing Area

Atlantic Ocean and the Mediterranean and Black Sea

Capture fisheries production in the **Northwest Atlantic** (Area 21) yielded approximately 1.5 million tonnes in 2023, continuing the long-term decline from a peak of 4.6 million tonnes in the late 1960s, following the collapse of several major groundfish stocks. Fisheries in this area are supported by comprehensive scientific assessment systems across the United States of America, Canada and the Northwest Atlantic Fisheries Organization (NAFO). Despite sustained reductions in fishing pressure for decades, rebuilding stocks remains uneven among key groundfish species. Several stocks of Atlantic cod (*Gadus morhua*), American plaice (*Hippoglossoides platessoides*), winter flounder (*Pseudopleuronectes americanus*) and yellowtail flounder (*Limanda ferruginea*) were still overfished in 2023, with recovery constrained in part by environmentally driven changes in productivity. European hake (*Merluccius merluccius*) and haddock (*Melanogrammus aglefinus*)

gave mixed signals, with some stocks improving while others remained overfished. In contrast, invertebrate fisheries were mostly classified as biologically sustainable in 2023 and accounted for a substantial share of regional landings. American lobster (*Homarus americanus*), and several scallop (*Placopecten magellanicus*) and crab stocks were considered biologically sustainable. About 58.5 percent of assessed stocks in the area were classified as biologically sustainable in 2023, a decline of 5 percentage points from 2021.

The **Northeast Atlantic** (Area 27) progressed from fourth- to third-most productive FAO Major Fishing Area in 2023, with reported landings of 8.3 million tonnes, a 3 percent increase from 2021. Historically, catches peaked at around 13 million tonnes in the mid-1970s before declining sharply during the late 1970s and early 1980s under intense fishing pressure and recovering slightly in recent years. The present analysis covered 168 assessed stocks across 58 species using information available until 2023. Of these, 67.3 percent were classified as biologically sustainable in 2023, a decrease of 8.5 percentage points from 2021. This decrease is largely attributable to a comprehensive stock status update using the latest assessments, many of which shifted from empirical or indicator-based approaches to fully analytical model-based assessments. Progress in stock rebuilding varies across species groups. Demersal sharks and rays (90.9 percent sustainable) and flatfishes (69.7 percent sustainable) ranked among the groups with the highest proportions of biologically sustainable stocks in 2023. Demersal stocks such as Atlantic cod (*Gadus morhua*), beaked redfish (*Sebastes mentella*) and whiting (*Merlangius merlangus*) ranked among the most overfished demersal groups, with less than 40 percent classified as biologically sustainable in 2023; more than half of the Atlantic herring (*Clupea harengus*) stocks were overfished.

Capture fisheries production in the **Western Central Atlantic** (Area 31) peaked at 2.5 million tonnes in 1984 before declining to 1.1 million tonnes in 2020. In 2023, landings amounted to 1.2 million tonnes. The region is characterized by high marine biodiversity, and it supports diverse small-scale, industrial and recreational fisheries. Small pelagic fishes accounted for nearly half of total landings, led by Gulf menhaden (*Brevoortia patronus*) and round sardinella (*Sardinella aurita*), both classified as biologically sustainably fished. Shrimps and prawns, and blue crab (*Callinectes sapidus*) also contributed substantial landings, generally in a biologically sustainable state. Caribbean spiny lobster (*Panulirus argus*) remained a high-value species with most of the assessed stocks classified as biologically sustainable. By contrast, concerns persist for certain reef-associated and coastal species, with a majority of assessed snapper and grouper stocks still overfished, despite ongoing management measures. Overall, 68.5 percent of assessed stocks in the Western Central Atlantic were classified as biologically sustainable in 2023, an improvement of 6.4 percentage points from 2021.

Landings harvested in the **Eastern Central Atlantic** (Area 34) reached 5.1 million tonnes in 2023, with an upward trend observed from the 1950s to 2018. Coastal pelagic species remained the dominant component of the harvest and accounted for about 54 percent of total landings in 2023, driven mainly by over 1 million tonnes of sardines (*Sardina pilchardus*), and two species of sardinella (bonga shad [*Ethmalosa fimbriata*] and Atlantic horse mackerel [*Trachurus trachurus*]). Sardine, which represented about 33 percent of the total landings, was classified as overfished in 2023. The stocks of round sardinella (*Sardinella aurita*) were also overfished, whereas flat sardinella (*S. maderensis*) stocks were generally classified as maximally sustainably fished, except for the central stock. Assessments of demersal species classified hake (*Merluccius merluccius*) and bobo croaker (*Pseudotolithus elongatus*) as overfished in 2023. Overall, 47.1 percent of assessed stocks were classified as biologically sustainable in 2023; this is similar to the previous estimate of 47.4 percent in 2021.

Capture fisheries production in the **Mediterranean and Black Sea** (Area 37) increased from about 1 million tonnes in the early 1970s to nearly 2 million tonnes in the late 1980s, before declining following the collapse of several pelagic fisheries in the Black Sea. In 2023, reported production reached nearly 1.2 million tonnes, with the Mediterranean accounting for the majority of catches, while Black Sea anchovy (*Engraulis*

encrasicolus) remained the single largest fishery in the area. In 2023, 45.7 percent of assessed stocks were biologically sustainable, compared to 35.1 percent in 2021 – an increase of around 11 percentage points. The improvement in stock status is associated with sustained reductions in fishing pressure and gradual rebuilding of biomass in several fisheries, supported by the implementation of multiannual management plans.[11] Positive developments are evident in several demersal fisheries, including giant red shrimp (*Aristaeomorpha foliacea*), red mullet (*Mullus sormulettus*) and common sole (*Solea solea*). By contrast, all but one European hake (*Merluccius merluccius*) stock remained in an overfished state. Overall, data from 2023 signal a shift away from the longstanding pattern of overexploitation towards measurable rebuilding in several fisheries.

In the **Southwest Atlantic** (Area 41), capture production has fluctuated between 1.5 and 2.6 million tonnes since the mid-1980s. In 2023, total landings were approximately 2.0 million tonnes. Argentine hake (*Merluccius hubbsi*) (22 percent of total landings), Argentine shortfin squid (*Illex argentinus*) (20 percent) and Argentine red shrimp (*Pleoticus muelleri*) (10 percent) remained the most important species in terms of volume, which together accounted for 52 percent of total production. In this analysis, 67 stocks across 52 species were assessed. Overall, 55.2 percent of stocks were classified as biologically sustainable in 2023, representing a decrease of 2.8 percentage points from 2021. Stock status varied considerably across functional groups. Argentine hake, one of the region's most important demersal resources, remained overfished in both northern and southern stock units, despite partial recovery under quota-based management and spatial protection measures. Whitemouth croaker (*Micropogonias furnieri*), a key coastal species supporting artisanal and industrial fisheries, also continued to be overfished in 2023. In contrast, several invertebrate and short-lived species exhibited a higher proportion of stocks classified as biologically sustainable. Notably, Argentine red shrimp stock is currently biologically sustainable due to effective management, including strict quotas, seasonal/area closures and strong monitoring. While several demersal and coastal stocks remained overfished, productive fisheries of biologically sustainable stocks of shrimps (Argentine red shrimp), squids (Patagonian squid [*Doryteuthis gahi*], Argentine shortfin squid) and pelagic fishes contributed substantially to the regional catches in 2023.

In the **Southeast Atlantic** (Area 47), capture fisheries declined from a peak of 3.3 million tonnes in the late 1970s to 1.4 million tonnes in 2023. Fisheries in the region are structured around the Benguela Current ecosystem, with hakes, small pelagic species and invertebrates accounting for most landings. In 2023, 60 percent of assessed stocks were classified as biologically sustainable, representing an increase of 2 percentage points from 2021. Hakes (*Merluccius capensis* and *M. paradoxus*) remained the dominant demersal resources and illustrated contrasting stock trajectories. The southern stock of hake is managed under management procedures and was estimated to be above B_{MSY} reference levels, while the northern stock remained overfished in 2023, reflecting differences in stock dynamics and management across jurisdictions. Stock status differed across functional groups. Demersal and coastal fish groups accounted for a substantial share of overfished stocks in 2023, while several invertebrate and short-lived species showed higher levels of sustainability. Squid (*Loligo reynaudii*) and some shrimp and crab fisheries remained within biologically sustainable levels, while West Coast rock lobster (*Jasus lalandi*) and Southern African sardine (*Sardinops sagax*) continued to be overfished in 2023.

Indian Ocean

Capture fisheries in the **Western Indian Ocean** (Area 51) continued to increase and reached a peak of 5.8 million tonnes in 2023. Tunas and tuna-like species continued to contribute the most to landings, followed by small pelagic fishes (Indian oil sardine [*Sardinella longiceps*]) and mixed reef fishes (groupers and snappers like Malabar blood snapper [*Lutjanus malabaricus*] or orange spotted grouper [*Epinephelus coioides*]). This region is primarily data-limited and most updates were derived from Tier 2 assessments (see Box 1.3). Pelagic fishes contributed around 56 percent of total landings. Shrimps (Penaeidae), in particular Indian white prawn (*Penaeus indicus*)

and giant tiger prawn *(P. monodon*) – important generators of foreign revenue – were either maximally sustainably fished or overfished in the region in 2023, as were cephalopod molluscs. Overall, 58.3 percent of the assessed stocks in the Western Indian Ocean were within biologically sustainable levels in 2023, a decline of 4.7 percentage points from 2021.

Landings caught in the Eastern Indian Ocean (Area 57) have displayed a consistent upward trend over the past decades, surging to around 7 million tonnes in 2017 before levelling off at around 6 million tonnes in recent years, including in 2023. The drop in landings from 2019 to 2021 was likely caused by the COVID-19 pandemic as effort declined in the Bay of Bengal. The region continues to suffer from lack of comprehensive stock status data. Most assessment updates were from Tier 2 assessments (see Box 1.3). Hilsa shad (*Tenualosa lisha*), narrow-barred Spanish mackerel (*Scomberomorus commerson*) and horse mackerel (*Trachurus trachurus*) showed increasing trends in production and were biologically sustainable in 2023, along with anchovies (*Engraulidae* spp.), Indian mackerel (*Rastrellinger kanarguta*), giant tiger prawn (*Penaeus monodon*) and cuttlefish (Sepiida). Stocks of toli shad (*Tenualosa toli*), Indian oil sardine (*Sardinella longiceps*) and other sardinellas were considered overfished in 2023. Overall, 65.1 percent of the assessed stocks were considered biologically sustainable in 2023, a decline of 7.6 percentage points from 2021.

Pacific Ocean

The **Northwest Pacific** (Area 61) recorded 19.3 million tonnes of capture fisheries production in 2023, making it the FAO Major Fishing Area with the highest landings globally. The region supports highly diverse and large-scale fisheries dominated by small pelagic and demersal species, including the largest fishery of Alaska pollock (*Gadus chalcogrammus*) at 2.1 million tonnes, in addition to Pacific chub mackerel (*Scomber japonicus,* 0.9 million tonnes), Pacific sardine (*Sardinops sagax*, 1.3 million tonnes), largehead hairtail (*Trichiurus lepturus*, 1.0 million *tonnes*) and Japanese anchovy (*Engraulis japonicus*, 0.9 million tonnes). Overall, 67 percent of assessed stocks were classified within biologically sustainable levels in 2023, an improvement of 4 percentage points from 2021. Localized depletion occurred on some stocks of yellow croaker (*Larimichthys polyactis*), largehead hairtail and Pacific sardine. Alaska pollock is under a management procedure and was sustainably fished in 2023. Given the scale of capture production in Area 61, further expansion and consolidation of assessment coverage in this region will be central to strengthening regional and national management.

In the **Northeast Pacific** (Area 67), capture fisheries production amounted to 2.8 million tonnes in 2023, remaining broadly stable since the late 1990s. Alaska pollock dominated regional landings (1.44 million tonnes). North Pacific hake (*Merluccius productus*), Pacific cod (*Gadus macrocephalus*) and several flatfish species also contributed substantially to total production. Fisheries are managed through well-established science-based systems, including precautionary harvest control rules, comprehensive monitoring and transparent stock assessments. Overall, 89.3 percent of assessed stocks were classified within biologically sustainable levels in 2023, a decrease of 3.4 percentage points from 2021, but still representing the second highest proportion among all FAO Major Fishing Areas.

The **Western Central Pacific** (Area 71) is the second-largest marine capture production region globally, with reported landings of approximately 13.8 million tonnes in 2023. The region hosts the world's largest fishing fleet, operating across vast archipelagic, coastal and high-seas environments and dealing with diverse production units, making it challenging to assess and monitor. Landings span a wide diversity of species, although a substantial share continues to be reported under broad taxonomic groupings, reflecting the complexity of monitoring fisheries across numerous species, gears and jurisdictions. In 2023, tuna and tuna-like species accounted for roughly one-quarter of total landings, which were mostly biologically sustainable (see **Highly migratory tunas**), while small pelagic species – including sardines, anchovies and scads – contributed a further significant proportion. Tropical reef fish (e.g. steephead parrotfish [*Chlorurus microrhinos*], humphead wrasse [*Cheilinus undulatus*]), groupers (e.g. highfin grouper [*Epinephelus maculatus*], speckled grouper [*E. cyanopodus*]) and snappers

(e.g. yellow-banded snapper [*Lutjanus adetii*], humpback red snapper [*L. gibbus*]) were evaluated using data-limited approaches and were classified as primarily overfished in 2023. Overall, 55.1 percent of assessed stocks were classified as biologically sustainable in 2023, an improvement of 2.2 percentage points from 2021.

Capture fisheries production in the **Eastern Central Pacific** (Area 77) amounted to 2.2 million tonnes in 2023. The area spans a vast and highly dynamic oceanographic region extending from Mexico to Colombia. Landings were dominated by small pelagic species – including Pacific sardine (*Sardinops caeruleus*), anchovy (*Engraulis mordax*), Pacific thread herring (*Opisthonema libertate*) and Pacific anchoveta (*Cetengraulis mysticetus*). These fisheries are strongly influenced by interannual environmental variability, particularly El Niño Southern Oscillation (ENSO) events. Overall, 64 percent of assessed stocks were classified as biologically sustainable in 2023, a decrease of 3.7 percentage points from 2021. While the region's major small pelagic fisheries remain largely sustainable, several coastal and demersal resources – notably groupers, snappers and some shrimp stocks – continued to be overfished in 2023.

The **Southwest Pacific** (Area 81) has the second lowest volume of landings globally, with total landings of approximately 0.4 million tonnes in 2023, declining from a peak in the early 1990s; this reduction is primarily due to management interventions. Despite its modest scale, the region supports a diversified species composition, with blue grenadier (*Macruronus novaezelandiae*), mackerels and squids accounting for a substantial share of total landings. Southern blue whiting (*Micromesistius australis*), orange roughy (*Hoplostethus atlanticus*) and several invertebrate fisheries also contributed to regional production in 2023. In this region, 86.8 percent of assessed stocks were classified as biologically sustainable in 2023, similar to the 85.5 percent of 2021. These good results are attributed to well-established analytical assessment frameworks, and structured scientific advice.

The **Southeast Pacific** (Area 87) remains one of the most productive marine fishing regions globally, with total landings of approximately 6.9 million tonnes in 2023. Production is highly concentrated geographically and taxonomically, largely driven by the Humboldt Current system. Small pelagic species dominate the catches, particularly Peruvian anchoveta (*Engraulis ringens)*, which underpins overall catch dynamics, followed by jumbo flying squid (*Dosidicus gigas*) and Chilean Jack mackerel (*Trachurus murphyi*). Pacific sardines (*Sardinops sagax*), which used to dominate landings in the 1980s and 1990s, accounted for less than 1 percent of landings in 2023. Landings are characterized by pronounced interannual recruitment variability associated with oceanographic conditions. In 2023, 52 percent were classified as biologically sustainable, an improvement of 5.6 percentage points from 2021. Small pelagic stocks show greater responsiveness to environmental variability and management measures. Jumbo flying squid (*D. gigas*) was classified as sustainable in coastal jurisdictions, while the status of other ABNJ stocks remains uncertain (note that a joint assessment for the *D. gigas* stock in South Pacific Regional Fisheries Management Organisation [SPRFMO] jurisdictions is currently being developed).

Several demersal fisheries, including hakes and coastal demersals, account for a higher share of overfished classifications. Overall fluctuations in dominant pelagic fisheries mask more varied biological conditions across other stock groups.

Antarctic Areas

The **Antarctic Areas** (Areas 48, 58, 88) are one of the smallest marine fishing regions globally, with total reported landings of approximately 0.4 million tonnes in 2023. Fisheries are concentrated on a limited number of target species, primarily Antarctic krill (*Euphausia superba*) and toothfish (*Dissostichus eleginoides*), managed across clearly identified stocks. All 15 assessed stocks were 100 percent biologically sustainable in 2023, both by number of stocks and by volume of landings, primarily attributed to precautionary approaches to management with extensive data coverage. The Antarctic Areas represent a global benchmark for precautionary, ecosystem-based fisheries management.

Conclusions

The analysis of the state of fishery resources highlights persistent regional contrasts in the state of stocks, while also pointing to areas of

measurable progress. Sustainability outcomes across FAO Major Fishing Areas are shaped by environmental variability, the distribution of overall yield across stocks, and the continuous improvements in stock assessment and scientific advisory programmes to support effective fisheries management.

Regions operating under long-established precautionary advisory frameworks and effective management systems continue to report the highest proportions of biologically sustainable stocks, namely the high-latitude fisheries of the Northeast Pacific (Area 67) and Southwest Pacific (Area 81) and of the Antarctic Areas (Areas 48, 58 and 88).

In the **Northwest Pacific** (Area 61), improvements in sustainability classification alongside expanded assessment coverage improved global indicators, given the region's position as the largest source of global landings. Encouraging signals are also emerging in regions with a history of sustained overexploitation. In the Mediterranean and Black Sea (Area 37), for example, reductions in fishing pressure due to effective management measures are increasingly reflected in the improvement of stock status.[11]

Highly productive eastern boundary current and upwelling systems – such as those in Areas 34, 47, 77 and 87 – display a distinct pattern. In these systems, sustainability indicators may differ, depending on whether they are based on the number of stocks or the volume of landings, as a small number of large pelagic stocks account for most of the yield and are subject to significant fluctuations driven by environmental processes, while demersal and coastal fisheries exhibit more heterogeneous status.

In contrast, several lower-latitude marine systems, including those in Areas 51, 57 and 71, are characterized by high species diversity and dispersed small-scale, multispecies fisheries, with yield distributed across many relatively small stocks. This configuration limits the feasibility of applying traditional analytical stock assessments across all exploited species and increases reliance on data-limited approaches and expert-based methods to improve coverage and representativity of sustainability estimates (see Box 1.4).

Overall, the analysis herein underscores that environmental variability and the distribution of yield across stocks, together with strong assessments, science-based advisory systems and management frameworks, shape regional sustainability patterns. Management systems such as those in the Northeast or Southwest Pacific reinforce FAO's Blue Transformation vision of achieving 100 percent of fisheries under management, which would result in improved stock status globally.[12]

Prospects of achieving the SDG target on fisheries

FAO supports Members and other actors to achieve the targets of SDG 14 (Life below Water) relevant to fisheries and aquaculture. As custodian of four SDG 14 indicators,[j] FAO coordinates the measurement and reporting for these indicators in the global SDG framework.[k] Indicator 14.4.1 measures the proportion of fish stocks based on whether stock abundance is at or above the biomass level that can produce MSY (see Box 1.5).

Despite improvements in several regions, fisheries and species, the further decline of the state of the world's assessed marine fishery stocks calls for concern. The share of the world's assessed marine fishery stocks in a biologically sustainable state dropped from 64.5 percent in 2021 to 62.4 percent in 2023.[1] The gap between the current global state of sustainable stocks and the SDG Target 14.4 of 100 percent of stocks around B_{MSY} will be very difficult to close by 2030. The persistence of this gap presents a significant challenge, particularly in regions characterized by complex multispecies fisheries and limited assessment, reporting and management capacity. »

j FAO is the custodian agency of four out ten SDG 14 Indicators: a) **14.4.1**: Proportion of fish stocks within biologically sustainable levels; b) **14.6.1**: Degree of implementation of international instruments aiming to combat illegal, unreported and unregulated fishing; c) **14.7.1**: Sustainable fisheries as a proportion of GDP in small island developing States, least developed countries and all countries; and d) **14.b.1**: Degree of application of a legal/regulatory/policy/institutional framework which recognizes and protects access rights for small-scale fisheries.

k Under the United Nations Sustainable Development Goal (SDG) 14, FAO is mandated to monitor global progress towards the sustainable use of fishery resources. SDG Target 14.4 calls for effectively regulating harvesting, ending overfishing and restoring fish stocks to levels capable of producing maximum sustainable yield (MSY) through science-based management.

BOX 1.5 PROGRESS TOWARDS ACHIEVING SDG TARGET 14.4

FAO supports Members and partners to monitor and report the progress of the SDG 14 indicators related to fisheries and aquaculture. *The State of World Fisheries and Aquaculture* has traditionally provided global and regional values for SDG Indicator 14.4.1 (Proportion of fish stocks within biologically sustainable levels) derived from fewer than 600 stocks assessed through FAO and regional fishery bodies, while national SDG Indicator 14.4.1 results have been calculated separately based on data from a dedicated questionnaire submitted to FAO Members and territories with marine borders with reference years 2019, 2021 and 2023.

To date, 130 of 181 countries and territories invited to report on SDG Indicator 14.4.1 have submitted data at least once (72 percent). Approximately half have reported in each data collection round, with the highest level of reporting for the 2021 round, following global awareness-raising workshops. Reporting rates are highest in Central and Southern Asia, Europe and Northern America, and Eastern and South-Eastern Asia. By contrast, participation remains limited in Oceania, sub-Saharan Africa, and Latin America and the Caribbean, constrained by insufficient data availability and technical capacity (see figure).

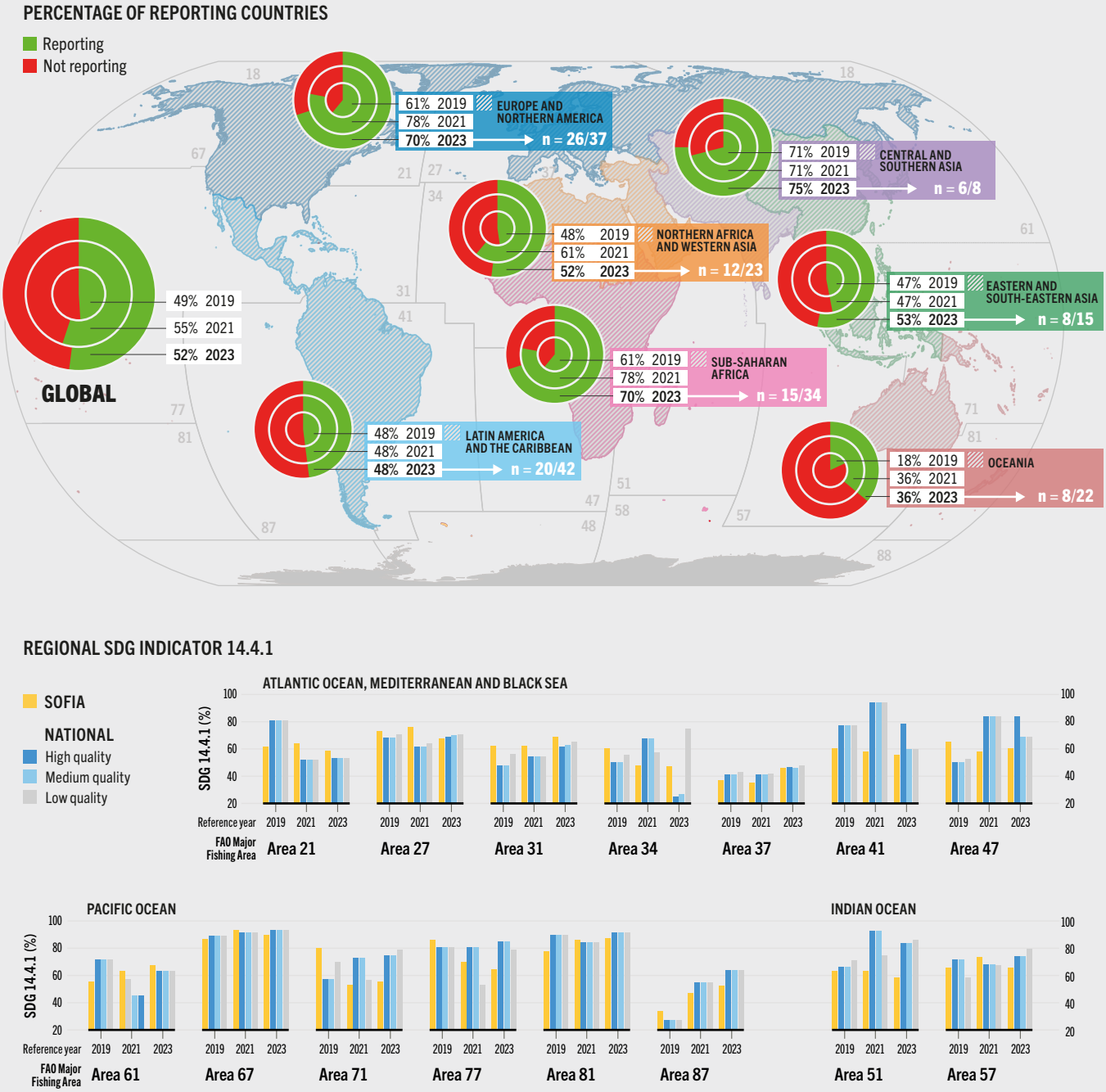
Submitted reports are reviewed by FAO for quality assurance and validation[13] and receive a score of high, medium or low quality. Across the three reporting cycles, there has been a substantial increase in the number of high-quality submissions, alongside a marked decline in quality assurance failures. Of the 94 reports reviewed out of 95 for the 2023 round, 48 scored high quality, an increase of 54.8 percent from 2019. Nine countries were medium quality, due to lack of key criteria (e.g. number of assessments, stocks covering at least 60 percent of landings with adequate references). Thirty-one countries scored low quality in 2023, down by 16.3 percent from 2019. Just six countries failed the quality assurance review, a decrease of about 70 percent compared to previous reports. Further progress was reflected in the declining proportion of stocks reported and classified as unassessed or of unknown status, from 47 percent in 2019 to 36 percent in 2023.

Under the updated framework of the state of stocks, which now covers 2 570 stocks, national reports have been incorporated into a single hierarchical system linking national, regional and global indicators (landings data were used until 2021 in Sharma *et al*. [2025]).[1] There is high correspondence between the global SDG Indicator 14.4.1 results (64.5 percent in 2021 and 62.4 percent in 2023) and the average indicator of high-quality reporting countries (62.5 percent in 2023 from SDG questionnaires). Nevertheless, important regional differences are found (up to 35 percentage points), particularly in areas where fewer high-quality national stocks are available (Southeast Atlantic, Southwest Atlantic, Eastern Central Atlantic, Western Indian Ocean, Eastern Central Pacific) or where national reporting is low (Western Central Pacific) (see figure). Overall, convergence across reporting levels is progressing, but full alignment will take time as coverage and data consistency improve further.

Building on these findings and on recommendations from stakeholders, FAO launched a Global Capacity Development Programme on Fisheries Data Collection and Stock Assessment* to further support Members in strengthening fisheries data systems. These positive trends in reporting and data quality signal enhanced data collection, strengthened national monitoring systems, and improved technical capacity resulting from targeted capacity development initiatives (e.g. FAO training programmes, workshops, e-learning courses, virtual research environments with over 1 200 members, and help desk support). This reflects meaningful national engagement to contribute robust stock assessment data to SDG Indicator 14.4.1. Nevertheless, indicator values continue to display variability across reporting years, and the analysis highlights persistent data gaps and methodological limitations. The Global Capacity Development Programme aims to coordinate and enhance capacity development activities across the world, to facilitate the improvement needed.

* For further information, see: https://openknowledge.fao.org/items/481d23f2-d0cb-4b5e-a795-4da440847b1c

GLOBAL REPORTING RATES FOR SDG INDICATOR 14.4.1 QUESTIONNAIRE AND PROPORTION SUSTAINABLE BY FAO MAJOR FISHING AREA BASED ON THE QUESTIONNAIRES COMPARED TO *THE STATE OF WORLD FISHERIES AND AQUACULTURE*



REFER to the disclaimer on the copyright page for the names and boundaries used in this map.

NOTES: n – number of reporting countries out of the total countries for that SDG region; SOFIA – *The State of World Fisheries and Aquaculture*. The relevant section of the 2022, 2024 and 2026 editions of SOFIA is "Status of fishery resources: Marine fisheries". SDG 14.4.1 indicators are calculated by FAO Major Fishing Area in the bar plots where the yellow bars indicate regional scores calculated using FAO methodology (2019, 2021, 2023 reference years for the three editions cited). These are compared to regional scores calculated using stocks derived only from national reports (2019, 2021, 2023 reference years), where dark blue bars represent stocks from reports of "high quality" (with a quality assurance [QA] score of 2), light blue bars represent stocks from reports of "medium quality" (with a QA score > 1.5), and grey bars include stocks from "low quality" (with a QA score > 1).

SOURCE: Authors' own elaboration.

» In addition, maintaining the biomass of individual stocks at MSY levels may in some circumstances constrain potential capture fisheries production, particularly where biomass exceeds the level associated with maximum sustainable yields (for example, in a multispecies context, this may imply that more resilient stocks are maintained at levels significantly above B_{MSY} in order to achieve the targets set for less resilient species). Thus, advancing towards the Blue Transformation objective of ensuring that all fisheries are effectively managed,[12] and applying context-specific management approaches grounded in science that take into consideration ecological, food security, social and economic objectives is critical.

Inland fisheries

Approximately 13 percent of global capture fisheries production comes from inland capture fisheries in rivers, lakes, floodplains and wetlands, which together cover less than 2 percent of the Earth's surface area, yet hold roughly 40 percent of all known fish species.[14, 15] The sector is overwhelmingly small-scale: an estimated 99 percent of inland fishers operate using diverse and often seasonal gear. In landlocked, low-income food-deficit countries, inland fisheries serve as a critical, easily accessible, socioeconomic "safety net" – a role that becomes especially evident during climate emergencies such as floods and droughts.

Given the dispersed, seasonal and multispecies nature of inland fisheries and the challenges around obtaining reliable catch data, most production is poorly monitored. While stock assessment methods have been applied to selected species in some larger systems such as the African Great Lakes, they have proven difficult to extend to the majority of inland fisheries, which are characterized by highly variable, low-volume catches dispersed across vast river basins and floodplains. More fundamentally, environmental pressures, including hydrology, land use, water abstraction, pollution and climate variability, often have a greater influence on fishery resources than fishing pressure *per se*. This has made evaluating the environmental pressures exerted on the basins from which fish are harvested an essential component of managing inland fisheries.

The water basin scale is the most appropriate spatial unit for evaluating pressures on inland fisheries, given the highly heterogeneous nature of freshwater habitats, with processes that sustain or degrade fish populations operating at the catchment scale. In collaboration with the United States Geological Survey, FAO has developed a global basin threat assessment that evaluates 29 anthropogenic pressures grouped into five major threat categories – habitat degradation, pollution, climate change, invasive species and fishing pressure – across watersheds worldwide.[I] Threats are weighted using a three-pronged approach combining global spatial datasets, literature review and expert knowledge [14, 17] to develop a composite basin-level threat assessment.

The composite assessment published in the 2024 edition of this report found that 47 percent of major basins important to inland fisheries were under low pressure, 40 percent under moderate pressure, and 13 percent under high pressure.[2] Building on this composite assessment, disaggregation by threat category reveals which specific pressures are most significant in each basin. This provides a diagnostic layer to support the targeting of management interventions within inland fisheries management and integrated water resources management (IWRM) frameworks.

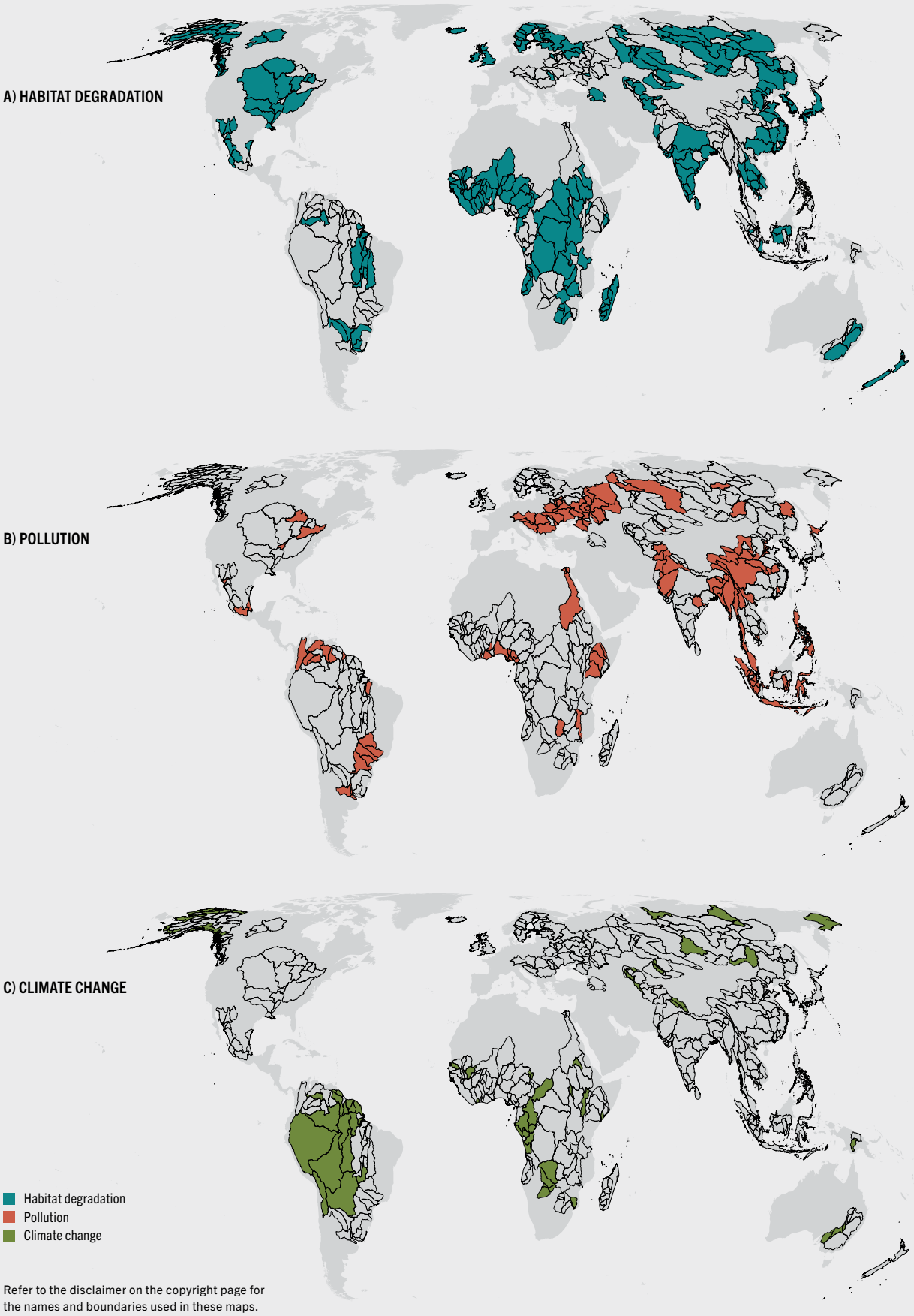
Dominant threats to inland fisheries

Habitat degradation emerges as the most widespread threat to inland fisheries globally. Of the 529 basins most important to inland fish catch, over half (284 basins, 54 percent) are most threatened by habitat alteration (Figure 1.21A). This pressure is prevalent across all regions, from the Mississippi system in North America, to the Congo, Niger, Zambezi and Great Lakes basins in Africa, and the Ganges, Mekong and Yangtze systems in Asia.

Habitat alteration encompasses deforestation and associated sediment runoff, fragmentation of river systems by dams and other infrastructure, riparian degradation, wetland drainage, channelization, and water abstraction. In the Mekong River Basin, the world's most productive inland fishery, the construction of »

I The assessment uses Level 4 HydroBASINS,[16] a globally consistent sub-basin delineation derived from HydroSHEDS, as the spatial unit of analysis.

FIGURE 1.21 DOMINANT THREATS IN BASINS IMPORTANT TO INLAND FISHERIES



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NOTE: Black-outlined basins indicate those most important to fisheries based on catch allocations in Ainsworth, Cowx and Funge-Smith (2023); coloured basins indicate those where the respective threat category is dominant.

SOURCES: Adapted from Sievert, N.A., Wieferich, D.W., Stokes, G.L. *et al.* (forthcoming). A global dataset of threats to inland fisheries by hydrological basins: U.S. Geological Survey data release 2024. https://doi.org/10.5066/P1BU4FSA; catch allocations based on Ainsworth, R.F., Cowx, I.G. & Funge-Smith, S.J. 2023. Putting the fish into inland fisheries – A global allocation of historic inland fish catch. *Fish and Fisheries*, 24(2): 263–278. https://doi.org/10.1111/faf.12725

» mainstream and tributary dams has been shown to block critical fish migration routes and trap nutrient-rich sediments, with modelling studies projecting substantial losses in migratory fish biomass under full development scenarios.[18, 19] In the African Great Lakes, catchment deforestation and shoreline habitat loss, including through sand mining and riparian clearance, are threatening fisheries that provide over 60 percent of regional animal protein in some riparian communities.[20, 21] In Mexico, where inland fisheries contribute to rural food security, an International Union for Conservation of Nature (IUCN) assessment found that 40 percent of freshwater fish species are threatened with extinction, driven primarily by habitat loss caused by unsustainable water extraction and hydroelectric infrastructure.[22] In India, floodplain wetlands covering over 500 000 hectares face compounding pressures from habitat degradation and eutrophication that constrain their fisheries potential.[23] These examples underscore the need for biodiversity-inclusive spatial planning and targeted ecosystem restoration in basins where inland fisheries are most at risk.

Pollution is the dominant threat in 144 of the 529 basins important to inland fish catch (27 percent), concentrated in industrialized and densely populated watersheds, particularly across Europe and in parts of Asia (Figure 1.21B). Key drivers include agricultural runoff leading to nutrient loading and eutrophication, industrial discharge, and inadequate municipal wastewater treatment. In the floodplain wetlands of eastern India, trophic state assessments found most wetlands in a mesotrophic state or progressing towards eutrophy, with nutrient enrichment adversely affecting fish diversity and catch.[24] Reducing pollution to levels that do not compromise aquatic ecosystem functioning remains a priority for sustaining inland fisheries globally.

Climate change is the dominant threat in 74 basins (14 percent), predominantly in high latitude regions, certain tropical lake systems and arid zones subject to altered precipitation, rising water temperatures and increased hydrological variability (Figure 1.21C). In Lake Tanganyika – one of the world's most biodiverse freshwater ecosystems, yielding up to 200 000 tonnes of fish annually – paleoecological records show that climate warming has intensified water column stratification and depressed algal production. These changes in the lake resulted in declines in commercially important fishery-targeted species that predate the onset of intensive fishing pressure.[21] In the Brazilian Pantanal, hydrological analysis of data recorded over a 42-year period shows that days without precipitation have increased significantly and drought-season water mass has declined by 16 percent, threatening the flood-pulse dynamics on which floodplain fisheries depend.[25]

Invasive species and fishing pressure are the dominant threats in a smaller number of basins; however, data limitations at the global scale constrain assessment of these categories. Collectively, nearly all inland fisheries face multiple concurrent stressors,[14, 17] and the interaction between threats can amplify their individual effects.

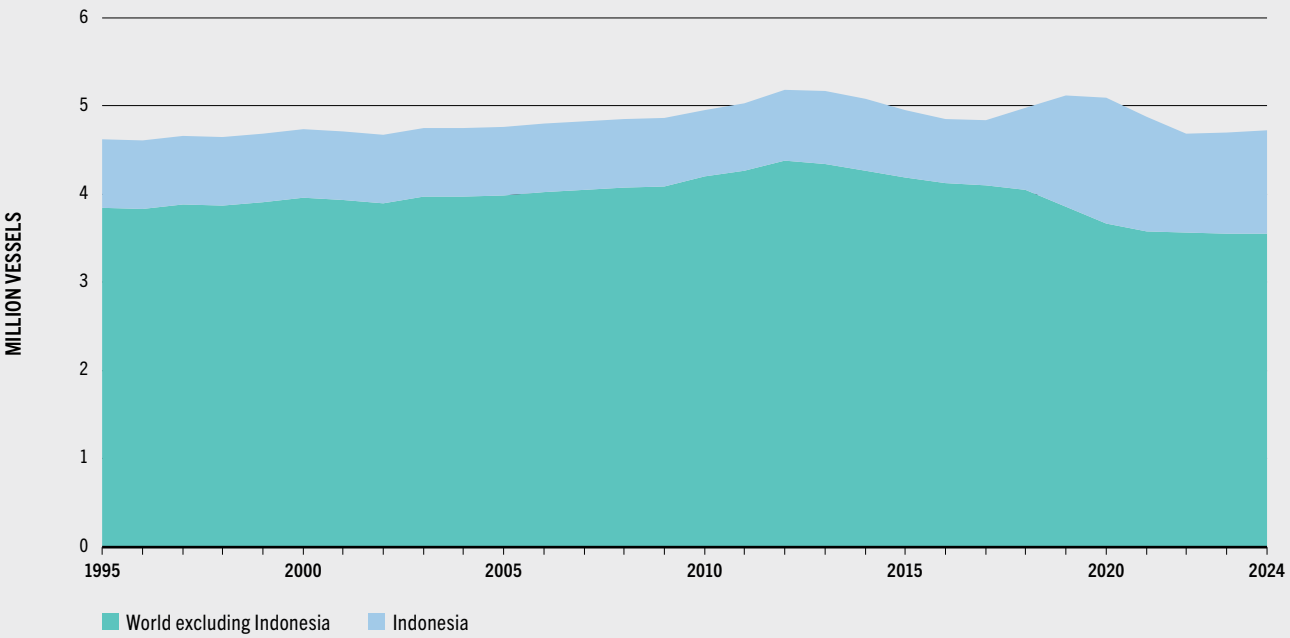
These results reinforce the case for integrating inland fisheries into IWRM frameworks and broader basin governance, since the dominant threats originate largely outside the fisheries sector.[26] Addressing them requires, in addition to fisheries management, intersectoral coordination on spatial planning, ecosystem restoration, pollution control and climate adaptation – areas where inland fisheries have historically been under-represented in both policy and research. As the global assessment is refined through downscaling and ground-truthing, including the development of sentinel fishery monitoring, future work by FAO aims to monitor changes in threat patterns over time. ■

FISHING FLEET

Estimate of the world fishing fleet and its regional distribution

In recent years, efforts by several countries to improve fishing fleet statistics, combined with FAO's strengthened data collection and analytical frameworks, have enabled a comprehensive revision of the fishing fleet data for the period 1995–2024. The world fishing fleet was estimated at 4.7 million vessels in 2024; this compares with a low of 4.6 million in 1996 and a high of

FIGURE 1.22 WORLD FISHING FLEET, 1995–2024



SOURCE: Preliminary data. Final data will be available here: FAO. (forthcoming). *Fishery and Aquaculture Statistics – Yearbook 2024*. FAO Yearbook of Fishery and Aquaculture Statistics. Rome. https://www.fao.org/fishery/en/statistics/yearbook

TABLE 1.10 WORLD FISHING FLEET BY REGION, 2024

Region	Number of vessels (thousands)	Share of world fishing fleet (%)
Africa	841	17.8
Asia	3 396	71.9
Europe	87	1.8
Latin America and the Caribbean	289	6.1
Northern America	93	2.0
Oceania	5	0.3
Total	**4 721**	**100.0**

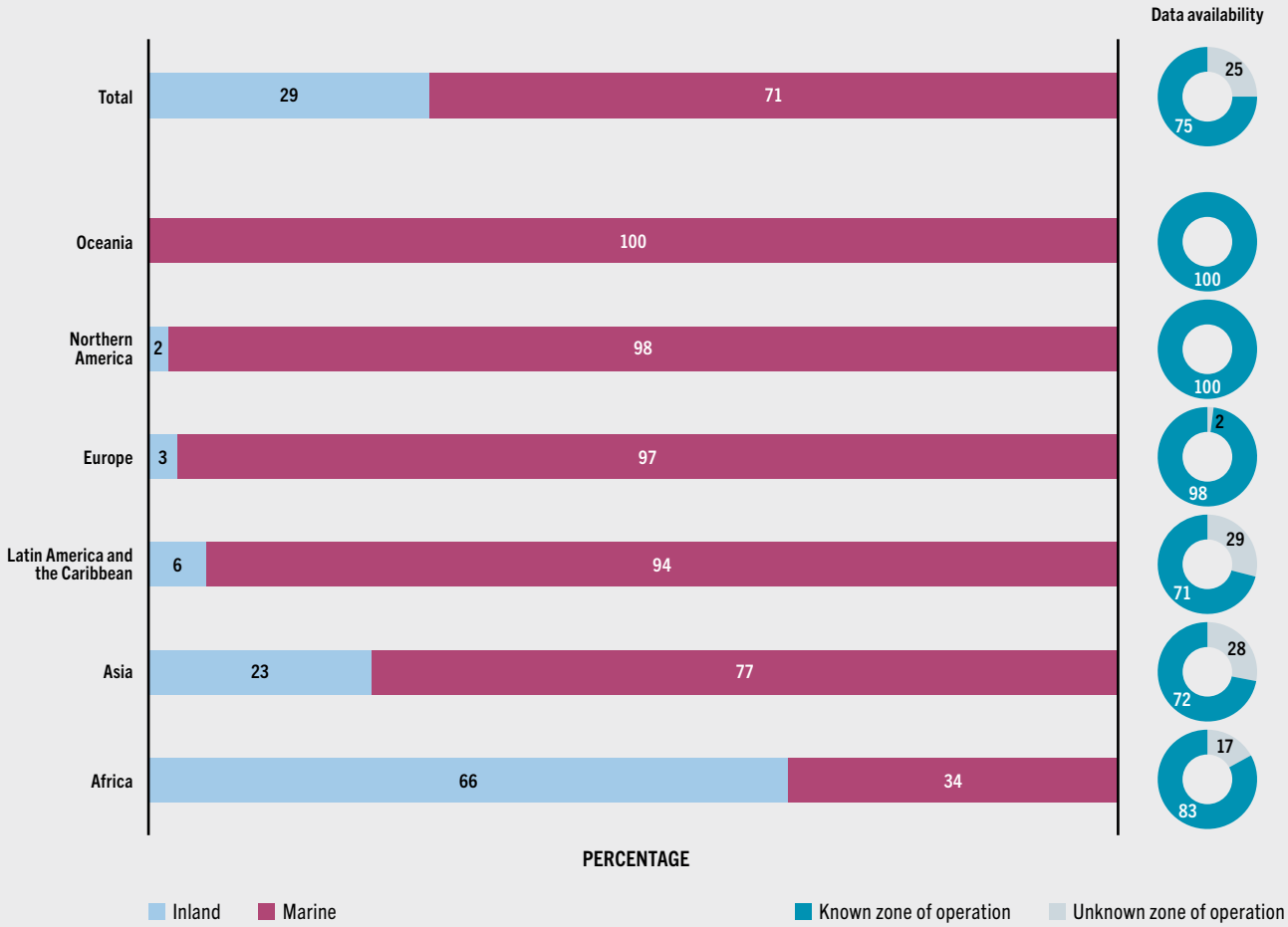
SOURCE: Preliminary data. Final data will be available here: FAO. (forthcoming). *Fishery and Aquaculture Statistics – Yearbook 2024*. FAO Yearbook of Fishery and Aquaculture Statistics. Rome. https://www.fao.org/fishery/en/statistics/yearbook

https://doi.org/10.4060/cd8357en-table1.10

5.2 million in 2012. Global trends have been influenced by Indonesia, which – following major data improvements since 2015 – now reports the world's largest fleet (over 1 million vessels in 2024). Indonesia recorded a sharp increase between 2017 and 2024; in contrast, a consistent downward trend was seen in the rest of the world. Notably, the sharpest decline occurred between 2019 and 2020 (–5 percent), largely reflecting disruptions caused by the COVID-19 pandemic (Figure 1.22).

Asia hosts the world's largest fishing fleet, estimated at 3.4 million vessels or 72 percent of the global total. Asia's share of the global total has been gradually decreasing from its peak of 77 percent in 2012, while Africa's has been increasing and now represents nearly 18 percent of all fishing vessels, up from 14 percent in 2012. The shares of Latin America and the Caribbean (6 percent), Northern America and Europe (2 percent each) and Oceania (less than 1 percent) have not changed significantly since 2012 (Table 1.10).

FIGURE 1.23 DISTRIBUTION OF WORLD FISHING FLEET BY ZONE OF OPERATION AND REGION, 2024



SOURCE: Preliminary data. Final data will be available here: FAO. (forthcoming). *Fishery and Aquaculture Statistics – Yearbook 2024*. FAO Yearbook of Fishery and Aquaculture Statistics. Rome. https://www.fao.org/fishery/en/statistics/yearbook

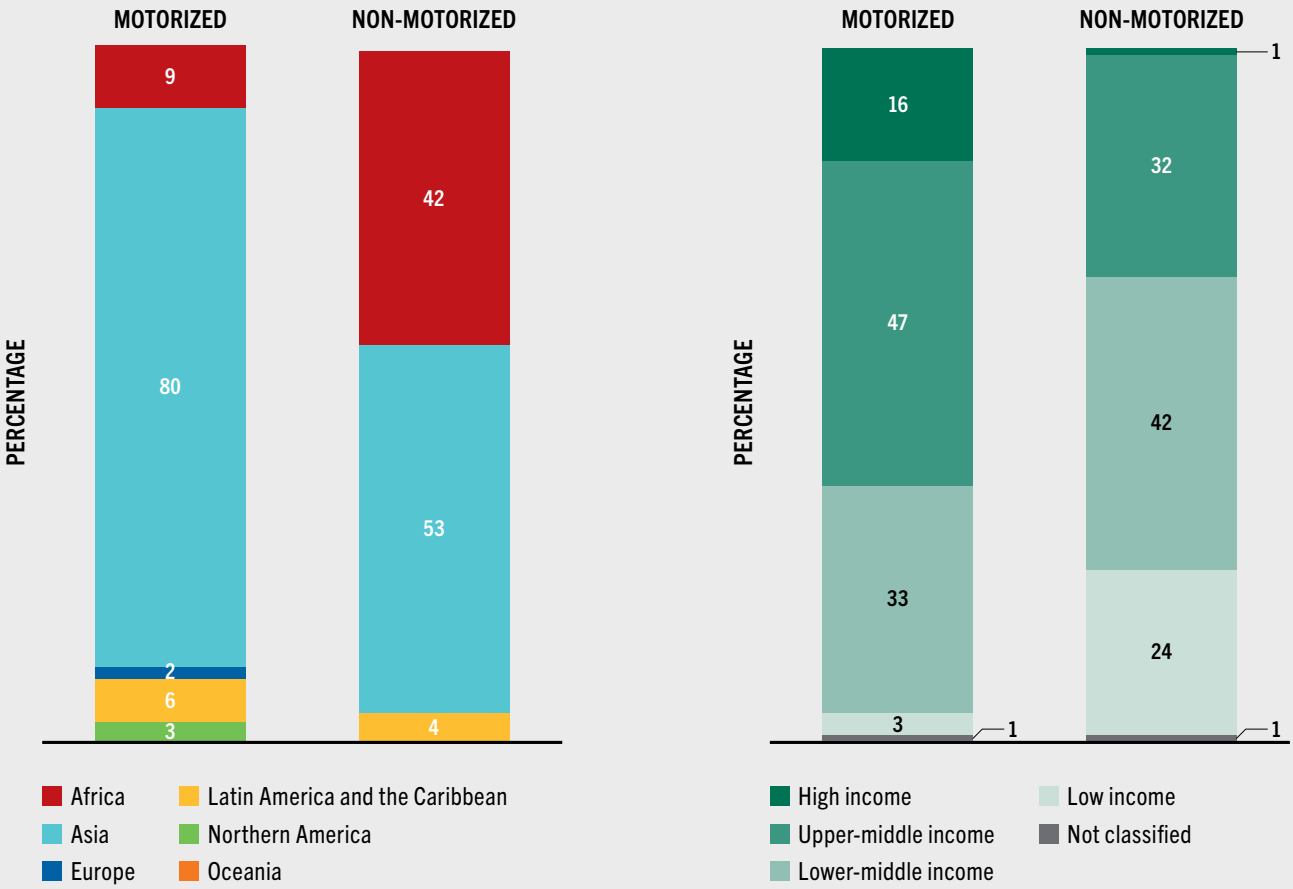
https://doi.org/10.4060/cd8357en-fig1.23

Half of the world fishing fleet is concentrated in four Asian countries (Indonesia, Philippines, China and India), and two-thirds in just ten countries. Eleven of the 18 countries with fleets of over 50 000 vessels are in Asia. It is important to note, however, that fleet size alone is not a sufficient descriptor of fleet capacity: a fleet composed of large, motorized vessels has a much greater capacity than a fleet of the same size but comprising mainly small, non-motorized vessels.

Vessels operating in inland and marine waters

Figure 1.23 shows the global and regional distribution of vessels operating in inland and marine waters, based on the available information for each zone of operation. The knowledge on zone of operation of vessels is not complete. Of the vessels for which the zone of operation is known (3.5 million, i.e. around 75 percent of the total number of vessels operating in the world): 1 million operate in inland waters, while 2.5 million operate in marine waters, with major differences between geographical

FIGURE 1.24 DISTRIBUTION OF WORLD FISHING FLEET BY MOTORIZATION STATUS, REGION AND INCOME GROUP, 2024



NOTE: Oceania has 0.03 percent of non-motorized and 0.38 percent of motorized vessels, both rounded to 0.

SOURCE: Preliminary data. Final data will be available here: FAO. (forthcoming). *Fishery and Aquaculture Statistics – Yearbook 2024*. FAO Yearbook of Fishery and Aquaculture Statistics. Rome. https://www.fao.org/fishery/en/statistics/yearbook

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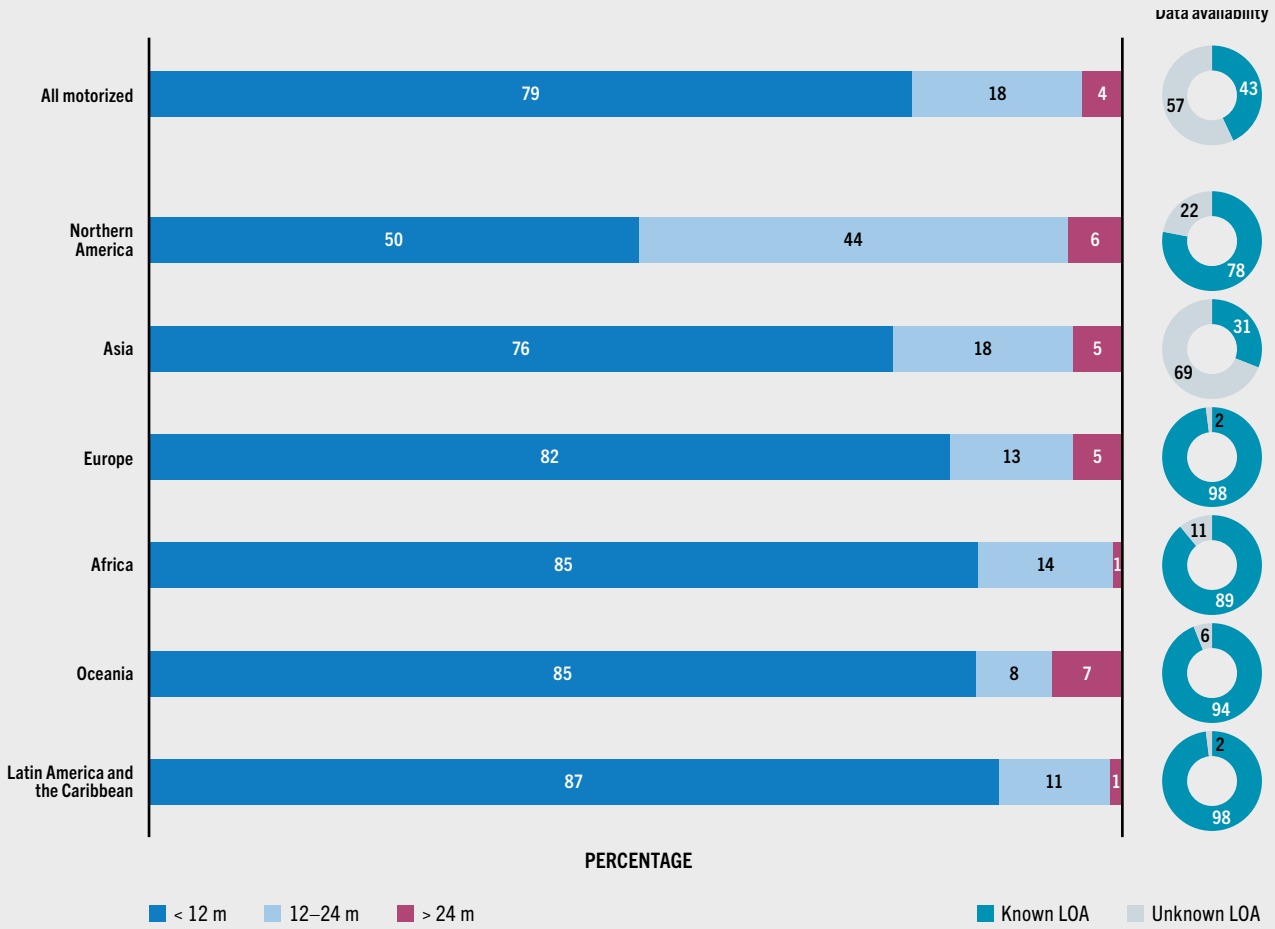
regions. In Africa, 66 percent of vessels operate in inland waters, followed by Asia (23 percent), Latin America and the Caribbean (6 percent), Europe (3 percent) and Northern America (2 percent). Nearly all vessels in Oceania operate in marine waters.

Motorization status

In 2024, motorized vessels represented more than two-thirds of the global fishing fleet. Their number increased from 2.6 million in 1995 to a peak of 3.7 million in 2020, before declining to 3.4 million in 2024 (excluding data from Indonesia, the number peaked in 2013, more closely aligned with the overall fleet peak in 2012). Meanwhile, the number of non-motorized vessels decreased from 2 million in 1995 to 1.3 million in 2024.

Asia accounted for 80 percent (2.7 million) of the world's motorized vessels and 53 percent (0.7 million) of non-motorized vessels in 2024. Africa has the second largest non-motorized fleet, estimated at 42 percent of the world total (Figure 1.24).

FIGURE 1.25 DISTRIBUTION OF MOTORIZED FISHING FLEET BY LENGTH OVERALL AND REGION, 2024



NOTE: LOA – Length overall.

SOURCE: Preliminary data. Final data will be available here: FAO. (forthcoming). *Fishery and Aquaculture Statistics – Yearbook 2024*. FAO Yearbook of Fishery and Aquaculture Statistics. Rome. https://www.fao.org/fishery/en/statistics/yearbook

https://doi.org/10.4060/cd8357en-fig1.25

Disaggregating by income group, nearly half of the world's motorized vessels are located in upper-middle-income countries (47 percent), followed by lower-middle-income (33 percent), high-income (16 percent) and low-income countries (3 percent). On the other hand, most non-motorized vessels are found in lower-middle-income countries (42 percent), followed by upper-middle-income (32 percent) and low-income countries (24 percent), while only 1 percent are found in high-income countries (Figure 1.24).

Size distribution of vessels

Many countries do not report vessel size to FAO, because the information is not available at country level. Data coverage and quality also differ across vessel size groups, with industrial vessels more likely to be licensed and registered than small vessels. As a result, information on the size of vessels is available for only 46 percent of reported vessels.

Coverage has improved since last reported in the 2024 edition *The State of World Fisheries and Aquaculture*, mainly due to additional

information obtained on China's motorized fleet. Strengthening national data collection systems to systematically record and report vessel size would substantially improve the completeness, comparability and analytical value of global fleet statistics – in addition to supporting countries' fleet management efforts. Among vessels with reported length overall (LOA), the share of small vessels has slowly decreased over time, from 89 percent in 1995 to 85 percent in 2024. The share of medium-size vessels increased from 8 percent to 12 percent during the same period, while the share of large vessels increased from 2.4 percent to 2.7 percent.

For motorized vessels, size data are available for 43 percent of vessels. Among these, 79 percent have an LOA under 12 m, 18 percent between 12 m and 24 m, and 4 percent 24 m and above. For non-motorized vessels, 57 percent of the available data include information on size; based on these data, around 99 percent of non-motorized vessels belong to the under 12 m LOA class.

Figure 1.25 illustrates the distribution of motorized vessels with known LOA in 2024 by geographical region. A breakdown for non-motorized vessels is not shown because – as noted above – 99 percent belong to the small vessels category. Small vessels represent the largest share among all motorized vessels with known LOA in all regions. In 2024, this share was highest in Latin America and the Caribbean (87 percent) and also above 80 percent in Oceania, Africa and Europe. In Asia, 76 percent of vessels belonged to this category, while in Northern America only 50 percent of the fleet consisted of small vessels. The proportion of large vessels (with an LOA above 24 m) was highest in Oceania and Northern America (7 percent and 6 percent, respectively), followed by Europe and Asia (5 percent each), and Latin America and the Caribbean and Africa (1 percent each).

Data quality and improvements

Data collection at the country level continues to improve in many parts of the world. Nevertheless, important gaps remain, and additional efforts are required to strengthen coverage, standardization, and reporting practices. FAO's comprehensive revision of fleet data dating back to 1995 has involved close communication with countries to ensure correct interpretation of the data received, supporting them in their reporting, uncovering new data sources, controlling data errors, and making informed estimates where necessary. Efforts are made to clarify and harmonize data coverage to the extent possible, including all active vessels operating in marine and inland waters.

The work on improving fishing fleet data will continue and will eventually be expanded to include historical data from 1950 to 1995, and information on tonnage and engine power. ■

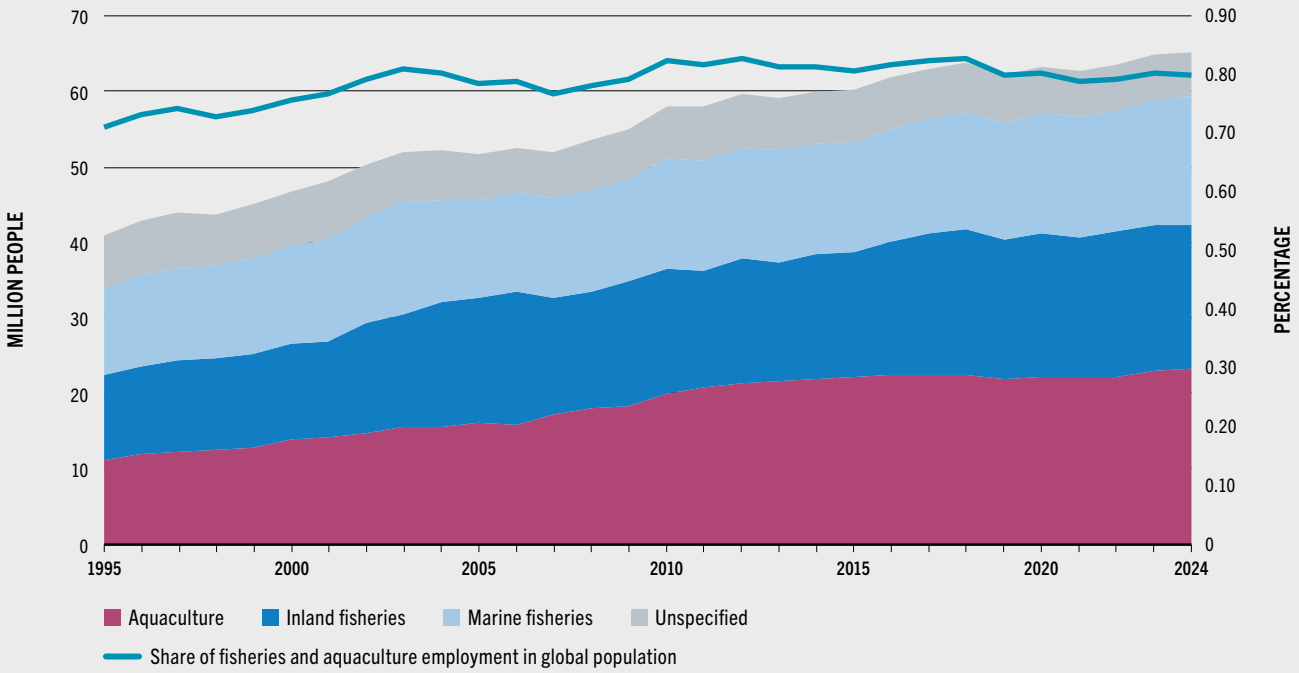
EMPLOYMENT IN FISHERIES AND AQUACULTURE

Global review

In 2024, an estimated 65.3 million people were engaged as full-time, part-time, occasional or unspecified workers in the primary sector of fisheries and aquaculture, excluding subsistence activities. Thirty-five percent were employed in aquaculture and 56 percent in capture fisheries; the remaining 9 percent could not be allocated to either subsector due to data limitations.

The total number of people engaged in the sector has been increasing over time, and their share in the global population increased from 0.71 percent in 1995 to a peak of 0.83 percent in 2012, after which it showed marginal fluctuations. The number of people engaged in aquaculture increased rapidly from 11.2 million in 1995 to 22.0 million in 2015, after which growth continued at a slower pace, reaching 23.1 million in 2024. Marine fisheries provided employment for 16.9 million people in 2024, increasing from 11.7 million in 1995. The number of people in inland fisheries increased from 11.3 million in 1995 to a peak of 19.3 million in 2018, after which it remained stable. Due to insufficient data, a share of the workers in the sector are reported as unspecified. Between 1995 and 2024, the number of unspecified workers fluctuated between 6 and 8 million, and was 6 million in 2024 (Figure 1.26).

FIGURE 1.26 EMPLOYMENT IN THE PRIMARY SECTOR OF FISHERIES AND AQUACULTURE BY SUBSECTOR AND SHARE OF WORLD POPULATION, 1995–2024



SOURCE: Preliminary data. Final data will be available here: FAO. (forthcoming). *Fishery and Aquaculture Statistics – Yearbook 2024*. FAO Yearbook of Fishery and Aquaculture Statistics. Rome. https://www.fao.org/fishery/en/statistics/yearbook

https://doi.org/10.4060/cd8357en-fig1.26

Regional distribution

The distribution of fishers and fish farmers across regions is highly uneven. In 2024, Asia accounted for the vast majority (85 percent) of workers involved in fisheries and aquaculture, followed by Africa (9 percent) and Latin America and the Caribbean (5 percent), while Europe, Oceania and Northern America combined accounted for just 1 percent (Table 1.11). In terms of employment in the primary sector at national level (Figure 1.27), just ten countries represent about 83 percent of the global total. Nine of these countries are in Asia, accounting for around 80 percent of total employment in the sector, while Brazil represents the other 3 percent (Figure 1.28).

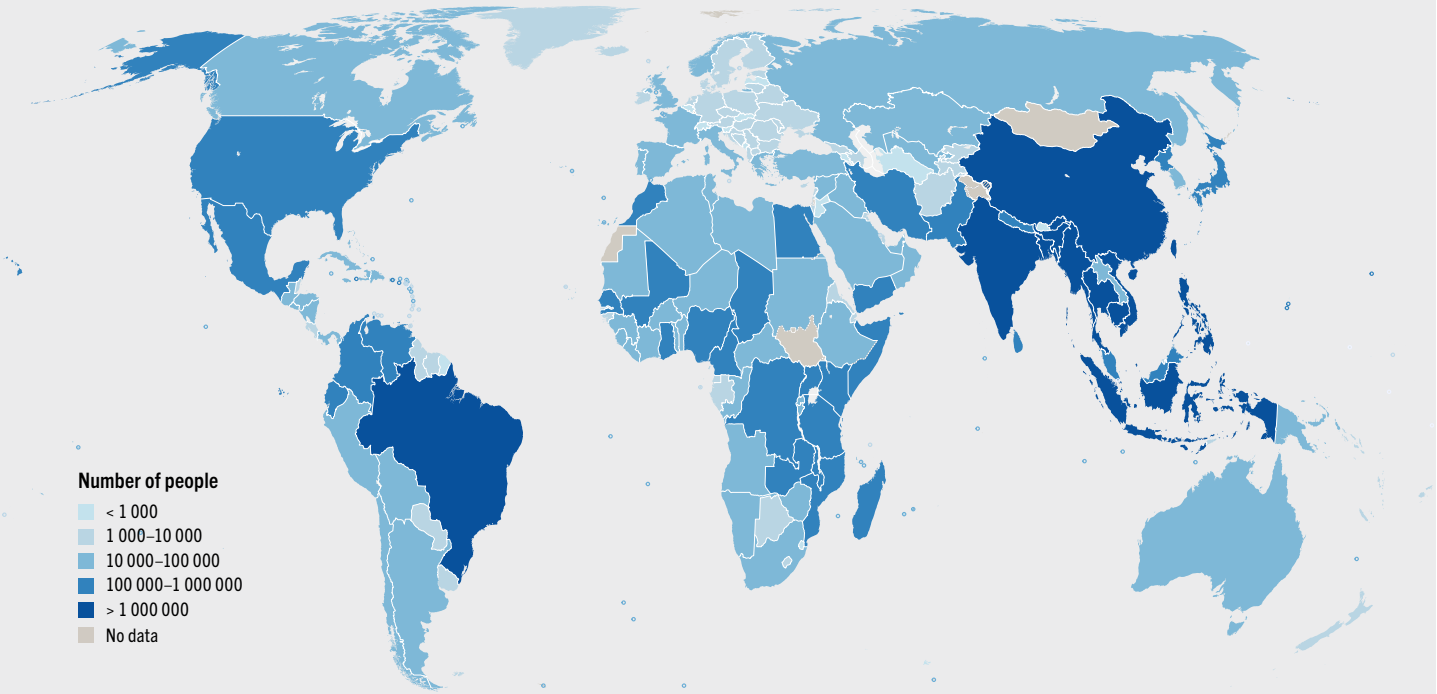
Figure 1.29 shows the subsector employing most people by country, and the share of this subsector in total primary sector employment in fisheries and aquaculture. Aquaculture is dominant in many Asian and European countries. Inland fisheries are the largest employer in Central and Southern Asia, and a large part of Africa, while marine fisheries are the most important subsector in Oceania, the Americas, and countries with long coastlines in Africa and Asia.

Working time status

Figure 1.30 shows that in 2024, 63 percent of workers employed in the primary sector of fisheries and aquaculture could be disaggregated by working time status into full-time, part-time or occasional work. This represents a notable increase of 8 percentage points since 2022 – mainly attributable to enhanced working time data availability in the aquaculture sector, which grew by 18 percentage points.

When considering the subset of data with working time information, aquaculture and marine fisheries have similar working time structures at »

FIGURE 1.27 EMPLOYMENT IN THE PRIMARY SECTOR OF FISHERIES AND AQUACULTURE BY COUNTRY OR TERRITORY, 2024



Refer to the disclaimer on the copyright page for the names and boundaries used in this map. Dotted line represents approximately the Line of Control in Jammu and Kashmir agreed upon by India and Pakistan. The final status of Jammu and Kashmir has not yet been agreed upon by the parties. Final boundary between the Republic of Sudan and the Republic of South Sudan has not yet been determined. Final status of the Abyei area is not yet determined.

SOURCE: Preliminary data. Final data will be available here: FAO. (forthcoming). *Fishery and Aquaculture Statistics – Yearbook 2024*. FAO Yearbook of Fishery and Aquaculture Statistics. Rome. https://www.fao.org/fishery/en/statistics/yearbook

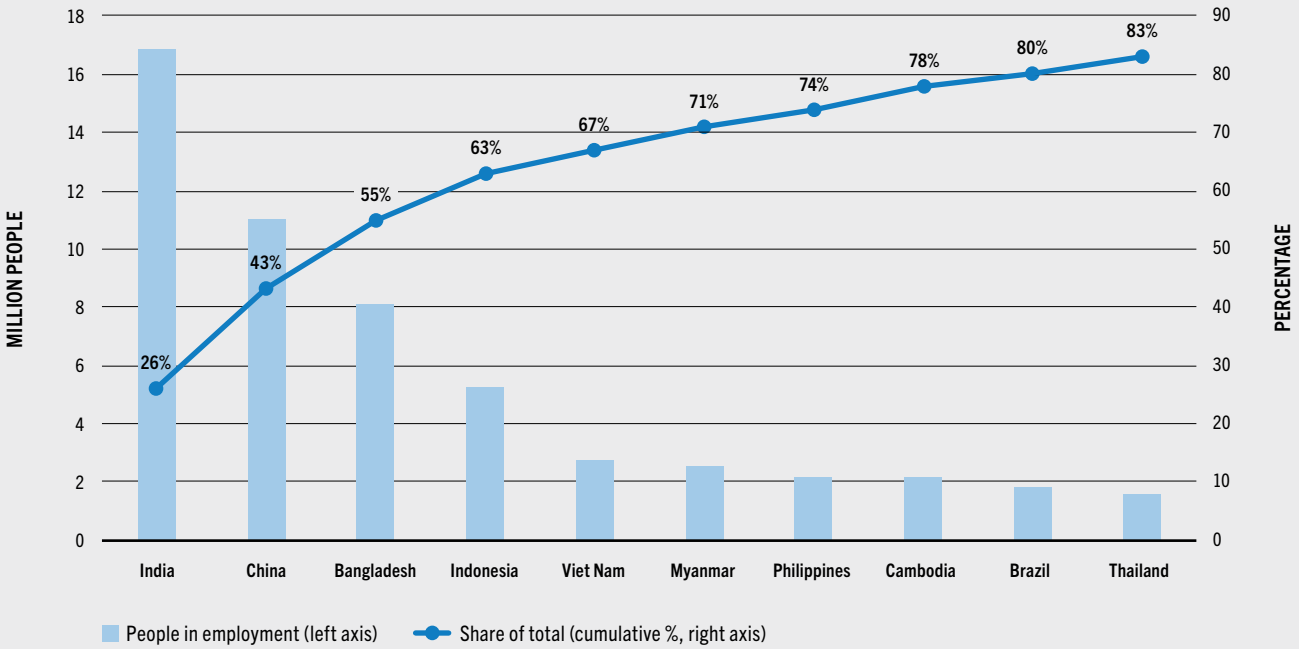
TABLE 1.11 EMPLOYMENT IN THE PRIMARY SECTOR OF FISHERIES AND AQUACULTURE BY REGION, 2024

Region	Number of people (thousands)	Share of world primary sector employment (%)
Africa	6 057	9.3
Asia	55 435	84.9
Europe	330	0.5
Latin America and the Caribbean	3 154	4.9
Northern America	226	0.3
Oceania	91	0.1
Total	**65 293**	**100.0**

SOURCE: Preliminary data. Final data will be available here: FAO. (forthcoming). *Fishery and Aquaculture Statistics – Yearbook 2024*. FAO Yearbook of Fishery and Aquaculture Statistics. Rome. https://www.fao.org/fishery/en/statistics/yearbook

https://doi.org/10.4060/cd8357en-table1.11

FIGURE 1.28 TOP TEN COUNTRIES BY EMPLOYMENT IN THE PRIMARY SECTOR OF FISHERIES AND AQUACULTURE, 2024



SOURCE: Preliminary data. Final data will be available here: FAO. (forthcoming). *Fishery and Aquaculture Statistics – Yearbook 2024*. FAO Yearbook of Fishery and Aquaculture Statistics. Rome. https://www.fao.org/fishery/en/statistics/yearbook

https://doi.org/10.4060/cd8357en-fig1.28

» the global level. Both sectors feature about 64 to 73 percent of full-time workers and around 12 to 19 percent of part-time and occasional workers. Inland fisheries, however, are characterized by lower full-time employment (42 percent) and higher shares of part-time (35 percent) and occasional (22 percent) workers.

Sex disaggregation

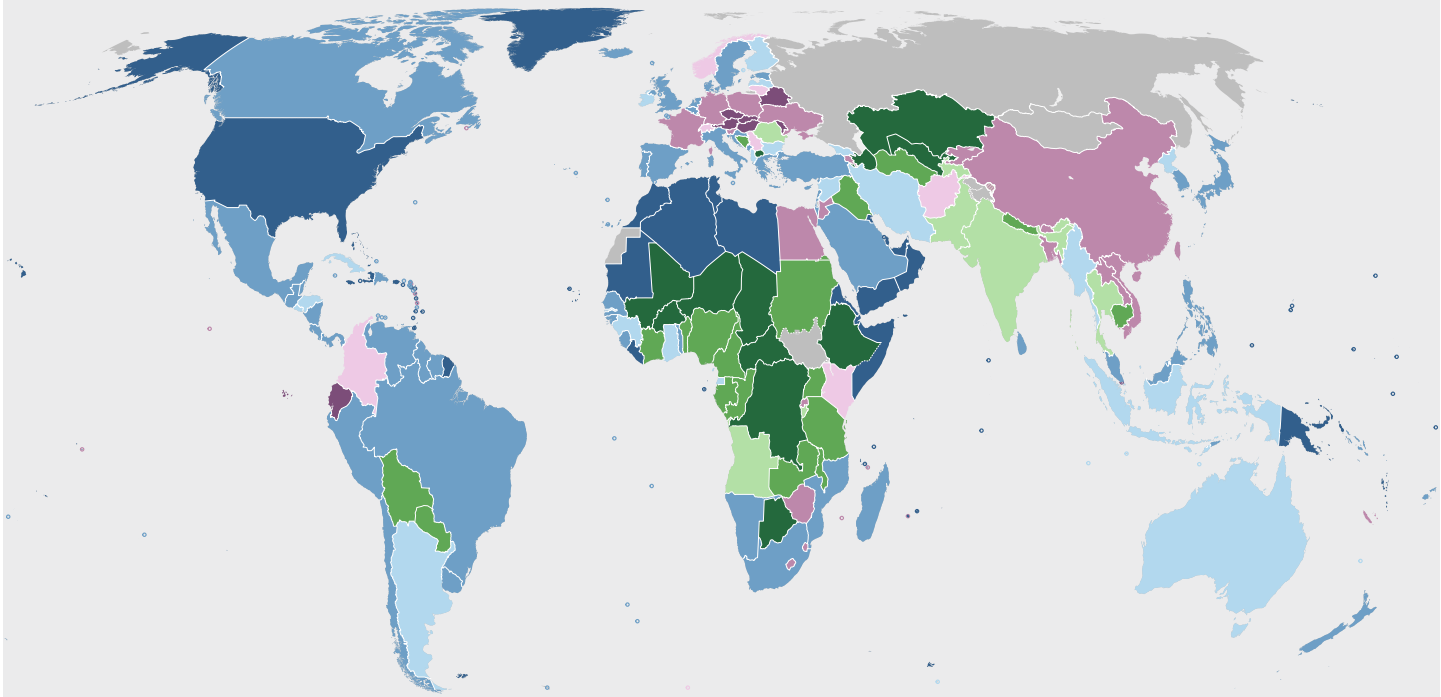
Data on sex disaggregation are available for almost two-thirds of workers employed in the primary sector of fisheries and aquaculture in 2024. However, in contrast to the working time data, this share is strikingly higher for inland fisheries (87 percent). Out of the top ten countries for inland fisheries employment, eight report data disaggregated by sex, covering 75 percent of global inland fisheries employment.

Where data could be disaggregated by sex and subsector, the shares of female workers are highest in inland fisheries (31 percent), lowest in marine fisheries (21 percent) and close to the primary sector average in aquaculture (26 percent) (Figure 1.31).

Processing

FAO's work on improving data collection on employment in processing fish and fishery products has progressed consistently over the years (Table 1.12). In 2024, FAO received processing employment data from 85 countries – almost three times more than in 2018, when FAO started collecting such statistics. Employment in processing in 2024 stood at about 3.3 million workers in these 85 countries, which host 74 percent of the world's population.

FIGURE 1.29 SUBSECTOR EMPLOYING MOST PEOPLE IN THE PRIMARY SECTOR OF FISHERIES AND AQUACULTURE BY COUNTRY OR TERRITORY AND SHARE OF NATIONAL TOTAL, 2024



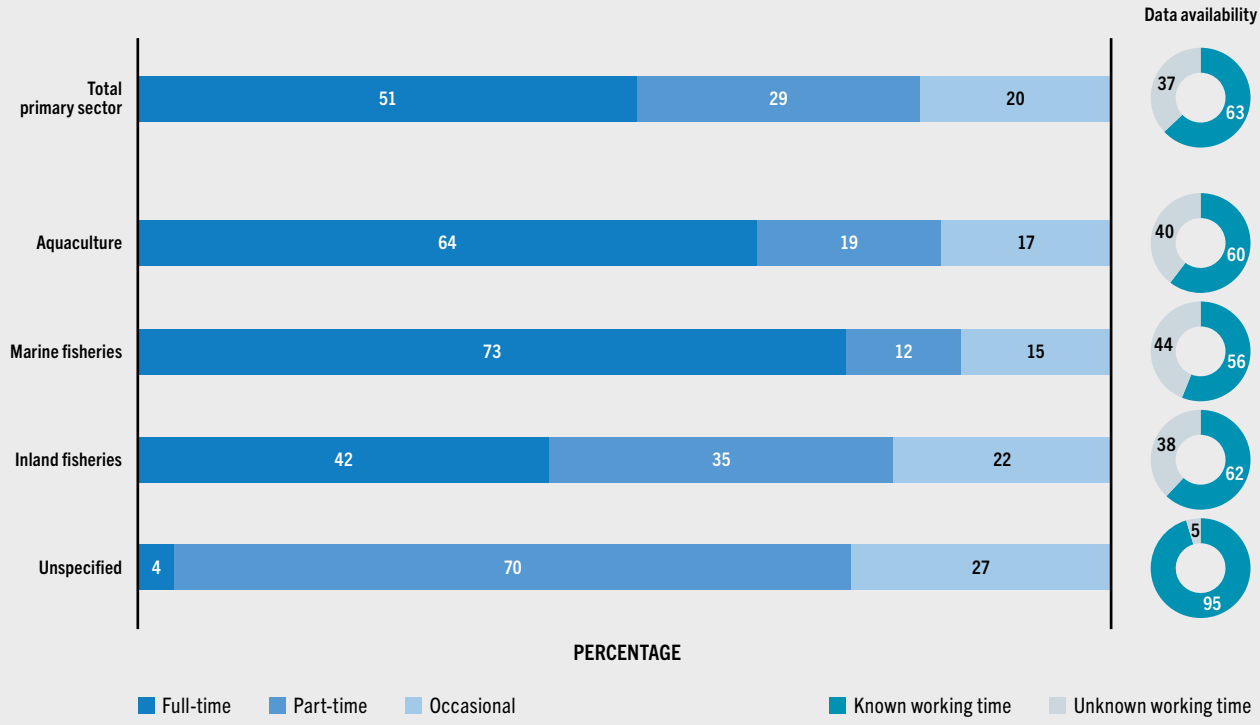
Refer to the disclaimer on the copyright page for the names and boundaries used in this map. Dotted line represents approximately the Line of Control in Jammu and Kashmir agreed upon by India and Pakistan. The final status of Jammu and Kashmir has not yet been agreed upon by the parties. Final boundary between the Republic of Sudan and the Republic of South Sudan has not yet been determined. Final status of the Abyei area is not yet determined.

SOURCE: Preliminary data. Final data will be available here: FAO. (forthcoming). *Fishery and Aquaculture Statistics – Yearbook 2024*. FAO Yearbook of Fishery and Aquaculture Statistics. Rome. https://www.fao.org/fishery/en/statistics/yearbook

Similar to primary sector employment, 63 percent of workers employed in processing could be disaggregated by working time. About three-quarters of workers are employed on a full-time basis, and this is a higher proportion than in any of the primary subsectors. Part-time and occasional employment, respectively, represent 11 percent and 12 percent of employment.

Sex-disaggregated employment data were reported for only 42 percent of employment in the processing sector – much lower than in the primary sector. Based on the data reported, women account for 28 percent of processing workers. This share is notably influenced by the data from Bangladesh, which cover 24 percent (800 000 people) of total processing employment and regard a 92 percent male workforce. Excluding data from Bangladesh, the share of women in fish processing rises markedly to an estimated 56 percent. This aligns more closely with the global estimate of the share of female »

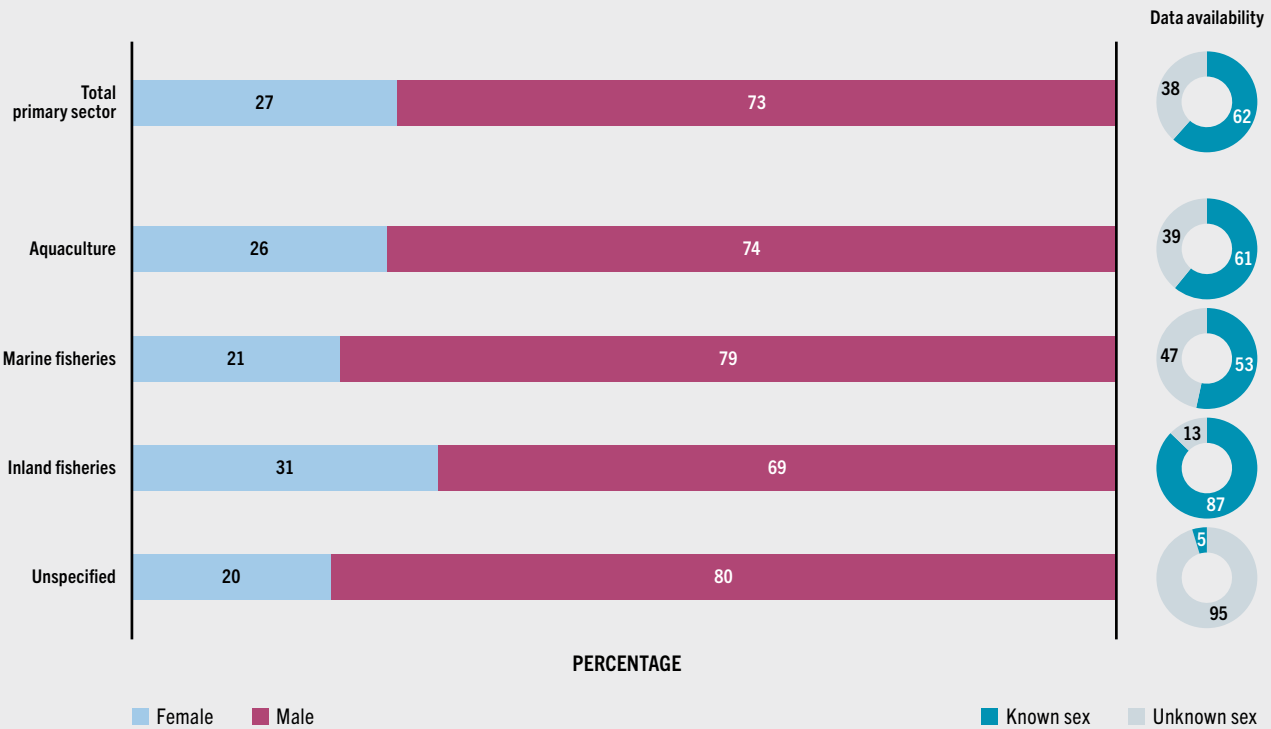
FIGURE 1.30 EMPLOYMENT IN THE PRIMARY SECTOR OF FISHERIES AND AQUACULTURE BY WORKING TIME STATUS, 2024



SOURCE: Preliminary data. Final data will be available here: FAO. (forthcoming). *Fishery and Aquaculture Statistics – Yearbook 2024*. FAO Yearbook of Fishery and Aquaculture Statistics. Rome. https://www.fao.org/fishery/en/statistics/yearbook

https://doi.org/10.4060/cd8357en-fig1.30

FIGURE 1.31 SHARE OF EMPLOYMENT IN THE PRIMARY SECTOR OF FISHERIES AND AQUACULTURE BY SEX, 2024



SOURCE: Preliminary data. Final data will be available here: FAO. (forthcoming). *Fishery and Aquaculture Statistics – Yearbook 2024*. FAO Yearbook of Fishery and Aquaculture Statistics. Rome. https://www.fao.org/fishery/en/statistics/yearbook

https://doi.org/10.4060/cd8357en-fig1.31

TABLE 1.12 NUMBER OF COUNTRIES REPORTING DATA ON FISH PROCESSING EMPLOYMENT, 2018–2024

Year	Number of reporting countries	Share of world population covered (%)
2018	29	15.0
2019	29	15.0
2020	41	21.8
2021	49	41.5
2022	52	41.4
2023	59	43.8
2024	85	74.2

SOURCE: Preliminary data. Final data will be available here: FAO. (forthcoming). *Fishery and Aquaculture Statistics – Yearbook 2024*. FAO Yearbook of Fishery and Aquaculture Statistics. Rome. https://www.fao.org/fishery/en/statistics/yearbook

https://doi.org/10.4060/cd8357en-table1.12

» post-harvest workers (50 percent) reported in the Illuminating Hidden Harvests report.[7]

Data quality and improvements

Collection and analysis of employment data in fisheries and aquaculture continue to improve as a result of enhanced country reporting combined with FAO's ongoing effort to improve data processing. Joint data collection and methodology alignment continue with the Organisation for Economic Co-operation and Development (OECD). Thanks to these improvements, FAO is able to report for the first time the employment dataset in FishStatJ during 2026 (see Box 1.6). ■

UTILIZATION AND PROCESSING

Recent trends

In 2024, around 89 percent (or 174 million tonnes) of the approximately 195 million tonnes (live weight equivalent) of aquatic animals produced globally were utilized for direct human consumption. The remaining 11 percent (21 million tonnes) were destined for non-food uses. Fishmeal and fish oil accounted for the vast majority of non-food uses (about 18 million tonnes). The remaining production was used in aquaculture (e.g. as fry, fingerlings or small adults for ongrowing), as bait, as raw material for direct feeding (in livestock production, fur farming and aquaculture), for pet food, in pharmaceutical applications or as ornamental fish.

Over the past decades, the share of aquatic animal production used for direct human consumption has shown sustained growth, reflecting both increasing demand for aquatic foods and a gradual decline in the proportion of catches used for producing fishmeal and fish oil (Figure 1.32).

Of the aquatic animal foods destined for human consumption in 2024, live, fresh and chilled products continued to represent the largest share (about 44 percent). They are preferred by many consumers and tend to command premium prices. Frozen products represented the second-largest share (34 percent), followed by prepared and preserved products (12 percent) and cured preparations (including drying, salting, fermentation and smoking) (10 percent) (Figure 1.33). Freezing remains the principal preservation method, accounting for the majority of processed aquatic animal products destined for human consumption.

Marked regional and national differences persist in patterns of utilization, processing, packaging and commercialization. Aquatic species can be prepared using a wide range of methods, from manual to fully automated, depending on the scale of operation, the country's infrastructure and know-how, and market demand. Preservation and processing techniques may also vary among species, depending on their characteristics, composition, size and shape.

In general, in high-income countries, most aquatic animal foods are marketed as frozen, prepared or preserved products, with an ever-expanding »

BOX 1.6 FISHERY AND AQUACULTURE'S CONTRIBUTION TO LIVELIHOODS: REVISED METHODOLOGY

FAO previously estimated that fisheries and aquaculture contribute to the livelihoods of around 600 million people.[13] This estimate relied on a set of assumptions anchored in primary sector employment, based on which secondary employment and dependents were estimated. FAO has now updated the methodology, incorporating more accurate and disaggregated employment figures across broader value chains. All data used in these calculations refer to 2022.

To improve the estimation, extensive country data on the number of indirectly employed and their dependents were collected, based on statistical yearbooks, scientific publications and regional reports. The data covered 96 countries and reveals major differences in the ratio of direct and indirect employment across regions and income levels. This confirms that the number of people employed in the primary sector alone is not a sufficient predictor of the total number of jobs created in the sector.

A linear regression was used to estimate the population share engaged in fisheries and aquaculture throughout the value chain by country. Variables included the total production of fisheries and aquaculture, gross domestic product (GDP) per capita, the share of aquatic products in total food supply (in kilocalories), the dependency ratio (number of non-working age people divided by the working age population) by country, and whether the country was landlocked. Two other estimations were also generated by applying the average share of indirect employment in total employment and the average production per worker in each region and income group to the countries where these data were missing. Finally, to estimate the number of dependents, country-level data on the average household size provided by the UN Population Division were used.

The results indicate that the fisheries and aquaculture sector contributes to the livelihoods of 612 million people, confirming previous approximations. Two complementary methods (average ratio of indirect jobs to direct jobs and average production per worker, by both region and income group) produced estimates of 618 million people and 550 million people respectively, providing a plausible range for global livelihoods supported by the sector.

Large differences exist across regions and income groups. Based on these results, fisheries and aquaculture contribute to the livelihoods of 11 percent of the population in Africa, 9 percent in Asia, 4 percent in Oceania, 2 percent in Latin America and the Caribbean, and 1 percent in both Northern America and Europe. By income group, the sector contributes disproportionately to the livelihoods of the most vulnerable populations: 13 percent of the population in low-income countries, 11 percent in lower-middle-income, 5 percent in upper-middle-income, and less than 1 percent in high-income countries.

While this analysis focuses on livelihoods supported through employment, fisheries and aquaculture also make a critical contribution through food supply and healthy diets, as discussed in **Aquatic food availability**. It is also important to note that these estimates include all people engaged in the sector, even if only on an occasional basis. As a result, many of these households may not be dependent primarily on the fisheries and aquaculture sector, even though they are benefiting from it in meaningful ways.

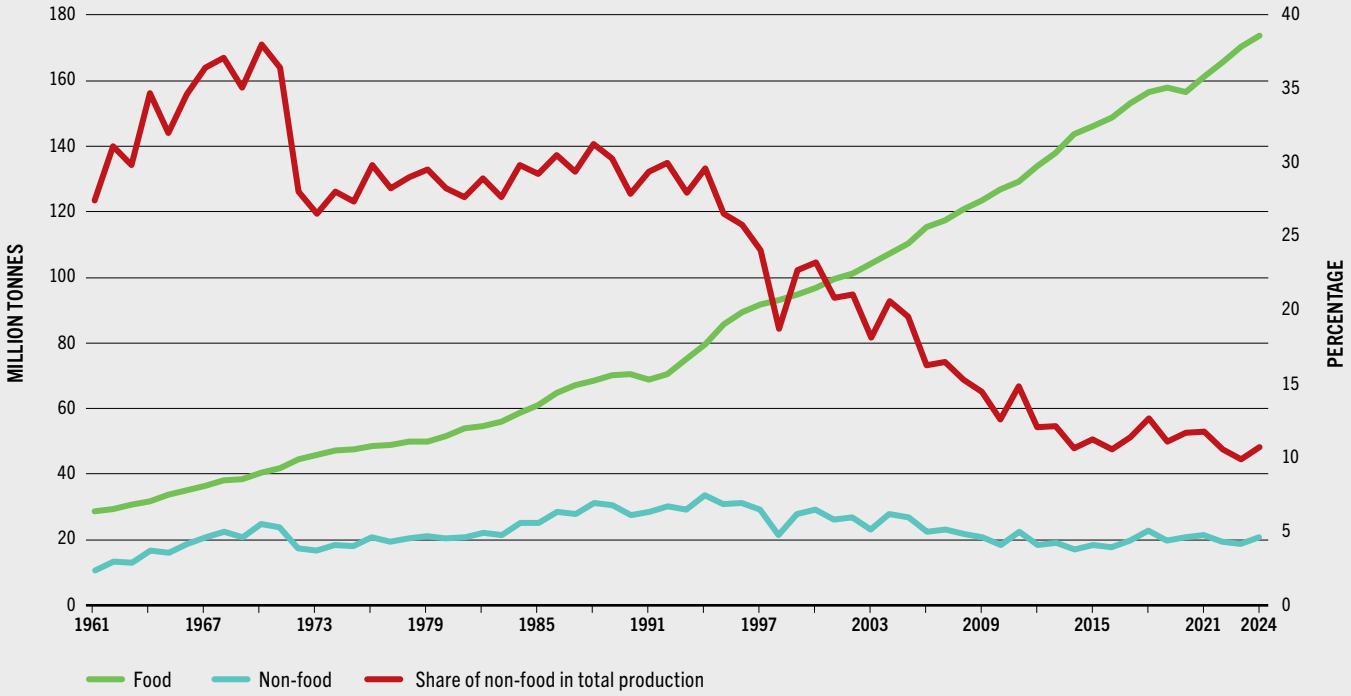


Fish vendors sell dried fish at the fishing harbour in Visakhapatnam, India
© FAO/Harsha Vadlamani



Fishers from the Capivara community carry arapaima fish to a boat near Tefé, Brazil
© FAO/Lalo de Almeida

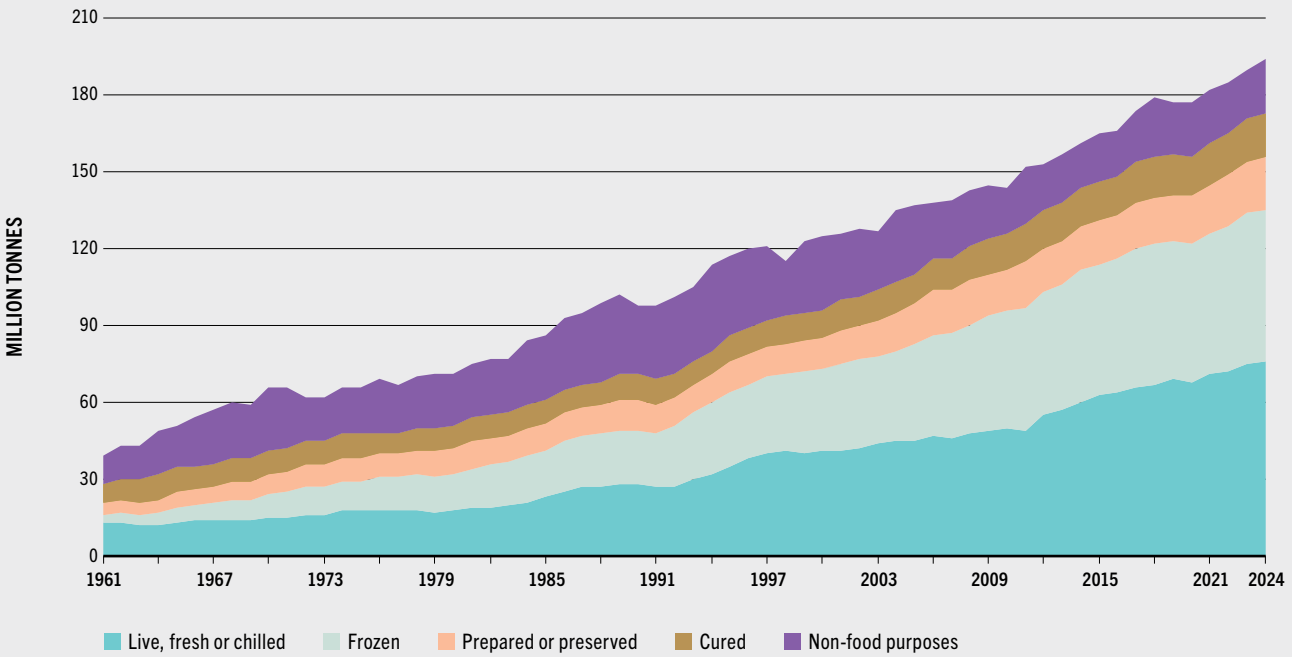
FIGURE 1.32 UTILIZATION OF WORLD FISHERIES AND AQUACULTURE PRODUCTION OF AQUATIC ANIMALS BY FOOD AND NON-FOOD USE, 1961–2024



NOTES: Aquatic animals exclude aquatic mammals, crocodiles, alligators, caimans, sponges, corals, pearls and algae. Data are expressed in live weight equivalent.

SOURCE: Preliminary data. Final data will be available here: FAO. (forthcoming). *Fishery and Aquaculture Statistics – Yearbook 2024*. FAO Yearbook of Fishery and Aquaculture Statistics. Rome. https://www.fao.org/fishery/en/statistics/yearbook

FIGURE 1.33 UTILIZATION OF WORLD FISHERIES AND AQUACULTURE PRODUCTION OF AQUATIC ANIMALS, 1961–2024



NOTES: Aquatic animals exclude aquatic mammals, crocodiles, alligators, caimans, sponges, corals, pearls and algae. Data are expressed in live weight equivalent.

SOURCE: Preliminary data. Final data will be available here: FAO. (forthcoming). *Fishery and Aquaculture Statistics – Yearbook 2024*. FAO Yearbook of Fishery and Aquaculture Statistics. Rome. https://www.fao.org/fishery/en/statistics/yearbook

» range of convenience and ready-to-eat foods. In 2024, over 60 percent of the aquatic animal production destined for human consumption in high-income countries was frozen, under 25 percent prepared and preserved, and 11 percent cured. In contrast, in many low- and middle-income countries, a substantial proportion of production continues to be distributed in live (mainly in East and Southeast Asia and in niche markets in other regions), fresh or chilled form, reflecting infrastructure constraints, consumer preferences and shorter supply chains. Indeed, in 2024, in low-income countries, these forms represented about 70 percent of aquatic animal food uses, while about 20 percent was cured, and only 9 percent was frozen. Finally, considering only middle-income countries, in the same year, live, fresh and chilled forms accounted for a smaller share (approximately 50 percent), followed by frozen (around 31 percent), and canned and cured (about 9 percent each).

At regional level, approximately two-thirds of the fisheries and aquaculture production used for human consumption is in frozen, prepared and preserved forms in Europe and Northern America. Traditional preservation methods such as drying, salting, smoking and fermentation remain particularly important in parts of Africa and Asia, where they play a critical role in food security and rural livelihoods, and the resulting share of cured products is higher than the world average. The share of fisheries and aquaculture production destined for reduction into fishmeal and fish oil is highest in Latin America, followed by Asia and Europe.

In addition to the growth in aquatic animal production, the interest in algae production and use has increased worldwide in recent years. Algae are utilized in a broad spectrum of food products, ingredients and supplements. In non-food sectors, they are an essential source of hydrocolloids (e.g. alginate, agar and carrageenan), used widely in nutraceutical, pharmaceutical and cosmetic applications. Algal biomass is also used in fertilizers, animal feeds, biofuels and bioplastics.

Technological innovations in refrigeration, cold chain logistics, packaging and processing continue to improve shelf-life and food safety, and to extend distribution across longer distances and more diversified markets. At the same time, modernization of processing facilities and increased automation have improved raw material utilization and product yield, including through the increasing use of trimmings and by-products.

The expansion of global trade and retail distribution continues to shape product diversification and quality requirements. Large retailers and supermarket chains increasingly influence product standards, traceability requirements and certification schemes. Compliance with international food safety standards, aligned with the Codex Alimentarius codes of practice, guidelines and standards, remains essential to ensure consumer protection and facilitate market access.

Marketing and transportation can be challenging, in view of the stringent sanitary regulations, quality standards and animal welfare requirements applied – notably in Europe and Northern America. Aquatic foods are highly perishable and require careful handling from harvest to final consumption. In particular, adequate cold chain and hygienic practices are essential to prevent spoilage and food safety risks. Continued investments in cold storage, hygienic landing sites, potable water supply, ice production, refrigerated transport, and processing infrastructure are therefore critical, particularly in low-income countries, to reduce post-harvest losses and improve safety, quality and value addition.

Fishmeal and fish oil

Fishmeal and fish oil continue to play a strategic role in global agrifood systems, primarily as key ingredients in aquafeeds and, to a lesser extent, in livestock feeds and human nutrition. Fishmeal is a protein-rich flour made by milling and drying aquatic animals or parts of them, while fish oil is obtained by pressing cooked fish and centrifuging the liquid extracted. Their production derives both from whole fish (mainly small pelagic species such as anchoveta, menhaden, blue whiting, capelin, sardine, mackerel and herring) and from fish processing by-products (offal and trimmings), including those produced from aquaculture.

Fishmeal and fish oil are considered among the most nutritious and digestible ingredients for farmed fish, as well as the principal source of omega-3 long-chain polyunsaturated fatty acids (eicosapentaenoic acid [EPA] and docosahexaenoic acid [DHA]) in animal diets. Fish oil is the major source of EPA and DHA, which perform a wide range of critical functions for human health and nutrition.

Demand for fishmeal and fish oil continues to be driven primarily by aquaculture; smaller quantities are used in pig and poultry production, the growing pet food industry and other specialized applications. The Marine Ingredients Organisation (IFFO) estimates that in 2024, over 90 percent of fishmeal was used in aquaculture, around 3 percent in pig farming and 6 percent for other uses (mainly pet food). In the same year, about 64 percent of fish oil was destined for aquaculture, 17 percent for human consumption and almost 20 percent for other uses (including pet food and biofuel) (Figure 1.34).

Although fed aquaculture has expanded significantly in recent decades, the volume of whole fish used for reduction has declined and the overall amount of fishmeal and fish oil has remained quite stable. This indicates that aquaculture growth has not increased pressure on reduction fisheries at global level. The proportion of marine capture fisheries destined for reduction has in fact fallen considerably from its peak in 1994, when approximately 30 million tonnes (about 32 percent of total capture production and 36 percent of total marine capture production) were reduced into fishmeal and fish oil. This volume then decreased steadily, reaching less than 14 million tonnes in 2014; it has since remained relatively stable, with interannual fluctuations between 14 and 18 million tonnes. In 2024, more than 18 million tonnes were utilized for reduction, representing about 20 percent of total capture production and 23 percent of marine capture production (Figure 1.35).

Overall, fishmeal and fish oil output varies from year to year, largely due to fluctuations in the catches of small pelagic species, particularly anchoveta, whose abundance is influenced by oceanographic conditions such as the El Niño Southern Oscillation and by management measures. Over time, the adoption of good management practices and certification schemes has increased the volume of responsibly sourced species fished for reduction to fishmeal and fish oil.

Despite these natural and management-driven fluctuations, fishmeal and fish oil production has remained relatively stable since the mid-2000s, averaging, respectively, around 5 million tonnes and 1 million tonnes (product weight). This stability reflects the increased use of by-products, estimated by IFFO to have contributed in 2024 to 34 percent of the global production of fishmeal and to 54 percent of that of fish oil (Figure 1.36). This proportion is expected to continue growing (see **A medium-term outlook for the fisheries and aquaculture sector**). The valorization of by-products not only reduces waste, but also enhances resource efficiency, although fishmeal produced from trimmings typically contains lower protein levels and higher mineral content than fishmeal made from whole fish.

Although production volumes of fishmeal and fish oil have stabilized, demand remains high, maintaining upward pressure on prices (at least in nominal terms) and encouraging continuous optimization of feed formulations. Inclusion rates of fishmeal and fish oil in compound aquafeeds have continued their long-term decline, driven by improved feed efficiency, the growing use of diversified protein sources – including substitution with plant and animal-based alternatives – and technological innovation. Today, the bulk of global aquafeed production relies on grain products from maize, soybean and wheat, while fishmeal and fish oil are increasingly targeted towards production stages where their unique nutritional properties are most critical (e.g. hatchery and broodstock) and towards integration in functional diets. Aquafeed development has thus become fundamental to the advancement of aquaculture, supporting the best use of raw materials for feed production and optimizing aquaculture efficiency.[27]

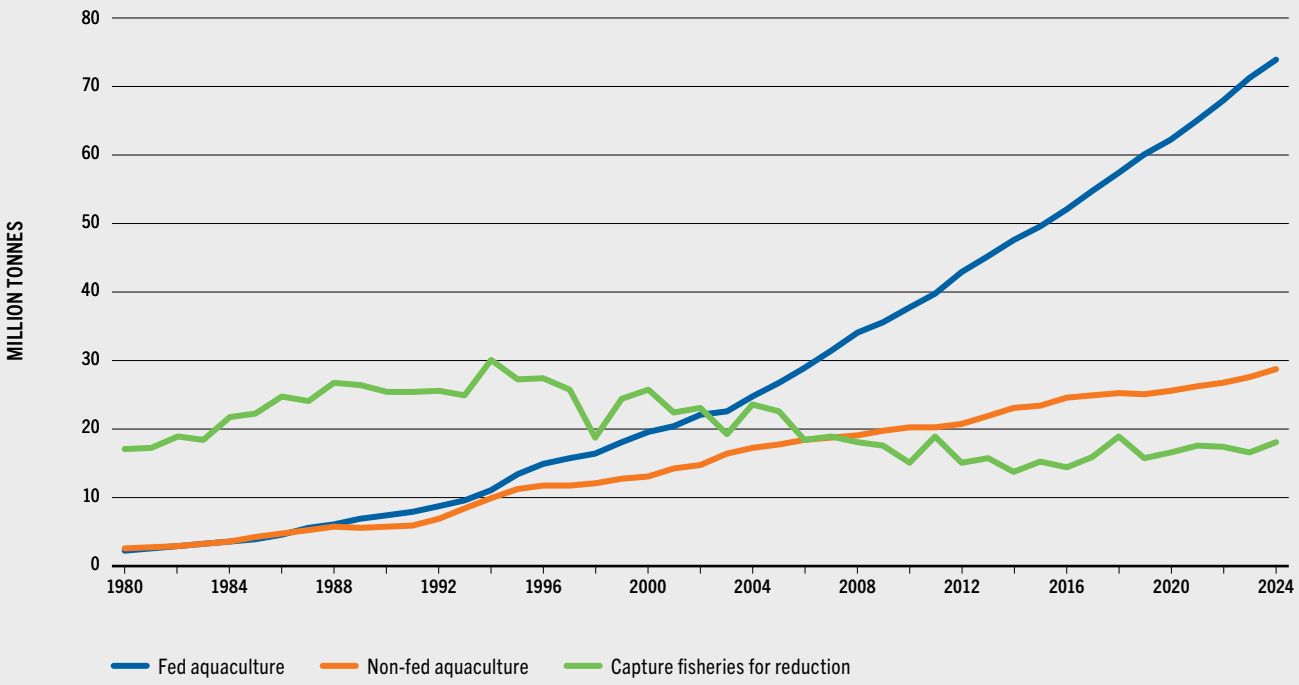
In the future, increasing the profitability of the sector would require additional or alternative sources of aquafeed ingredients. Concerns still persist regarding the sustainability and governance of certain fisheries that supply raw »

FIGURE 1.34 UTILIZATION OF FISHMEAL AND FISH OIL IN SELECTED YEARS



NOTES: * Mainly pet food. ** Pet food, biofuel, cooking oil.
SOURCE: IFFO estimates.

FIGURE 1.35 TRENDS IN GLOBAL PRODUCTION OF AQUATIC ANIMALS BY AQUACULTURE (FED AND NON-FED) AND AMOUNT OF CAPTURE FISHERIES REDUCED INTO FISHMEAL AND FISH OIL, 1980–2024



NOTES: Aquatic animals exclude aquatic mammals, crocodiles, alligators, caimans, sponges, corals, pearls and algae. Data are expressed in live weight equivalent.

SOURCE: FAO estimates based on FAO. 2026. FishStat: Global production by production source 1950-2024. [Accessed on 28 March 2026]. In: *FishStatJ*. Available at: https://www.fao.org/fishery/en/statistics/software/fishstatj. Licence: CC-BY-4.0.

FIGURE 1.36 SHARE OF RAW MATERIAL UTILIZED FOR REDUCTION INTO FISHMEAL AND FISH OIL, 2024



SOURCE: IFFO estimates.

» material for reduction – particularly in contexts where species traditionally consumed locally are being increasingly diverted to the production of fishmeal for export. In such cases, it is essential to strengthen fisheries management, ensuring that food security remains central.[28] Over the past 25 years, substantial research and development have advanced the discovery of alternative ingredients as sources of protein and energy. These include insect meals, bacterial proteins, microbial and algal oils, and marine zooplankton resources. However, economic, technical and environmental challenges still limit the substitution of marine ingredients. Recent years have seen an increasing focus on assessing the spectrum of challenges and opportunities that these ingredients may bring, in addition to their nutritional value.[29]

By-product utilization

Processing of aquatic products generates substantial quantities of by-products, which can represent 30–70 percent of the whole animal depending on the species and processing methods.[30] These by-products (including heads, skins, bones, scales and viscera) were traditionally considered of low value and often discarded as waste. When not properly managed, such waste contributes to environmental pollution and can create breeding grounds for insects and pests, posing significant public health risks. At the same time, by-products can represent an opportunity for industry. Improving their utilization is important for ecological, social and economic reasons and to safeguard consumer health and food security.[31] Aquatic by-products can be converted into food products for human consumption. Fish powder, produced by drying and finely milling whole aquatic animals, their fillets, meat or by-products, is increasingly used as a nutrient-dense ingredient for human consumption. It provides a concentrated source of high-quality protein with a well-balanced amino acid profile, along with essential micronutrients such as calcium, iron, zinc, iodine and vitamin D. When produced from small fish species consumed whole (including bones and viscera), fish powder is particularly rich in highly bioavailable minerals, especially calcium and iron, which are critical for child growth and maternal health.[32] Fish powder can also be made from larger fish species, but this typically requires more industrial processing methods, including filleting, controlled drying, mechanical milling, and sometimes defatting or deodorization to improve shelf-life, texture, and sensory acceptability for consumers .[33, 34]

Fish powder offers further advantages for improving diets and food security. Its long shelf-life, ease of storage and transport, and versatility for incorporation into staple foods such as porridges, soups, sauces and baked products, make it suitable for school feeding programmes (see **Promoting fish consumption in school feeding programmes**), maternal and child nutrition interventions, and emergency food aid.[32, 35, 36] Moreover, producing fish powder from underutilized species or by-products of fish processing supports sustainable resource use and reduces post-harvest losses,[2] aligning nutritional benefits with environmental and economic goals. As such, fish powder represents a promising solution to address protein and micronutrient deficiencies, while promoting more efficient and resilient agrifood systems.

Furthermore, by-products from aquatic food processing are rich in bioactive compounds and can serve as valuable raw materials for the production of high-value products such as collagen, gelatine, bioactive peptides, chitin, chitosan and chondroitin sulphate.[31] These bioactive molecules can be extracted and utilized in the nutraceutical, functional food, pharmaceutical, biomedical, cosmetic and materials industries, offering significant opportunities for value addition. When disposed of, or used only for low-value purposes, these by-products represent an important loss of potential resources and economic benefits.

However, producing high-value compounds from by-products often requires complex processes and sophisticated equipment, which may not be feasible or cost-effective for small-scale operations, given the limited volume of raw materials and high operational costs. In these cases, a simple and cost-effective alternative is to convert the by-products into fish silage, rich in hydrolysed protein and essential amino acids, which can be used for animal feed or as an organic fertilizer.[37, 38]

In Barbados, innovative initiatives are transforming fish waste into fish silage.[2, 39] In Kenya and Cabo Verde, fish skins are similarly being processed into high-quality leather. The fish leather sector is generating new livelihood opportunities, particularly for small-scale operators, artisans and women's cooperatives.[40] Together, these examples highlight how innovative solutions can add value to fishery resources, strengthen local economies and contribute to more sustainable and circular blue economies.

Aquatic food loss and waste

Food loss and waste (FLW) in aquatic value chains remains a major challenge, with estimates suggesting that up to 35 percent of global fisheries and aquaculture production is either lost or wasted every year.[41] While this figure highlights the scale of the problem, it masks substantial variations across supply chains. Levels of FLW differ widely according to numerous variables such as species, product, market access, stage of the value chain, access to services, equipment and infrastructure, and seasonal change, as well as economic development.

In terms of quantity and quality, food loss and waste is driven by inefficiencies in value chains. Many developing countries – especially the least developed economies – still lack the infrastructure, services and know-how for adequate onboard and onshore handling and preservation. The inability to access electricity, potable water, roads, ice, cold storage and refrigerated transport are contributing factors. Food loss and waste equates to a waste of time, energy and money, producing a detrimental effect on the well-being of fishers, processors, traders and consumers. Losses not only decrease the availability of aquatic products for human consumption but can also be a source of diseases and greenhouse gases, if not disposed of properly.

The FAO Fisheries Blue Transformation Roadmap[12] and several FAO codes and guidelines flag food loss and waste as a key issue. Reducing food loss and waste ultimately helps achieve FAO's high-level policy objectives of better production, better nutrition, a better environment and a better life,[m] as well as SDG Target 12.3, which focuses on responsible consumption and production, halving per capita global food waste and reducing food losses along production and supply chains by 2030. The FAO Blue Transformation Roadmap highlights the reduction of food loss and waste using diverse practices and processes.

The Voluntary Code of Conduct for Food Loss and Waste Reduction[n] provides internationally recognized guiding principles and standards for responsible practices for FLW reduction. It acts as a framework for strategies, policies, institutions, legislation and programmes on FLW reduction and provides guidance to gauge the effectiveness of solutions, promoting joint action, the harmonization of approaches and the assessment of progress. This code of conduct has been used as a gold standard for assessing fisheries, aquaculture and agrifood systems policies for inclusion of FLW reduction strategies and objectives in Ghana and the United Republic of Tanzania, finding mismatches between FLW reduction strategies and policies.[42]

Decision-making is hampered, particularly at the national level, by the lack of current data and information that could be used to target and design FLW interventions. According to the World Economic Forum,[43] policymakers should invest in data collection and interdisciplinary collaboration to support evidence-based decision-making. Furthermore, processing, handling and storage practices should be evaluated and benchmarked against current loss rates across different value chains to help target interventions.

Bearing in mind that data are key to informed decision-making, FAO has adopted methodologies to assess, measure and understand fish loss and waste and is also in the final stages of developing a Food Loss Index methodology,[o] which will be used to standardize the way in which quantitative data on fish loss are collected globally. The regular collection of these data will also support FAO to update global and regional

m For details, please see: https://www.fao.org/strategic-framework/en

n See: https://www.fao.org/3/nf393en/nf393en.pdf

o See: https://www.fao.org/platform-food-loss-waste/food-loss/foodloss-measurement/en

estimates of food loss and waste and better assess the availability of aquatic foods through the calculation of food balance sheets. Furthermore, knowledge tools such as e-learning courses[p] on food loss and waste in fish value chains are available alongside a comprehensive website[q] providing information on all aspects of FLW in aquatic value chains. Initiatives are also informed by renewable energy work around cold chains,[44] improved onboard handling,[45] and best practices and guidance on gender in relation to food losses.[46, 47] For example, in Indonesia, reducing gender inequalities – by supporting women's fish processing and marketing activities and fostering the equitable distribution of resources – led to a 27 percent increase in empowerment and 78 percent rise in productivity, while post-harvest losses fell by 5 percent.[48]

New climate-smart technologies, robust fisheries management, good aquaculture practices, more efficient transport, greater waste reclamation and capitalizing on the power of the consumer in influencing supply chain practices can all play a part in reducing food loss and waste and limiting the environmental effects of the sector. This feeds into a multidimensional solutions approach to address FLW, which is becoming increasingly mainstream and is echoed in both the Voluntary Code of Conduct for Food Loss and Waste Reduction and the FAO guide on food loss and waste in aquatic value chains.[49] For example, a combination of capacity building, improved handling and processing practices, business skills, access to microfinance and better marketing leads not only to FLW reduction but also to employment opportunities and increased income for producers.[50] ■

AQUATIC FOOD AVAILABILITY

Data source and terminology

Aquatic food availability refers to the quantity of aquatic products available for human consumption within a country during a given period. Based on data from the FAO food balance sheets (FBS), this indicator, expressed in live weight equivalent, represents the national availability of aquatic foods after accounting for domestic production, imports, exports, non-food uses and stock variations. Food availability does not reflect actual dietary intake – i.e. the amount effectively eaten – because food loss and waste can occur before final consumption.

This indicator, historically referred to as "apparent consumption", has been changed in FAO to "food availability" to more accurately reflect the nature of the data.

Current status of aquatic animal food availability

In 2023, global aquatic animal food availability reached an estimated 171 million tonnes (live weight equivalent) (Table 1.13). Its distribution across regions remains highly uneven. Asia accounted for 74 percent of global availability in 2023, reflecting both its large population and the rapid expansion of fisheries and aquaculture production in the region in recent decades. Asia's share of global aquatic animal food availability exceeds its share of the world population; as a result, availability per capita is higher than in other regions.

Europe accounted for 9 percent of global availability, followed by Africa (8 percent), Northern America (5 percent), Latin America and the Caribbean (4 percent) and Oceania (1 percent). While Europe and Africa represent similar shares of global availability, their population sizes differ substantially, resulting in pronounced contrasts in per capita availability.

At the global level, per capita aquatic animal food availability averaged 21.1 kg (live weight equivalent) in 2023, rising to a preliminary estimate of 21.3 kg in 2024. Regional variations in 2023 were pronounced, ranging from 9.1 kg in Africa to 26.3 kg in Asia, a nearly threefold difference. Northern America (22.1 kg), Europe (21.2 kg) and Oceania (20.6 kg) recorded comparable levels, slightly lower than Asia, while availability in Latin America and the Caribbean remained significantly lower (10.1 kg). At the country level, differences in availability are more striking, ranging from negligible quantities to nearly 100 kg per capita (Figure 1.37).

p See: https://elearning.fao.org/course/view.php?id=567

q See: https://www.fao.org/flw-in-fish-value-chains/en

TABLE 1.13 TOTAL AND PER CAPITA AQUATIC ANIMAL FOOD AVAILABILITY BY REGION AND INCOME GROUP, 2023

Region/income group	Total aquatic animal food availability		Per capita aquatic animal food availability
	(million tonnes, live weight equivalent)	Share of world total (%)	(kg/year)
World	**171.0**	**100**	**21.1**
World, excluding China	106.6	62	16.0
Africa	**13.4**	**8**	**9.1**
Americas	**15.1**	**9**	**14.5**
Latin America and the Caribbean	6.7	4	10.1
Northern America	8.5	5	22.1
Asia	**125.8**	**74**	**26.3**
Europe	**15.7**	**9**	**21.2**
Oceania	**0.9**	**1**	**20.6**
High income	**35.5**	**21**	**25.0**
Upper-middle income	**90.1**	**53**	**31.9**
Lower-middle income	**41.2**	**24**	**13.4**
Low income	**3.9**	**2**	**6.5**

NOTE: Aquatic animals exclude aquatic mammals, crocodiles, alligators, caimans, sponges, corals, pearls and algae.

SOURCES: Preliminary data. Final data will be available here: FAO. 2026. Food balance sheets of aquatic products. https://www.fao.org/fishery/en/collection/global_fish_consump. Licence: CC-BY-4.0; population data based on UN DESA. 2024. World Population Prospects 2024. [Accessed on 10 October 2024]. https://population.un.org/wpp. Licence: CC-BY-3.0-IGO.

In 2023, over one-third of all countries and territories, representing 42 percent of the world population, had a per capita availability of aquatic animal foods higher than the global average. Among the 25 most populous countries, the average per capita availability of aquatic animal foods was highest in China, Viet Nam and Indonesia (45.3 kg, 44.1 kg and 43.1 kg, respectively), and lowest in Ethiopia, Pakistan and the Democratic Republic of Congo (1.1 kg, 1.4 kg and 4.5 kg, respectively).

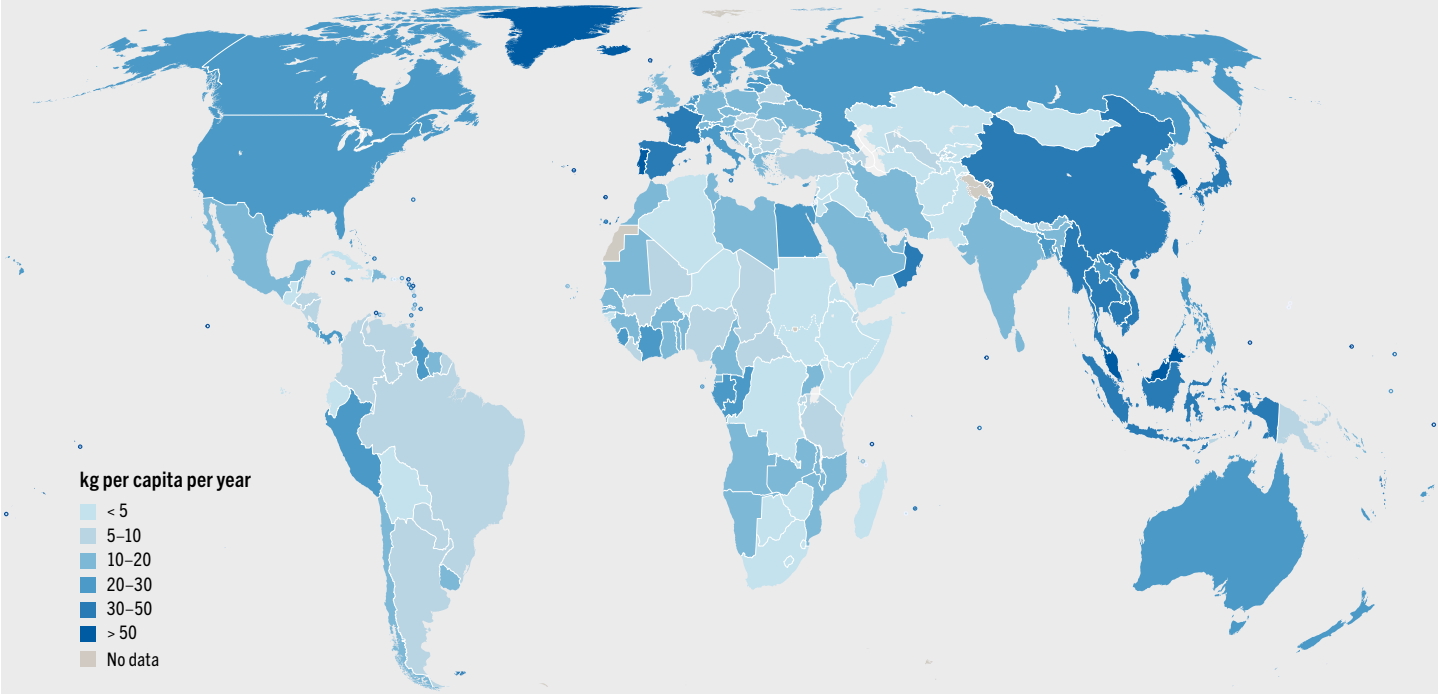
Pronounced differences exist also across income groups. In 2023, per capita availability of aquatic animal foods averaged 6.5 kg in low-income countries, compared to 13.4 kg in lower-middle-income, 31.9 kg in upper-middle-income and 25.0 kg in high-income countries. These patterns reflect differences in purchasing power, access to aquatic and other foods, storage and distribution infrastructure, culinary traditions and consumer preferences.

Historical trends and drivers

Current levels of aquatic animal food availability reflect decades of growth. Between 1961 and 2023, global availability increased at an average annual rate of 3.0 percent, outpacing population growth, which averaged 1.6 percent per year. As a result, global per capita availability rose at an average annual rate of 1.4 percent, from 9.2 kg in 1961 to 21.1 kg in 2023.

A key enabling factor for the increase in global aquatic animal food availability has been the growth of aquaculture, which has not only compensated for the stability of capture fisheries production since the 1990s, but has further responded to the ever-rising demand. At the same time, the proportion of capture fisheries production reduced into fishmeal and fish oil has continued to decline, while more wild aquatic resources are being used directly as food (see **Utilization and processing**).

FIGURE 1.37 **PER CAPITA AVAILABILITY OF AQUATIC ANIMAL FOODS BY COUNTRY, 2023**



Refer to the disclaimer on the copyright page for the names and boundaries used in this map. Dotted line represents approximately the Line of Control in Jammu and Kashmir agreed upon by India and Pakistan. The final status of Jammu and Kashmir has not yet been agreed upon by the parties. Final boundary between the Republic of Sudan and the Republic of South Sudan has not yet been determined. Final status of the Abyei area is not yet determined.

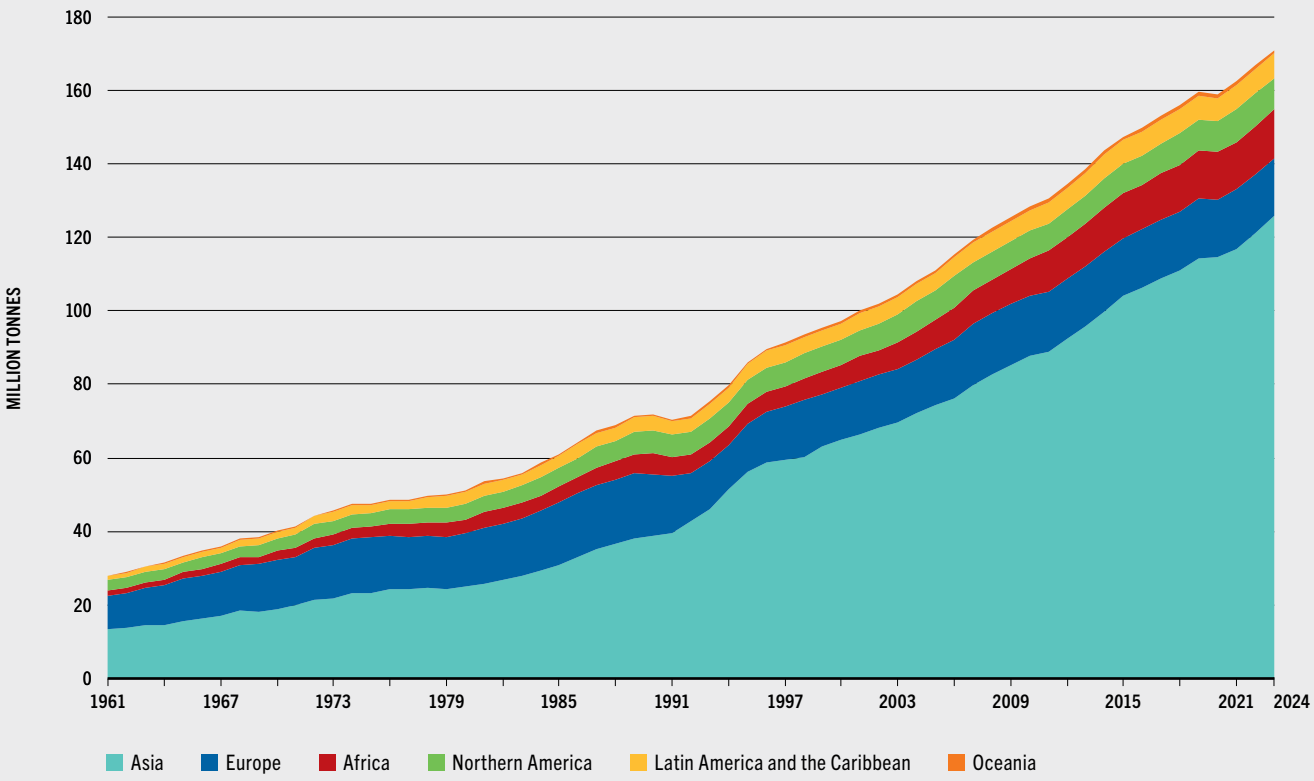
NOTES: Aquatic animals exclude aquatic mammals, crocodiles, alligators, caimans, sponges, corals, pearls and algae. Data are expressed in live weight equivalent.

SOURCES: Preliminary data. Final data will be available here: FAO. 2026. Food balance sheets of aquatic products. https://www.fao.org/fishery/en/collection/global_fish_consump. Licence: CC-BY-4.0; population data based on UN DESA. 2024. World Population Prospects 2024. [Accessed on 10 October 2024]. https://population.un.org/wpp. Licence: CC-BY-3.0-IGO.

In parallel, improvements in processing technologies, cold chain infrastructure, and distribution systems have reduced post-harvest losses and facilitated access to distant and urban markets. On the demand side, urbanization, rising incomes, improved global health awareness and changing lifestyles have supported dietary diversification and increased demand for aquatic animal foods. Taken together, these trends have increased the availability of aquatic animal foods, although outcomes vary across regions and income groups.

While all regions have seen increases since 1961, Asia has been the main driver of this growth, accounting for 79 percent of the increased availability of aquatic animal foods (Figure 1.38). Over the period 1961–2023, the rate of growth was strongest in Asia and Africa, at 3.7 percent per year (although from different starting points). As a result, Asia experienced rapid increases in both total and per capita availability, driven largely by production, in particular of aquaculture, and by income growth, especially in China and other emerging economies. In contrast, the same yearly growth rate of total availability in Africa only produced modest gains in per capita terms (+1.0 percent per year), reflecting a more rapid population growth (+2.7 percent per year). Latin America and the Caribbean experienced strong

FIGURE 1.38 AQUATIC ANIMAL FOOD AVAILABILITY BY REGION, 1961–2023



NOTES: Aquatic animals exclude aquatic mammals, crocodiles, alligators, caimans, sponges, corals, pearls and algae. Data are expressed in live weight equivalent. Europe includes data for the former Soviet Union for the years 1961–1991.

SOURCE: Preliminary data. Final data will be available here: FAO. 2026. Food balance sheets of aquatic products. https://www.fao.org/fishery/en/collection/global_fish_consump. Licence: CC-BY-4.0.

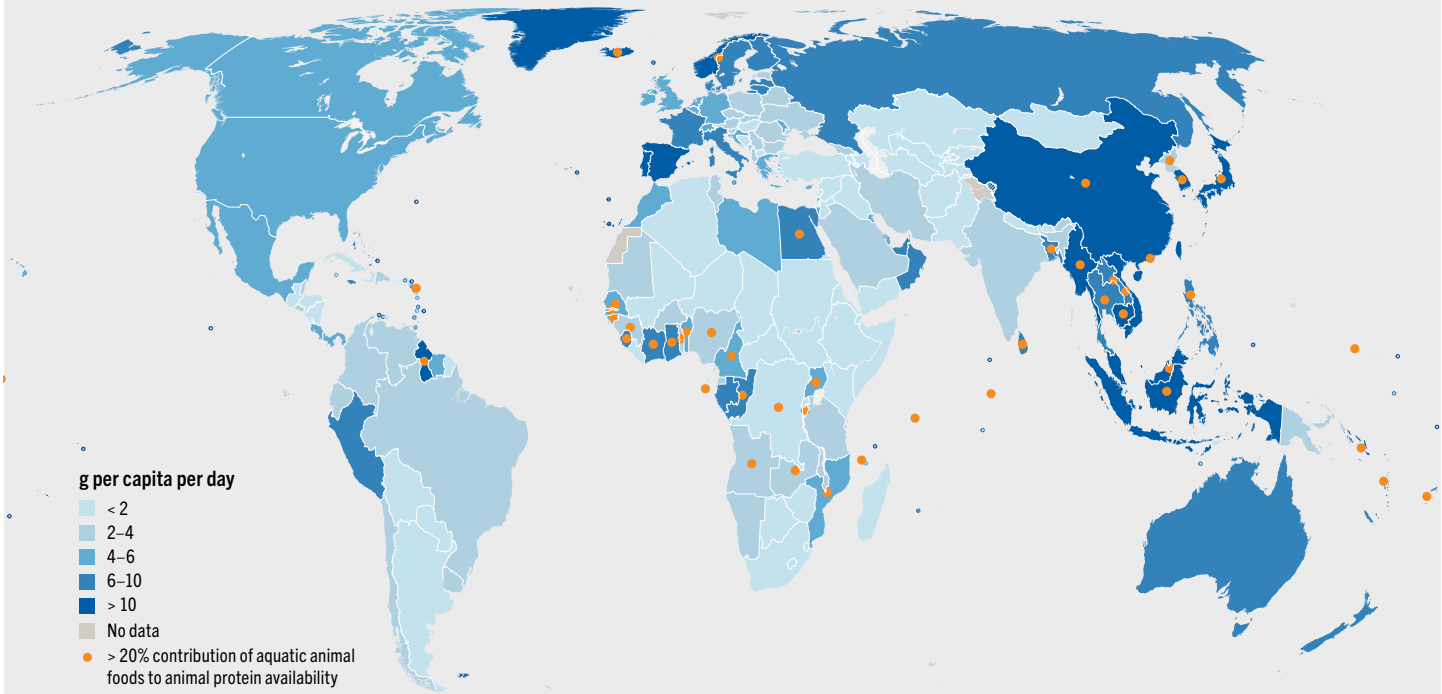
growth of total availability (+2.9 percent per year), while the annual growth of per capita availability was only 1.1 percent – the result of strong population growth. Europe, Northern America and Oceania showed the lowest growth rates of both total and per capita availability, as levels had been relatively high for several decades.

Between 1961 and 2023, the growth rate of the availability of aquatic animal foods exceeded that of all terrestrial meats combined (which averaged an estimated 2.7 percent per year). It also outpaced that of individual meat categories such as bovine, sheep and goat, and pig. Only poultry meat exhibited a higher growth rate: 4.6 percent per year. It is worth noting that Asia – which, together with Africa, had the strongest average growth rate (3.7 percent) of availability of aquatic animal foods – had an even higher average annual growth rate for meat availability (4.9 percent per year). Asia and Latin America and the Caribbean are the only two regions in which terrestrial meat availability experienced stronger growth than aquatic animal food availability over the period 1961–2023.

Trade and import dependence

For decades, a highly dynamic international trade of aquatic foods has enabled many regions and

FIGURE 1.39 **CONTRIBUTION OF AQUATIC ANIMAL FOODS TO ANIMAL PROTEIN AVAILABILITY PER CAPITA, 2023**



Refer to the disclaimer on the copyright page for the names and boundaries used in this map. Dotted line represents approximately the Line of Control in Jammu and Kashmir agreed upon by India and Pakistan. The final status of Jammu and Kashmir has not yet been agreed upon by the parties. Final boundary between the Republic of Sudan and the Republic of South Sudan has not yet been determined. Final status of the Abyei area is not yet determined.

NOTE: Aquatic animals exclude aquatic mammals, crocodiles, alligators, caimans, sponges, corals, pearls and algae.

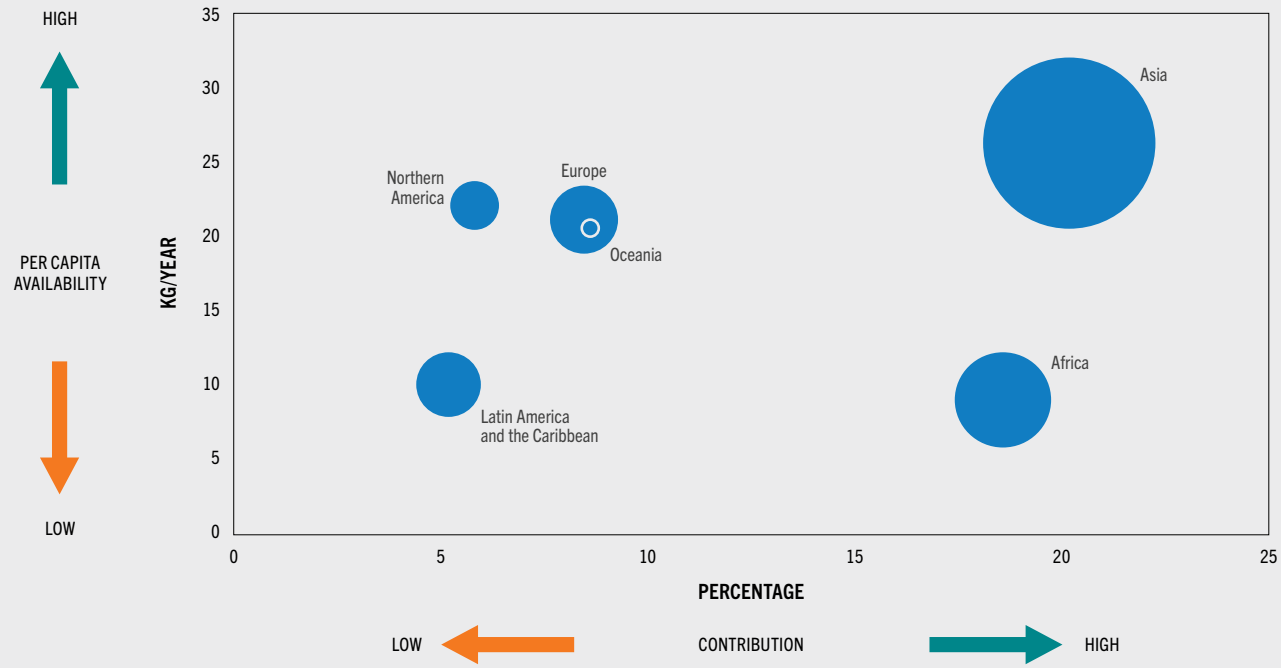
SOURCES: Preliminary data. Final data will be available here: FAO. 2026. Food balance sheets of aquatic products. https://www.fao.org/fishery/en/collection/global_fish_consump. Licence: CC-BY-4.0; animal (excluding aquatic) protein data based on FAOSTAT: Food Balance Sheets. [Accessed on 28 February 2026]. https://www.fao.org/faostat/en/#data/FBS. Licence: CC-BY-4.0; population data based on UN DESA. 2024. World Population Prospects 2024. [Accessed on 10 October 2024]. https://population.un.org/wpp. Licence: CC-BY-3.0-IGO.

countries with limited domestic production to access an increasingly large quantity and wide diversity of aquatic foods. Globally, the share of import volumes in total availability of aquatic animal foods rose from 15 percent in 1961 to 30 percent in 2023, although this trend varies considerably across regions. In 2023, imports accounted for 15 percent of availability in Asia, compared to 33 percent in Africa and 34 percent in Latin America and the Caribbean. The shares were substantially higher in Oceania, Northern America and Europe. Reliance on imports is greater in richer countries, where the supply chain infrastructure enables the distribution of aquatic products in good condition and, furthermore, consumers can afford aquatic species, particularly high-value, imported ones.

Nutritional contributions

The contribution of aquatic animal foods to nutrition and diets should be considered within the context of the availability of other foods and the nutrients they provide. In 2023, the highest per capita availability of aquatic animal foods (90 kg or more per year) was observed in the Faroe Islands, Iceland and Greenland. However, in these countries and territories, the share of aquatic animal proteins in total available proteins was still lower than in Kiribati, Maldives and Cambodia, where aquatic animal foods provided between 20 and 30 percent (Figure 1.39). Conversely, there are countries where smaller quantities of aquatic animal foods can represent a larger proportion of protein availability, because of the difficulty accessing or affording other animal proteins.

FIGURE 1.40 PER CAPITA AVAILABILITY OF AQUATIC ANIMAL FOODS AND THEIR CONTRIBUTION TO TOTAL ANIMAL PROTEIN AVAILABILITY BY REGION, 2023



NOTES: Aquatic animals exclude aquatic mammals, crocodiles, alligators, caimans, sponges, corals, pearls and algae. Per capita availability data are expressed in live weight equivalent. Bubble size is proportional to population size.

SOURCES: Preliminary data. Final data will be available here: FAO. 2026. Food balance sheets of aquatic products. https://www.fao.org/fishery/en/collection/global_fish_consump. Licence: CC-BY-4.0; population data based on UN DESA. 2024. World Population Prospects 2024. [Accessed on 10 October 2024]. https://population.un.org/wpp. Licence: CC-BY-3.0-IGO.

This is the case in Africa, which recorded the lowest per capita availability of aquatic animal foods (9.1 kg) in 2023, but the second-highest contribution to animal proteins (19 percent), suggesting a strong reliance on aquatic animal foods as a key source of animal proteins (Figure 1.40). In addition, aquatic animal proteins contain unique essential amino acids that supplement African diets rich in vegetable proteins. Asia, by contrast, combines the highest per capita availability of aquatic animal foods (26.3 kg) with the highest contribution to animal proteins (20 percent). Although per capita availability of aquatic animal foods in Asia is nearly three times higher than in Africa, their relative contributions to total animal protein availability are comparable. Northern America, Europe and Oceania show relatively high per capita availability of aquatic animal foods (22.1 kg, 21.2 kg and 20.6 kg, respectively), but much lower contributions to total animal proteins (5.8 percent, 8.5 percent and 8.6 percent, respectively), reflecting the contribution of terrestrial meat and dairy products to these regions' diets. Latin America and the Caribbean recorded the second-lowest per capita availability of aquatic animal foods (10.1 kg) and the lowest contribution to animal proteins (5.2 percent), as terrestrial meat products dominate animal protein availability in the region.

In 2023, aquatic animal foods contributed at least 20 percent of the per capita protein availability from all animal sources to 3.1 billion people, that is over 40 percent of the world's population. Globally, aquatic animal foods contributed 15 percent of animal protein availability and

BOX 1.7 AN FAO INITIATIVE TO SUPPORT DIETARY DATA DISSEMINATION AND NUTRITION POLICIES

A key obstacle to developing evidence-based policymaking and promoting healthy diets for all is the limited available, accessible and up-to-date high-quality data on food consumption and composition. Such data are often scattered; moreover, they lack standardization and a centralized repository for management and dissemination. To address this gap, FAO developed an integrated Food and Diet domain, available through FAOSTAT. Launched in February 2024, it represents the first centralized and regularly updated location for housing and sharing statistics on different nutritional data.

Among several food composition data sources, the FAO/INFOODS Global Food Composition Database for Fish and Shellfish (uFISh) compiles the nutrient content of aquatic foods including finfish, crustaceans and molluscs. The database is being updated and expanded to include data on seaweed and other aquatic animal foods, with a new release planned for the end of 2026.

Using these data, aquatic animal foods may be classified as naturally "low in fat" and/or a "source of" or "high in" essential nutrients, depending on their content of key macro- and micronutrients. Figure A illustrates these classifications for selected aquatic animal foods for fat, protein, magnesium, phosphorus, zinc, copper, selenium, and vitamins B6 and B12. All listed crustaceans and molluscs and certain finfish species are low in fat, while providing high levels of essential micronutrients. Among the nutrients listed, selenium, vitamin B12, phosphorus and protein are the most consistently abundant across species presented in the figure. Most crustaceans and molluscs stand out for their content of zinc and copper, whereas finfish show greater variation, with some species distinguished by higher levels of vitamin B6.

The extensive and varied range of nutrients in aquatic species reflects their role as part of a healthy diet comprising a wide variety of different foods. Such information facilitates understanding the nutritional value of aquatic foods and supports informed dietary guidance and policies.

While most aquatic animal foods are classified as low in fat, they are rich in omega-3 fatty acids, particularly eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), which are vital for human health, in particular the structural composition of cell membranes, optimal fetal growth and development, and the healthy functioning of the cardiovascular system. Figure B shows that the global availability of EPA and DHA from aquatic animal foods averaged 209 mg per capita per day in 2023. This corresponds to 83 percent of the 250 mg per capita per day recommended for adults,[51] underscoring the significant role aquatic animal foods can play in supplying these essential fatty acids. Marked regional differences are also observed, reflecting variations in overall availability of aquatic animal foods, species composition and product forms. Notably, in Asia, where per capita availability of aquatic animal foods is highest, the supply of EPA and DHA from aquatic animal foods alone could meet 100 percent of the recommended intake.

6 percent of all protein availability. Together, these trends underscore the role of fisheries and aquaculture in supporting diets and nutrition.

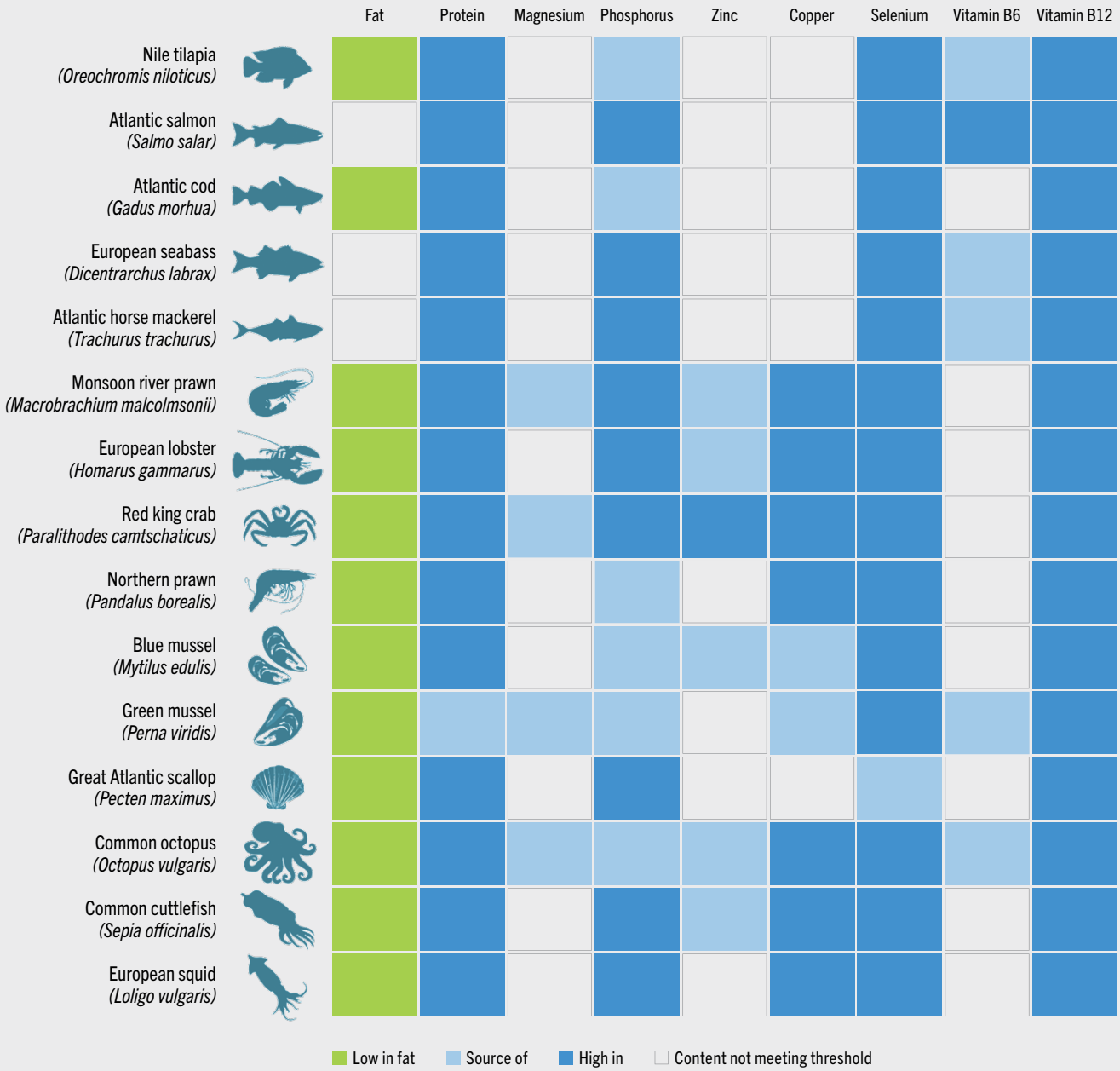
Beyond proteins, aquatic animal foods are a source of a broad range of nutrients. Globally, 6 percent of riboflavin, 6 percent of thiamin, 8 percent of calcium, 8 percent of vitamin C, 9 percent of vitamin A, 11 percent of zinc, 12 percent of iron, 13 percent of phosphorus, 13 percent of potassium and 17 percent of magnesium supplied by animal products are from aquatic animal foods. Aquatic animal foods are also a valuable source of omega-3 fatty acids, which are an essential component of a healthy diet (see Box 1.7).

Species composition and shifts

The species composition of aquatic animal food availability has evolved as the contributions of fisheries and aquaculture to availability have changed over time. The rapid expansion of aquaculture has significantly increased the share of farmed species in total food availability, rising from 6 percent in the 1960s to 58 percent in 2023 »

BOX 1.7 (Continued)

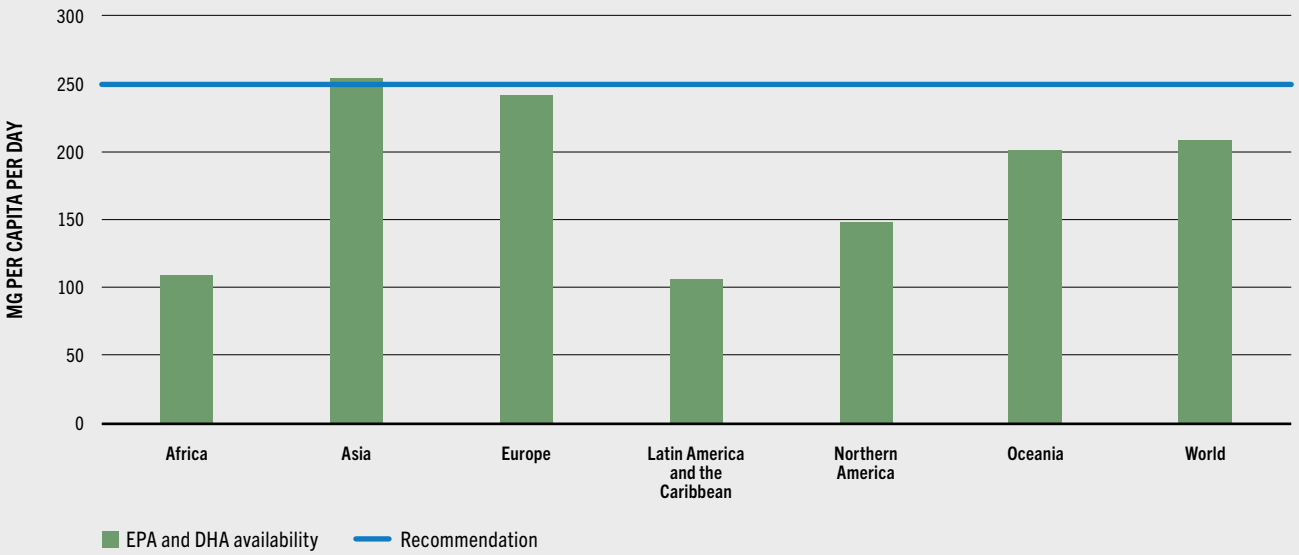
A CLASSIFICATION OF SELECTED NUTRIENT LEVELS IN A VARIETY OF AQUATIC ANIMAL FOODS



NOTES: Classification of nutrient levels for fat (green) and micronutrients (blue): "low in fat": fat content ≤ 3 g per 100 g; "source of": ≥ 15 percent of nutrient reference values (NRVs) per 100 g; "high in": ≥ 30 percent of NRVs per 100 g. Nutrient levels that do not meet these thresholds are shown in grey. Thresholds were set according to the Codex Alimentarius Guidelines for the Use of Nutrition and Health Claims (CAC/GL 23-1997, amended in 2013). NRVs for the general population are based on the Codex Guidelines on Nutrition Labelling (CXG 2-1985, revised in 2024). Nutrient contents are based on raw edible portions. The selected foods are examples and do not imply dietary guidance.

SOURCE: FAO. 2016. *FAO/INFOODS Global Food Composition Database for Fish and Shellfish Version 1.0- uFiSh1.0*. Rome. https://openknowledge.fao.org/handle/20.500.14283/i6655en

B AVERAGE PER CAPITA AVAILABILITY OF OMEGA-3 FATTY ACIDS SOURCED FROM AQUATIC ANIMAL FOODS BY REGION AND RECOMMENDED INTAKE, 2023



NOTES: EPA – eicosapentaenoic acid; DHA – docosahexaenoic acid. Food availability, rather than actual intake, is considered in this analysis, while recommendations for nutrients are provided based on actual intakes. Nutrient availability estimates are based on the nutrient content of foods in their raw form.

SOURCES: Preliminary data. Final data will be available here: FAO. 2026. Food balance sheets of aquatic products. https://www.fao.org/fishery/en/collection/global_fish_consump. Licence: CC-BY-4.0; population data based on UN DESA. 2024. World Population Prospects 2024. [Accessed on 10 October 2024]. https://population.un.org/wpp. Licence: CC-BY-3.0-IGO; EPA and DHA recommendation based on values for adult males and non-pregnant/non-lactating adult females from FAO & WHO. 2010. *Fats and fatty acids in human nutrition – Report of an expert consultation*. FAO Food and Nutrition Paper, No. 91. Rome, FAO. https://openknowledge.fao.org/handle/20.500.14283/i1953e

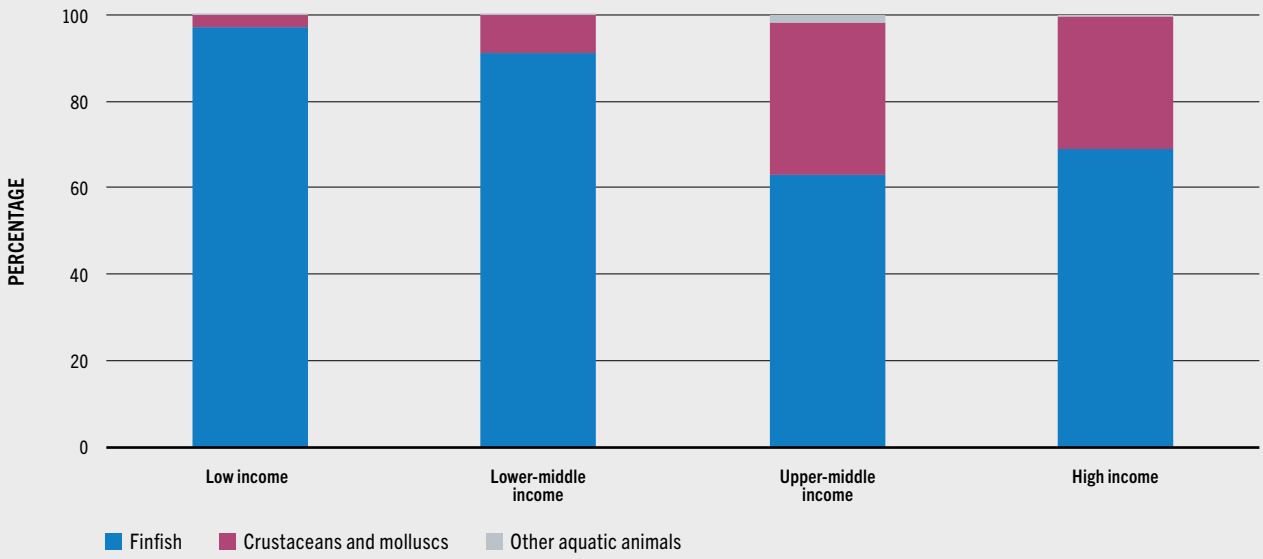
» and 59 percent in 2024. However, being expressed in live weight equivalent, these figures do not account for differences in inedible portions across species. In particular, bivalves and crustaceans, which contain substantial amounts of shells and other inedible parts, represent a much larger share of aquaculture production than of capture fisheries production (34 percent versus 8 percent in 2024). This means that the share of aquaculture is smaller when expressed in edible weight rather than in live weight equivalent.

Over time, global availability has shifted away from finfish in favour of crustaceans and molluscs. The share of finfish in global aquatic animal food availability decreased from 86 percent in 1961 to 72 percent in 2023. Among finfish, freshwater and diadromous species experienced the strongest growth, with their share in total aquatic animal food availability rising from 17 percent in 1961 to 40 percent in 2023. This reflects the increase in the production of farmed salmonoids, tilapias, carps and catfish. In contrast, the shares of demersal and pelagic fishes and other marine species in global aquatic animal food availability all declined. The shares of crustaceans and molluscs (including cephalopods) rose, respectively, from 5 percent and 9 percent in 1961 to 12 percent and 14 percent in 2023.

The downward trend in the share of finfish is observed across all regions, although the magnitude varies: in 2023, finfish constituted nearly all aquatic animal food availability in Africa (97 percent); this compares with the much lower share (57 percent) in Northern America. Other regions ranged from 69 percent in Asia, 73 percent in Oceania and 78 percent in Europe, to 81 percent in Latin America and the Caribbean.

When analysed by income group, the share of finfish in total aquatic animal food availability tends to decline as income increases, reflecting the greater availability of crustaceans and molluscs in wealthier countries (Figure 1.41). In 2023, low-income and lower-middle-income countries relied heavily on finfish, which accounted for, respectively, 97 percent and 91 percent of total aquatic animal food availability. In contrast, in

FIGURE 1.41 AQUATIC ANIMAL FOOD AVAILABILITY BY MAIN SPECIES GROUP AND INCOME GROUP, 2023



NOTE: Aquatic animals exclude aquatic mammals, crocodiles, alligators, caimans, sponges, corals, pearls and algae.

SOURCE: Preliminary data. Final data will be available here: FAO. 2026. Food balance sheets of aquatic products. https://www.fao.org/fishery/en/collection/global_fish_consump. Licence: CC-BY-4.0.

upper-middle-income and high-income countries, the share of finfish was lower (63 percent and 69 percent), reflecting the proportionally higher availability of crustaceans and molluscs.

Algae

Algae, which include macro-algae, micro-algae and cyanobacteria, have for centuries formed an integral part of daily diets in some countries in Asia, where species such as nori, Japanese kelp and Eucheuma have significant cultural and nutritional importance.

Highly nutritious, fibre-rich, low in kilocalories – interest in algae as a healthy food option has increased worldwide. In addition to their carbon sinking potential, their cultivation relies on seawater and does not compete for arable land or freshwater resources, making them a sustainable option to support diversified diets and food security. Algae are not currently included in the FAO food balance sheets for aquatic foods, due to insufficient data on their utilization in most countries. ■

TRADE OF AQUATIC PRODUCTS

Latest trends

In 2024, the global value of international trade in aquatic products reached USD 186 billion, involving 230 countries and territories. Aquatic animal products, including fish, crustaceans, molluscs and other aquatic animal products, accounted for 99 percent of the global value of aquatic trade, with approximately USD 184 billion in exports. The remaining USD 2 billion was contributed by trade in algae and other aquatic products such as sponges and shells. Globally, the value of trade in aquatic products accounted

BOX 1.8 AQUATIC TRADE AMID EVOLVING INTERNATIONAL TRADE POLICIES

For centuries, trade in agricultural products, including aquatic products, has supplemented diets in countries with insufficient domestic production or looking for diversified products. Trade liberalization policies and technological developments over the last 50 years have expanded trade and market opportunities, enabling fishing nations to integrate global supply chains to meet increasing demand and respond to changes in consumer preferences.

Since the 1980s, international trade in aquatic animal products has expanded rapidly, often outpacing the growth of global aquatic animal production. The 1980s and 1990s in particular – characterized by trade liberalization, technological improvements in processing, cold chain logistics, and rising demand in advanced and emerging economies – saw strong trade growth (see figure). For example, in the 1980s, aquatic animal trade grew at an average annual rate of 5.9 percent, while global aquatic animal production increased by 4.1 percent. Similar patterns, although more modest, characterized the 1990s. During these two decades, a growing proportion of global production entered international markets, reflecting increased capacity of exporting countries, in particular middle-income countries, to integrate global supply chains, taking advantage of favourable trade policies and market access requirements.

In the 2000s, trade and production growth rates were closer (1.8 percent and 1.7 percent, respectively). Between 2010 and 2024, the volumes traded continued to increase to meet demand; nevertheless, the growth rate of trade lagged behind that of production. While tariff measures to access international markets have remained globally favourable, export restrictions and non-tariff measures on resources sustainability, sanitary and phytosanitary standards, certification and traceability rules, have increasingly shaped trade flows. The Doha Round negotiations, launched in 2001 with the goal of further reducing trade barriers, have largely stalled, limiting opportunities for expanding trade and creating broader market access. In fisheries, the Doha Round aimed to promote sustainability, prohibiting harmful subsidies that contribute to illegal, unreported and unregulated fishing, overfished stocks and unregulated high-seas fishing. Although an agreement on fisheries subsidies was reached in 2025, its implementation still raises several issues (see Box 3.3). As a result, countries have increasingly resorted to bilateral and regional trade agreements. While these deepen intraregional trade, they are not sufficient to boost global trade to the pace seen in the 1980s and 1990s. In addition, some major economies have increasingly prioritized satisfying domestic markets over export; in China, for example, the share of fisheries and aquaculture production that is traded has decreased since 2014 to meet the domestic demand.

Although international trade in aquatic animal products is now growing at a slower rate than global aquatic animal production, it continues to make a vital contribution to foreign exchange earnings, employment generation and global food security. Approximately 36 percent of global aquatic animal production was traded in 2024, underscoring the sector's continued integration into global markets. Beyond the trade values and volumes, international trade in aquatic animals contributes significantly to global food security and the flow of nutrients (see Box 1.9).

for 9 percent of total agricultural trade (excluding forestry) and about 1 percent of total merchandise trade. The value of trade in aquatic animal products was similar in magnitude to that in terrestrial meat and meat preparations.

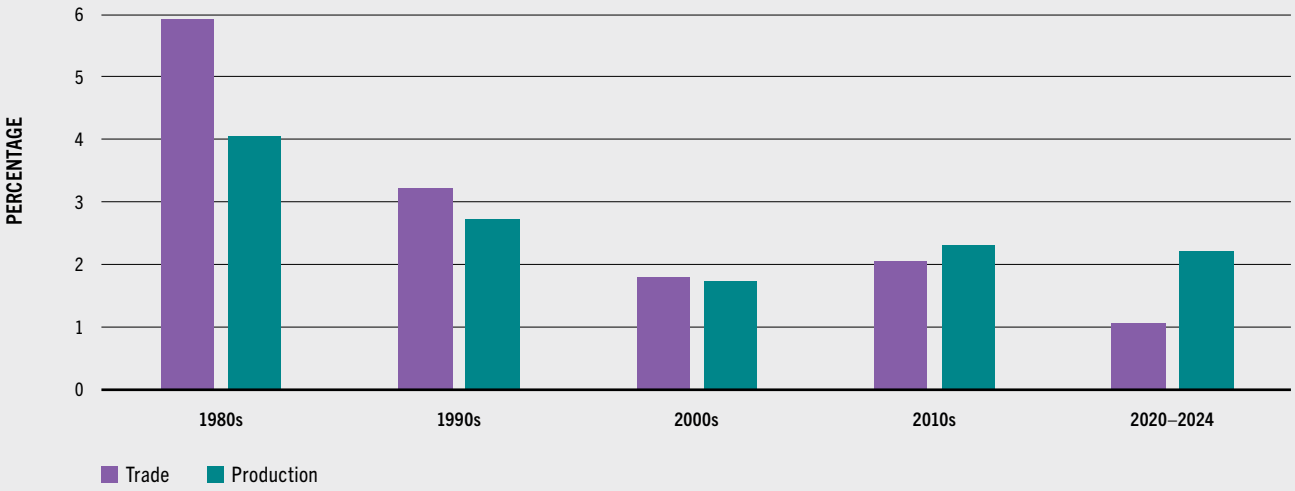
However, the relative importance of aquatic trade varies widely across countries and territories. In many coastal, riverine, insular and inland areas, trade of aquatic products represents a major economic activity and often accounts for a substantial share of total merchandise trade. In addition, the sector contributes to export revenues, employment, income generation and broader socioeconomic development.

Over the past decades, trade in aquatic products has expanded considerably, shaped by international trade policy decisions (see Box 1.8).

Between 1976 and 2024, the nominal value of global aquatic exports increased more than twenty-threefold (nearly sixfold in real terms), growing at an average annual rate of 6.8 percent (3.6 percent in real terms), closely comparable to the expansion of global merchandise trade over the same period. This expansion was supported not only by rising aquatic production but by improvements in storage, preservation, transportation, logistics, and processing technologies, as well as by competitive pricing and trade liberalization policies. Reduced transportation costs and improved logistics have enabled aquatic products to be processed far from their production sites, leading to the development of complex global supply chains, in which aquatic products often cross several national borders before reaching the final consumer.

BOX 1.8 (Continued)

AVERAGE ANNUAL GROWTH RATES OF GLOBAL AQUATIC ANIMAL TRADE AND GLOBAL AQUATIC ANIMAL PRODUCTION



NOTES: Aquatic animals exclude aquatic mammals, crocodiles, alligators, caimans, sponges, corals, pearls and algae. Calculations are based on trade and production data expressed in live weight equivalent.

SOURCES: FAO estimates based on FAO. 2026. FishStat: Global production by production source 1950-2024. [Accessed on 28 March 2026]. In: *FishStatJ*. Available at: https://www.fao.org/fishery/en/statistics/software/fishstatj. Licence: CC-BY-4.0 and on preliminary trade data. Final data will be available here: FAO. 2026. Global aquatic trade statistics. https://www.fao.org/fishery/en/collection/global_commodity_prod. Licence: CC-BY-4.0.

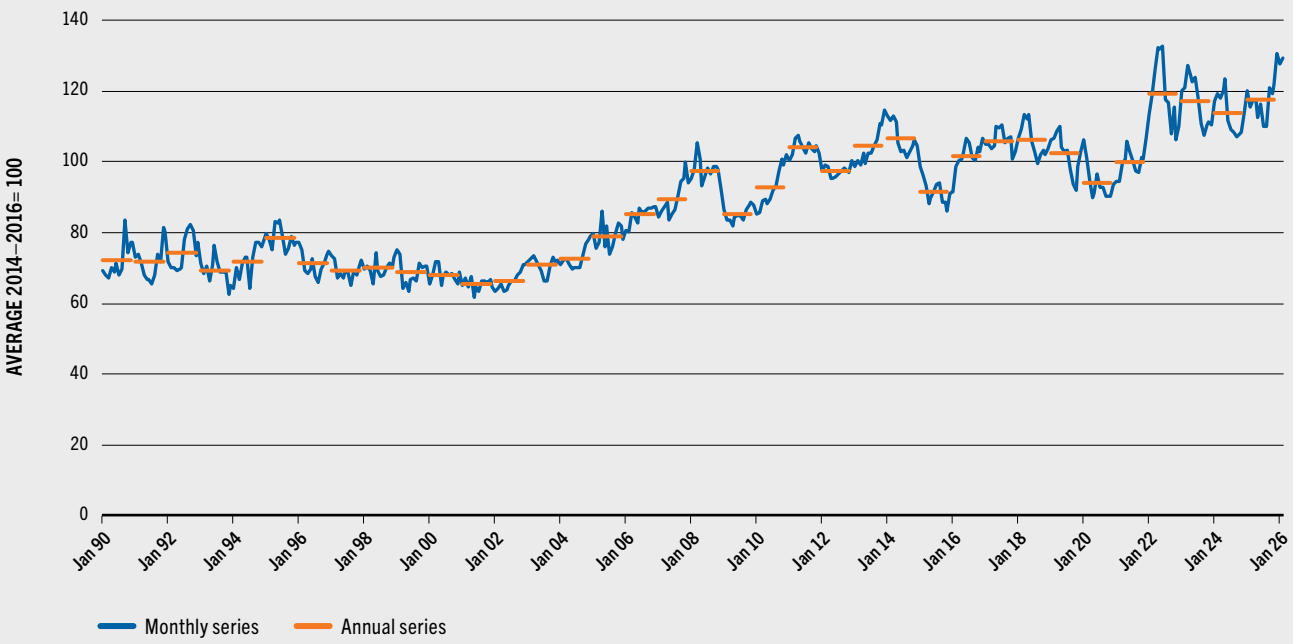
https://doi.org/10.4060/cd8357en-figbox1.8

At the same time, advances in aquaculture technology and management have allowed operators to better control production, respond to consumer preferences, and innovate across supply chains. As a consequence, the share of total aquatic animal production entering international trade, measured in volume, rose from 25 percent in the mid-1970s to approximately 36 percent in 2024. This trade registered a 3.0 percent average annual growth rate from 1976 (compared to 2.2 percent for production). These trends indicate that growth in trade has outpaced growth in production, underscoring the sector's increasing integration in the global economy.

More recently, aquatic trade dynamics have been strongly influenced by global economic conditions. After contracting in 2020, aquatic trade rebounded strongly by 25 percent over two years, reaching a record USD 192 billion in 2022, signalling a robust recovery. Momentum weakened in 2023, when aquatic trade declined by 3.7 percent compared to 2022. In 2024, export values recorded a modest increase compared to 2023. Preliminary estimates for 2025 point to some continued recovery, with export values of aquatic products projected to increase by between 3 percent and 4 percent compared to 2024.

These developments are consistent with price trends observed in international markets: the FAO Fish Price Index (FPI), which tracks international fish prices, reached a historic high in 2022, with its annual average standing 19 percent above the 2021 level (Figure 1.42). The index then recorded modest declines in 2023 and 2024. The figures for 2025 point to a partial recovery, with the FPI increasing by 3 percent.

FIGURE 1.42 FAO FISH PRICE INDEX, JANUARY 1990 – FEBRUARY 2026



NOTE: Raw data for the FAO Fish Price Index were sourced from: EUMOFA, INFOFISH, INFOPESCA, Statistics Norway, Danish Fisheries Agency.
SOURCE: FAO. 2026. FAO Fish Price Index. [Accessed on 12 March 2026]. https://www.fao.org/fishery/en/fishstat/fishpriceindex. Licence: CC-BY-4.0.

https://doi.org/10.4060/cd8357en-fig1.42

Trade in aquatic animal products by region and income group

Global trade in aquatic animal products in 2024 varied by region and across income groups, with distinct patterns also observed in nutrient flows (see Box 1.9). Europe and Asia accounted for 38 percent and 34 percent, respectively, of the total export value of aquatic animal trade in 2024, followed by Latin America and the Caribbean (15 percent), while Northern America (6 percent), Africa (5 percent) and Oceania (2 percent) played smaller roles.

Europe continues to be the largest importing region, representing 41 percent of the total import value in 2024; its share has however been gradually declining since its peak in 2007. Asia accounted for 34 percent of global imports and Northern America for 17 percent, while Latin America and the Caribbean, Africa and Oceania each held relatively small shares (3 percent, 3 percent and 1 percent, respectively).

Asia occupies a pivotal position in the trade of global aquatic animal products. In 2024, it was the main origin of imports (by value) in Oceania (69 percent), Northern America (40 percent) and Africa (33 percent), with 47 percent reflecting Asia's intraregional trade (Table 1.14). Europe and Latin America and the Caribbean relied more heavily on intraregional trade, but even in these regions Asia was their largest supplier.

Taken together, these export and import patterns result in distinct net trade positions across regions (Figure 1.43). Northern America and Europe were the principal net importers of aquatic animal products in 2024, recording trade deficits of USD 18 billion and USD 7 billion, respectively. In volume terms, Northern America registered a deficit of 1.6 million tonnes (product weight),

BOX 1.9 THE UNTOLD STORY OF NUTRIENT FLOWS IN THE GLOBAL TRADE OF AQUATIC ANIMAL FOODS

The socioeconomic impact of global trade in aquatic animal foods, widely reported in terms of economic value, volume and employment, can benefit significantly from measurement of the nutrient flows this trade generates. This analytical approach can provide an insightful perspective on the key role of international trade in supporting global food security and nutrition.[2] It can shed light on the extent to which countries rely on trade to meet dietary needs, not only through imports but also through exports. Trade in aquatic animal foods – expressed in food energy, proteins and fats – highlights how international trade redistributes nutrient availability across countries and regions and contributes to their nutrition outcomes.

The figure illustrates country-level net trade in aquatic animal foods in terms of proteins. In 2024, countries such as Viet Nam, China, Norway and Ecuador were significant net exporters, supplying aquatic animal proteins to the global market. In contrast, the United States of America, Japan and many European and African countries were net importers of these proteins. For most countries, net trade balances are consistent in value, food energy and nutrient (proteins and fats) terms; however, some countries display different patterns, being net importers in nutrient terms and net exporters in value terms. For example, Bangladesh is a net importer of aquatic animal food nutrients but a net exporter in terms of value.

At the regional level, a comparison of net value and nutrient flows reveals a consistent pattern: all regions, except Africa, are either net exporters or net importers across both dimensions. Northern America and Europe are net importers in both value and nutrient terms. They spend more on aquatic animal food imports than they earn from exports, while global markets allow them to increase their domestic availability of food energy, proteins and fats. Conversely, Latin America and the Caribbean, Asia and Oceania are net exporters in both dimensions, indicating that they generate net export revenue while also exporting more nutrients from aquatic animal foods to global markets than they import.

Africa is the exception: while a net exporter of aquatic animal foods in value terms, it is a net importer of these foods in nutrient terms. African exports comprise predominantly aquatic animal products of high economic value; the revenue generated supports imports of large volumes of aquatic animal foods of low economic value but rich in nutrients and essential for domestic food security. As a result, the region's trade of aquatic animal foods generates both revenue and improved nutrient availability.

In summary, aquatic animal food trade is far more than an economic exchange; the adoption of a nutrient flow lens clearly demonstrates how nutrient flows across countries and regions can contribute to global food security. Incorporating nutrient-based indicators alongside conventional trade metrics can provide a more comprehensive basis for analysis, helping to better link trade with nutrition policies and synergizing support towards achieving relevant targets of SDG 2 and SDG 14.

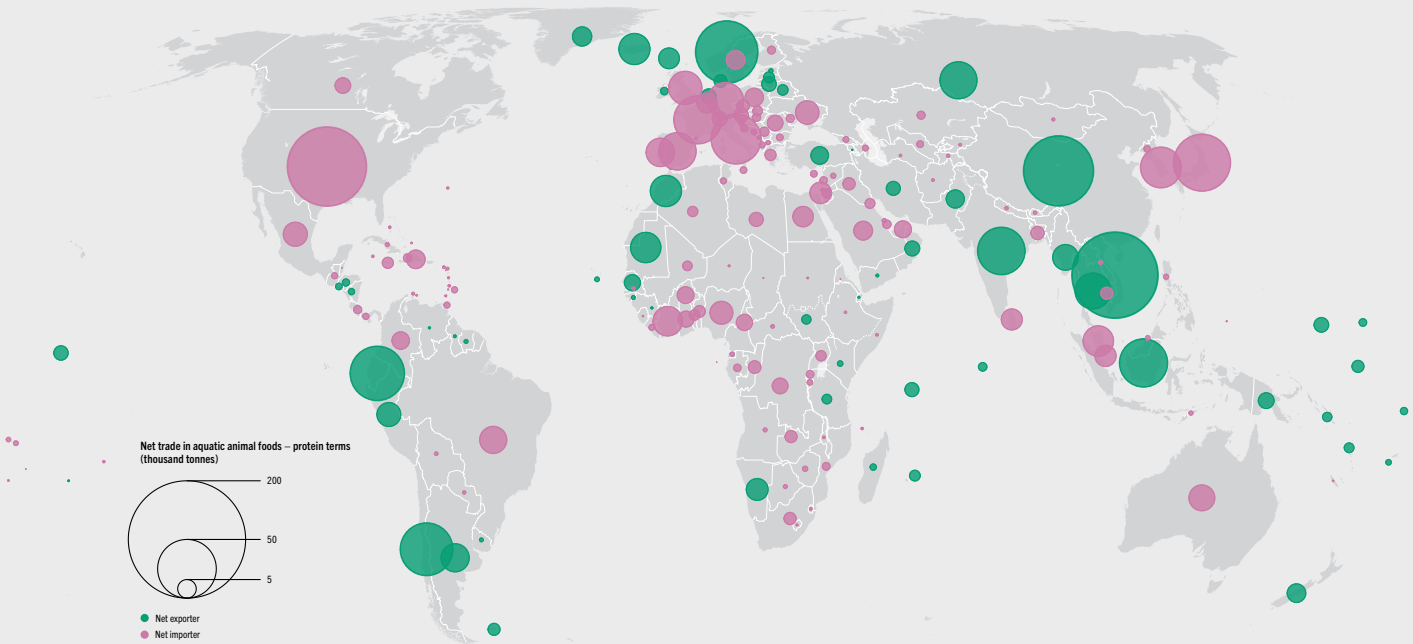
while Europe's trade remained broadly balanced. It should be noted that, as trade volumes are measured in product weight across different product forms (e.g. fresh, frozen, filleted, processed), volume comparisons may introduce biases in net trade assessments.

By contrast, Latin America and the Caribbean emerged as the leading net exporting region, with a surplus of USD 21 billion and 4.7 million tonnes. Oceania also recorded a surplus, albeit on a smaller scale (USD 2 billion, 0.8 million tonnes). Asia displayed a different profile with a modest value surplus (USD 1 billion), but a volume deficit (1.8 million tonnes), reflecting the region's import of raw materials for processing and re-export of higher-value products. Africa too had a value surplus (USD 2 billion) and a volume deficit (1 million tonnes), indicating the export of relatively high-priced products alongside the import of low-priced species.

Complementing these regional trends, trade patterns were also strongly differentiated by income level. High-income countries generated 55 percent of the global export value in 2024, »

BOX 1.9 (Continued)

NET PROTEIN TRADE IN AQUATIC ANIMAL FOOD PRODUCTS, 2024



Refer to the disclaimer on the copyright page for the names and boundaries used in this map. Dotted line represents approximately the Line of Control in Jammu and Kashmir agreed upon by India and Pakistan. The final status of Jammu and Kashmir has not yet been agreed upon by the parties. Final boundary between the Republic of Sudan and the Republic of South Sudan has not yet been determined. Final status of the Abyei area is not yet determined.

NOTE: Protein estimates were derived using the Global nutrient conversion table for FAO supply utilization accounts available at: https://doi.org/10.4060/cc9678en

SOURCE: Authors' own elaboration.

TABLE 1.14 TRADE FLOWS OF AQUATIC ANIMAL PRODUCTS BY REGION (SHARE OF TOTAL IMPORTS BY VALUE), 2024

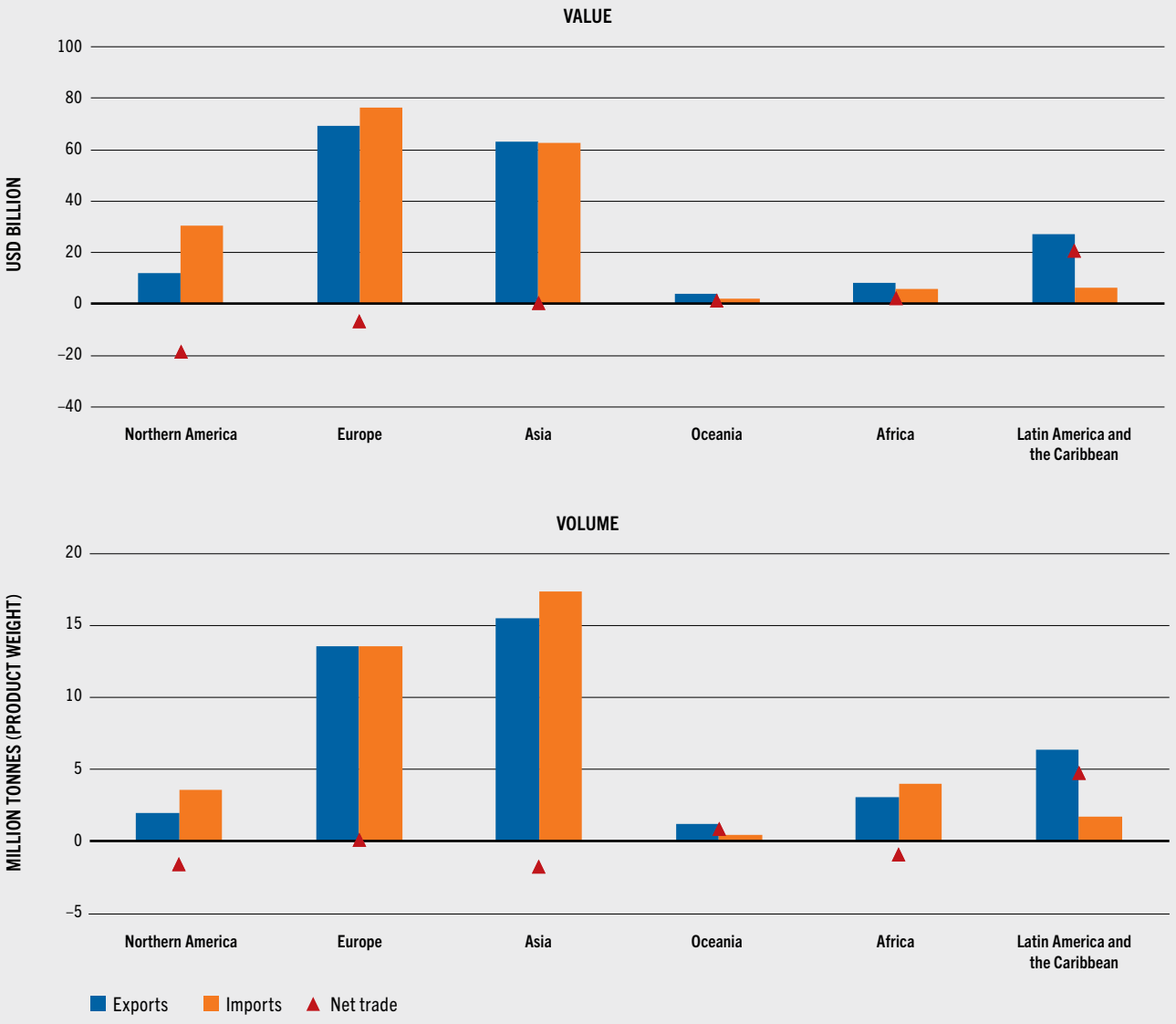
		Partner					
		Africa	Asia	Europe	Latin America and the Caribbean	Northern America	Oceania
		Share of total imports in reporting region (%)					
Reporter	Africa	25	**33**	27	13	1	1
	Asia	3	**47**	20	17	9	4
	Europe	7	12	**68**	9	4	1
	Latin America and the Caribbean	1	28	8	**55**	7	1
	Northern America	1	**40**	14	27	17	2
	Oceania	3	**69**	12	3	2	12

NOTES: Shares may not add up to 100 percent due to unspecified trading partners. Light blue cells indicate intraregional trade. Bold indicates the top partner region for each reporting region. Imports are measured by value.

SOURCE: Preliminary data. Final data will be available here: FAO. 2026. Global aquatic trade statistics. https://www.fao.org/fishery/en/collection/global_commodity_prod. Licence: CC-BY-4.0.

https://doi.org/10.4060/cd8357en-table1.14

FIGURE 1.43 IMPORT, EXPORT AND NET TRADE OF AQUATIC ANIMAL PRODUCTS BY REGION, BY VALUE AND VOLUME, 2024



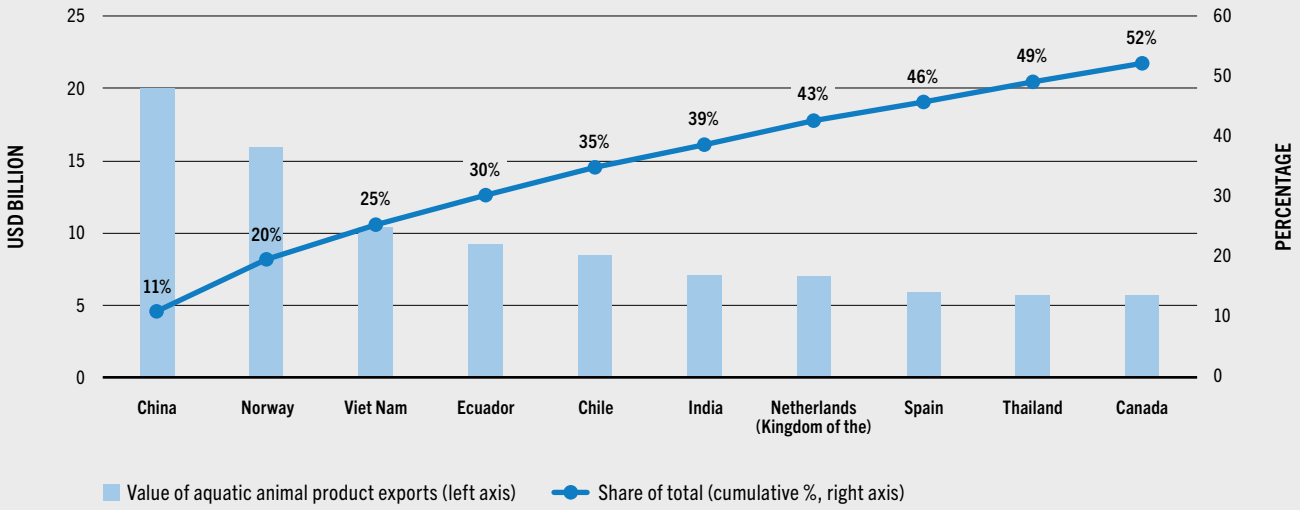
NOTE: Aquatic animals exclude aquatic mammals, crocodiles, alligators, caimans, sponges, corals, pearls and algae.

SOURCE: Preliminary data. Final data will be available here: FAO. 2026. Global aquatic trade statistics. https://www.fao.org/fishery/en/collection/global_commodity_prod. Licence: CC-BY-4.0.

https://doi.org/10.4060/cd8357en-fig1.43

» followed by upper-middle-income (29 percent) and lower-middle-income countries (15 percent), while low-income countries accounted for only a marginal share. Across all income groups, high-income countries were the primary destination for exports from both lower- and upper-middle income countries and also other high-income countries. High-income countries absorbed 74 percent of the global import value, compared to 20 percent for upper-middle-income,

FIGURE 1.44 TOP TEN EXPORTING COUNTRIES OF AQUATIC ANIMAL PRODUCTS BY VALUE, 2024



NOTE: Aquatic animals exclude aquatic mammals, crocodiles, alligators, caimans, sponges, corals, pearls and algae.

SOURCE: Preliminary data. Final data will be available here: FAO. 2026. Global aquatic trade statistics. https://www.fao.org/fishery/en/collection/global_commodity_prod. Licence: CC-BY-4.0.

https://doi.org/10.4060/cd8357en-fig1.44

5 percent for lower-middle-income and less than 1 percent for low-income countries. Taking into consideration trade volume data, high-income countries imported only 56 percent of the total volume (product weight) in 2024 – indication that their imports are higher-value products compared to those of low- and middle-income countries (USD 6.1/kg vs USD 2.6/kg).

Export unit values are similar across income groups, highlighting that divergences arise mainly on the import side: high-income countries tend to import higher-value products, such as premium or highly processed items, whereas low- and middle-income countries import lower-priced products. This asymmetry is further reflected in price differentials within each group: for low- and middle-income countries, export unit values exceed import unit values, whereas the opposite is observed for high-income countries.

In 2024, high-income countries were net importers in value terms, while low- and middle-income countries collectively recorded a net trade surplus. In low- and middle-income countries, the total net trade of aquatic animal products reached USD 36 billion, only slightly below the net trade balance of all other agricultural products (excluding forestry) combined (USD 37 billion), underscoring the sector's importance as a source of export and foreign exchange revenue.

Top exporters of aquatic animal products

Figure 1.44 illustrates the lead exporting countries of aquatic animal products in 2024.

China

China has dominated aquatic animal product exports since 2002, consolidating its presence in international markets. China's contribution to global exports of aquatic animal products increased from under 2 percent in 1976 to a peak of 15 percent in 2015, before decreasing to stand at 11 percent in 2024.

The value of China's exports of aquatic animal products expanded dramatically from approximately USD 0.1 billion in 1976 to an estimated USD 20.1 billion in 2024. Over this long period, year-to-year exports contracted in only ten years, reflecting a generally strong and sustained growth trajectory. However, four of these

contractions occurred within the last decade (2015, 2019, 2020 and 2023). In particular, China's exports fell by 12 percent in 2023 (compared to 2022), driven by weaker global demand and reduced availability of raw materials for processing. In 2024, however, exports rebounded by 2.2 percent, reflecting a recovery in international markets and renewed demand for Chinese aquatic animal products; however, this was still below the record high of USD 22.4 billion reached in 2022.

China exported aquatic animal products to over 180 countries and territories in 2024. In value terms, Japan remained the principal destination, accounting for 16 percent of total aquatic animal product exports. It was followed by the United States of America (11 percent), the Republic of Korea (9 percent), Malaysia (7 percent) and China, Hong Kong SAR (6 percent). Together, these five markets accounted for half of China's total aquatic animal product export value in 2024.

In 2024, live, fresh, chilled or frozen fish, crustaceans and molluscs accounted for half of the total value of China's aquatic animal product trade. Prepared and preserved aquatic animal products represented a further 46 percent of the total, highlighting again the importance and competitiveness of the Chinese processing industry and its capacity to meet international demand for processed and value-added aquatic animal products. Although live, fresh, chilled and frozen products still make up a large share, their importance has declined markedly over time: in the late 1970s, when exports were still limited in scale, they accounted for nearly all of China's aquatic export value.

Norway

Norway is the second-largest exporter of aquatic animal products, accounting for 9 percent of the global value of aquatic animal product exports and registering a new record high of USD 16.0 billion in 2024. The growth rate in 2024 was marginal, at +0.1 percent compared to 2023, and markedly lower than the significant growth rates seen after the COVID-19 pandemic (+25 percent in 2021, +12 percent in 2022 and +3 percent in 2023). It is worth noting that exported volumes declined in the period 2022–2024, with higher prices, particularly for salmonoids, driving the growth in export value.

Norway exports mostly farmed salmonids and some wild fish such as cod, mackerel, other whitefish and small pelagic species. Salmon products represented 74 percent of Norway's aquatic animal product export value in 2024. Just under 90 percent of Norwegian exports are in live, fresh, chilled or frozen form, and this share has been rising over time. This contrasts with China, where a growing share of exports consists of a wide range of prepared and preserved products and species.

Norway's exports of aquatic animal products are primarily destined for high-income countries, which accounted for 83 percent of its trade value in 2024. Norwegian aquatic animal products are shipped to around 140 countries, with Poland and Denmark – where products are processed before re-export – and the United States of America representing the three largest markets.

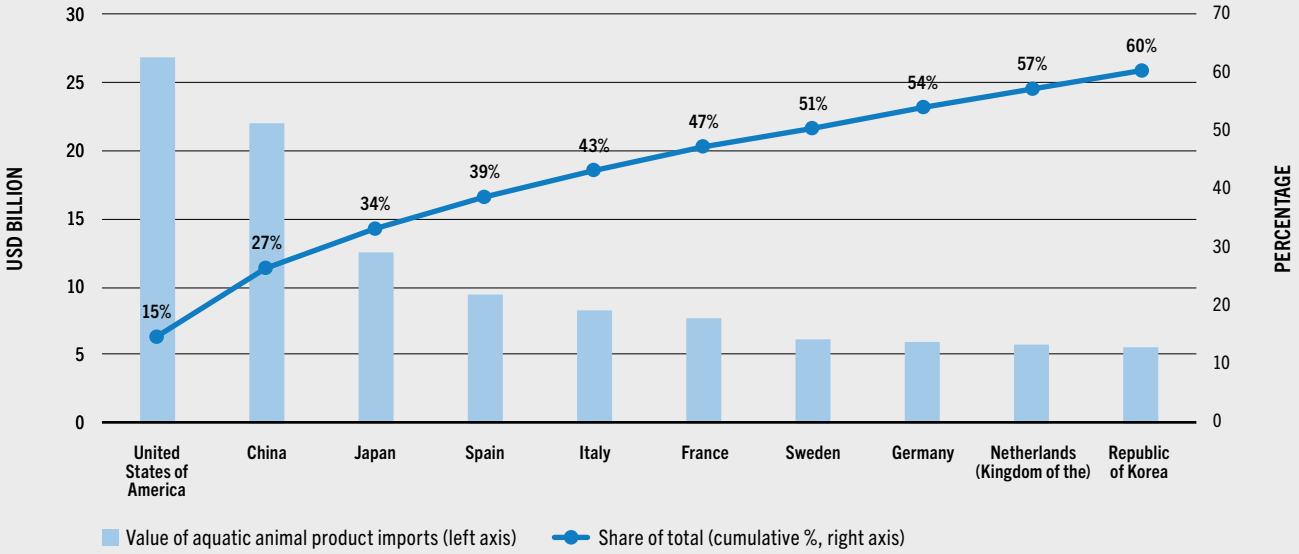
Viet Nam

Viet Nam has been the third-largest exporter of aquatic animal products since 2014. In 2024, Viet Nam's exports of aquatic animal products totalled USD 10.5 billion, destined to over 90 countries and territories (i.e. the geographical reach is narrower than that of Norway and China). Export markets are relatively concentrated. In 2024, the five largest destinations accounted for 65 percent of the total export value. China became the largest market for Viet Nam's exports, pushing the United States of America into second place, followed by Japan, the Republic of Korea and Australia. The country's primary exports were farmed shrimps, farmed catfish (*Pangasius* spp.) and tuna products.

Ecuador

Ecuador has become one of the most dynamic exporters of aquatic animal products. Over the last decade, export values have expanded at an average annual rate of 11 percent, compared to 0.2 percent for China, 6.4 percent for Norway and 5.0 percent for Viet Nam. This expansion has been largely driven by the rapid growth of its shrimp aquaculture sector, where the country has successfully scaled up production while keeping costs competitive. In 2024, Ecuador's total exports of aquatic animal products reached USD 9.2 billion – an increase from 2023, yet below the record high of USD 9.6 billion

FIGURE 1.45 TOP TEN IMPORTING COUNTRIES OF AQUATIC ANIMAL PRODUCTS BY VALUE, 2024



NOTE: Aquatic animals exclude aquatic mammals, crocodiles, alligators, caimans, sponges, corals, pearls and algae.

SOURCE: Preliminary data. Final data will be available here: FAO. 2026. Global aquatic trade statistics. https://www.fao.org/fishery/en/collection/global_commodity_prod. Licence: CC-BY-4.0.

https://doi.org/10.4060/cd8357en-fig1.45

achieved in 2022. Ecuador exported its aquatic animal products to just under 100 countries and territories in 2024, with China, the United States of America and Spain accounting for 65 percent of Ecuador's total export value. The vast majority of these exports consisted of live, fresh, chilled or frozen crustaceans and molluscs (76 percent), followed by prepared and preserved fish (18 percent).

Other exporters

Other major exporters include the European Union, Chile, India, Thailand, Canada, Indonesia, the United States of America and the Russian Federation. The European Union is the largest of these, exporting USD 41.0 billion of aquatic animal products in 2024, although an important share (79 percent by value) is attributed to intra-European Union trade. Moreover, a large proportion of these trade flows consist of re-exported products, either after processing within the European Union or after importing into the European Union market from non-EU countries.

Top importers of aquatic animal products

Figure 1.45 illustrates the lead importing countries of aquatic animal products in 2024.

European Union

The European Union was the world's largest single market for aquatic animal products in 2024, with total imports valued at USD 63.2 billion. While 49 percent of total imports are generated by trade among EU countries, the European Union continues to be the leading global importer for imports from non-EU countries. In 2024, extra-European Union imports of aquatic animal products reached USD 32.0 billion.

Salmons, trouts and smelts were the most important species group imported from outside the European Union, accounting for 29 percent of the total import value. Cods, hakes and haddocks ranked second at 15 percent, followed by shrimps and prawns at 13 percent, while tunas, bonitos and billfishes represented a further 11 percent. Norway was the principal supplier of

aquatic animal products to the European Union, accounting for 28 percent of the total import value in 2024; in particular, it dominated salmon imports, as 78 percent of the European Union's imports of salmons, trouts and smelts originated from Norway. Norway was also the largest supplier of cods, hakes and haddocks, providing 22 percent of total EU imports of these species. Ecuador was the leading supplier of shrimps, accounting for 25 percent of total EU shrimp and prawn imports in 2024 (valued at USD 4.2 billion). Ecuador was also the largest supplier of tunas, bonitos and billfishes, accounting for 29 percent of the USD 3.4 billion in extra-European Union imports of this species group. Morocco was the third-largest supplier to the European Union, supplying predominantly squids, cuttlefishes, octopuses and fishmeal products.

United States of America

The United States of America remains the world's largest single importer of aquatic animal products, with 2024 imports totalling USD 26.9 billion, representing a share of 15 percent of the global import value (Figure 1.45). This import value remained stable in 2024, following a decline of 16 percent in 2023, and a strong 31 percent surge in 2021, reflecting a post-pandemic market correction. The primary suppliers of aquatic animal products to the United States of America were Canada (15 percent), Chile (12 percent), India (10 percent), Indonesia (7 percent) and Viet Nam (7 percent), which collectively represented 51 percent of the total import value in 2024.

Salmonids were the leading species group imported by the United States of America, accounting for 25 percent of the total import value, closely followed by shrimps and prawns (24 percent). Tunas, bonitos and billfishes represented a further 8 percent. The importance of salmonids in the United States of America was comparable to that observed in the European Union. However, the suppliers differ markedly. Chile was by far the dominant supplier in 2024, providing nearly half of total United States of America salmon imports, followed by Norway (18 percent). By contrast, shrimp and prawn imports were more diversified, India (37 percent), Ecuador (21 percent) and Indonesia (17 percent) being the three leading suppliers.

China

The second-largest importing country in 2024 was China, accounting for USD 22.0 billion or 12 percent of the world's import value of aquatic animal products. Its imports grew rapidly by 16 percent and 31 percent in 2021 and 2022, respectively, before remaining broadly stable in 2023 and declining by 2.6 percent in 2024. Since 2022, China has become a net importer of aquatic animal products, reflecting the increasing role of imports to meet the growing demand for domestic consumption and processing for re-export.

The composition of Chinese imports is diverse, with shrimps and prawns representing the largest species groups. In 2024, shrimps and prawns accounted for 23 percent of the total import value, followed by crabs and sea spiders (10 percent), lobsters and spiny lobsters (8 percent), and cods, hakes and haddocks (7 percent). The top suppliers to China were Ecuador (15 percent), the Russian Federation (14 percent) and Peru (8 percent). Ecuador's top supplier position reflects strong shrimp imports, while the Russian Federation's prominence is largely driven by crab, Alaska pollock and cod imports; Peru's role, on the other hand, is largely associated with fishmeal products.

Japan

Japan remains the third-largest single importer of aquatic animal products, despite the downward trend of its imports since the 2010s. The value of its imports in 2024 totalled USD 12.6 billion, representing a 5.6 percent decline compared to 2023 and accounting for 7 percent of the global import value of aquatic animal products. Although import values rebounded in 2022, reflecting a recovery from the disruptions caused by the COVID-19 pandemic, this improvement was temporary, and the overall downward trajectory has since resumed. Nevertheless, imports of aquatic animal products remain crucial for Japan, as domestic production has been declining since the late 1990s, to the extent that capture fisheries and aquaculture production is now close to the levels of the early 1950s, when the population was significantly smaller. As a result, imports are even more essential for filling the gap left by the shrinking domestic production and maintaining the availability of aquatic animal foods in the country. In value terms, the

TABLE 1.15 EXPORT VALUE OF AQUATIC ANIMAL PRODUCTS BY MAIN SPECIES GROUP, 2024

Main species group	USD billion	Share of total (%)
Finfish	**124.4**	**68**
Salmons, trouts, smelts	38.1	21
Tunas, bonitos, billfishes	17.7	10
Cods, hakes, haddocks	15.0	8
Other pelagics	11.9	6
Other finfish	41.6	23
Crustaceans	**39.9**	**22**
Shrimps, prawns	28.7	16
Other crustaceans	11.2	6
Molluscs and other aquatic invertebrates	**19.6**	**11**
Squids, cuttlefishes, octopuses	12.7	7
Other molluscs and aquatic invertebrates	6.9	4
Total	**184.0**	**100**

NOTE: Shares may not add up to 100 percent due to rounding.

SOURCE: Preliminary data. Final data will be available here: FAO. 2026. Global aquatic trade statistics. https://www.fao.org/fishery/en/collection/global_commodity_prod. Licence: CC-BY-4.0.

https://doi.org/10.4060/cd8357en-table1.15

main sources of Japan's imports in 2024 were China, Chile and the United States of America. Salmonids were the leading species group, accounting for 17 percent of the total import value, closely followed by shrimps and prawns (15 percent), and tunas, bonitos and billfishes (13 percent), highlighting the importance of high-value species in the Japanese market.

Major aquatic products traded

Aquatic animal trade is highly diverse in terms of both species and product form. Table 1.15 shows the breakdown of the total value of globally traded aquatic animal products by major species group in 2024. Finfish dominated this global trade in 2024, making up 68 percent of the total value. Crustaceans followed with 22 percent, and molluscs and other aquatic invertebrates represented 11 percent.

Considering the species groups, salmonids – the most important group traded in value terms since 2013 – accounted for 21 percent of the total value of aquatic animal trade in 2024. The other main groups of exported species were shrimps and prawns (16 percent), followed by tunas (10 percent), cods, hakes and haddocks (8 percent), and other pelagic fishes (6 percent). Some species, particularly pelagic fishes, once processed into fishmeal and fish oil, accounted for, respectively, 3.3 percent and 2.3 percent of the export value of aquatic animal products.

Salmons and trouts

In 2024, global salmon and trout exports reached USD 38.1 billion, similar to the levels recorded in 2022 and 2023. Salmons and trouts have grown to play one of the most dynamic roles in international aquatic trade, contributing 21 percent to the global value of aquatic animal product exports. They represent a notable exception as their trade value remained stable in 2023 and 2024, while overall aquatic animal trade contracted in 2023 and several species groups continued to decline into 2024. The main exporters of salmons and trouts remain Norway and Chile, together accounting for nearly half of the global export value of these species. Over 200 countries and territories reported imports of

salmon and trout products in 2024. The European Union, the United States of America, Japan, China and the Republic of Korea were among the largest importers of these products.

In 2024, nearly 70 percent of the salmon and trout export value consisted of fresh products; this is an extremely high proportion, given that the share of fresh products for all aquatic animal product trade by value is only 27 percent. This underscores the premium market position of fresh salmons and trouts within the broader aquatic product trade.

Shrimps and prawns

Shrimps and prawns rank second for species group exports, representing 16 percent of the total trade value in 2024. Shrimp and prawn exports reached USD 28.7 billion in 2024, up 1.7 percent from 2023 (when an 11 percent decline was recorded).

Ecuador remained the top exporter of shrimps and prawns in 2024, accounting for 25 percent of the global shrimp and prawn export value. The country experienced impressive growth over five years, as its shrimp and prawn export value nearly doubled from USD 3.9 billion in 2019 to USD 7.0 billion in 2024. The other main exporters of shrimps and prawns were India, accounting for 17 percent of the global export value, followed by Viet Nam (13 percent) and China (7 percent). The largest importers of shrimps and prawns by value were the European Union, followed by the United States of America and China.

Shrimp and prawn exports are dominated by frozen products, which accounted for three-quarters of the global export value in 2024. However, the composition of product forms varies across major exporters. Ecuador exports shrimps almost exclusively in frozen form, reflecting its focus on long-distance markets and the efficiency of its cold chain infrastructure. China, by contrast, exports a larger share in prepared and processed forms, reflecting its large processing capacity, which serves both foreign and domestic convenience and ready-to-eat products. India and Viet Nam exhibit a more mixed export profile: while frozen shrimps still represent the majority of their export value, a significant portion of export earnings are also generated from prepared, processed and canned products.

Tunas, bonitos and billfishes

In 2024, global exports of tunas, bonitos and billfishes reached a value of USD 17.7 billion, representing 10 percent of the total value of aquatic animal product exports. By product form, canned tuna dominated, representing 56 percent of the total, followed by frozen products (36 percent) and fresh products (6 percent).

The global export value of tunas, bonitos and billfishes was up by 8.0 percent in 2024, although trends varied across product forms. Exports of fresh tuna declined, while canned tuna exports rose strongly.

The leading exporters in 2024 were Thailand, accounting for 15 percent of the global export value of tunas, bonitos and billfishes, followed by Spain (10 percent) and Ecuador (9 percent). On the import side, the United States of America represented 12 percent of the global import value, with Japan and Thailand each accounting for 9 percent. Thailand confirmed its prominence in both exports and imports of tunas, reflecting its role as a major processing and trading hub within the global tuna sector.

Cods, hakes and haddocks

In 2024, global exports of cods, hakes and haddocks reached USD 15.0 billion, representing 8 percent of the total value of aquatic animal product exports. Cods, hakes and haddocks are one of the few major species groups whose share has declined, down from 12 percent in 1976. Both traded volumes and value were down in 2023 and 2024, reflecting reduced supplies of these primarily wild-caught species.

The main exporters in 2024 were China, Norway and the Russian Federation, while the principal importers remained the European Union, China and the United States of America.

Despite relatively high prices, consumer demand has remained somewhat stable. However, some market segments (e.g. fast-food operators) have shifted to more affordable alternatives such as farmed whitefish species.

Cephalopods

Cephalopods, including octopuses, squids and cuttlefishes, accounted for 7 percent of global

aquatic animal product exports in 2024, with total exports reaching USD 12.7 billion. This marked a 2.5 percent decline compared to 2023, following an 8.6 percent drop in 2022.

China, Morocco and Mauritania account for the majority of octopus catches worldwide, while squids and cuttlefishes are supplied primarily by China, Viet Nam, India and Peru. Reduced landings in key producing regions, as well as adverse weather conditions including El Niño, which disrupted resource replenishment and led to notable squid scarcity particularly in Peru, contributed to keeping supplies of both octopuses and squids tight in 2024.

China, Spain, Morocco, Indonesia and Viet Nam were the largest cephalopod exporters, while Spain, Italy, China and Japan were the leading importers in value terms. Peru, which ranked as the fourth-largest exporter of cephalopod products by value in 2023, saw the value of its exports more than halve in 2024.

Frozen cephalopod products predominated exported cephalopod products, representing 76 percent of the total value in 2024, followed by canned (18 percent) and fresh (5 percent).

Bivalves

Bivalve molluscs – primarily scallops, clams and mussels – accounted for 3 percent of the global aquatic animal product export value in 2024, with total exports reaching USD 5.4 billion. This represented a decline of 2.7 percent compared to 2023, and 2022 had already seen a 6.2 percent contraction. This downturn was largely driven by lower scallop exports, mainly reflecting the import ban imposed by China since 2023 on aquatic products from Japan.

Fishmeal and fish oil

In 2024, fishmeal exports totalled USD 6.1 billion, representing 3 percent of the value of global aquatic animal product exports. Strong catches of Peruvian anchoveta drove a rebound in both production and exports of fishmeal in Peru, contributing to ease global prices following the steep declines of 2023, when Peruvian output and exports had halved. China consolidated its position as the largest importer, accounting for 47 percent of global imports by value, up from 39 percent five years earlier, driven by its large aquaculture sector.

Global fish oil exports totalled USD 4.3 billion in 2024, up 4.1 percent from 2023, despite the 11 percent reduction in export volumes. The decline in fish oil export volumes in 2024, despite rising fishmeal exports, reflects persistently low yields of fish oil. Fish oil export prices rose by about 17 percent in 2024, following rises of 30 percent in 2023 and 29 percent in 2022. Despite elevated prices, demand for fish oil remains highly resilient, with Norway and China continuing to be leading importers.

Algae

In 2024, exports of algae totalled USD 1.5 billion, a broadly stable figure compared to 2023. The top exporting countries were the Republic of Korea, Indonesia and China, accounting together for 61 percent of the total export value of algae in 2024. On the import side, China, Japan and the United States of America remained the top importers of algae, representing together just under half of the total import value in 2024.

Other aquatic products

Exports of other aquatic products include sponges, corals, shells and inedible products. In 2024, inedible products reached USD 0.8 billion, while sponges, corals and shells totalled USD 0.2 billion. ■



CHINA
Mud crab pens in the intertidal zone.
© iStock.com/LeonU

PART 2
BLUE TRANSFORMATION: TURNING VISION INTO IMPACT

ADVANCING BLUE TRANSFORMATION

Despite adequate global food production, an estimated 673 million people, representing 8.2 percent of the global population, faced hunger or malnutrition in 2024 because safe and nutritious food was not available, not accessible or, more often, not affordable.[1] The situation was especially severe in low-income countries, where households are highly vulnerable to price increases. This threatens not only the achievement of global food security and nutrition targets, but also the whole 2030 Agenda for Sustainable Development.

Aquatic food systems play an increasingly important role in addressing nutrition, food security and poverty alleviation. In 2023, 3.1 billion people derived at least 20 percent of their animal protein and obtained a significant share of vital micronutrients from aquatic animal foods. Globally, aquatic food systems contribute to the livelihoods of 600 million people.

To unlock the full potential of fisheries and aquaculture, FAO launched the Blue Transformation Roadmap (2022–2030),[2] which provides a common strategy with three global objectives (Figure 2.1):

1. sustainable aquaculture expansion and intensification to meet the rising demand for aquatic foods while ensuring equitable distribution of benefits;
2. effective management of all fisheries to secure healthy stocks and equitable livelihoods; and
3. upgraded aquatic value chains to guarantee the social, economic and environmental sustainability of aquatic food systems.

Part 2 of this edition of *The State of World Fisheries and Aquaculture* explores the transformational changes that are supporting implementation of this strategy on the ground. It describes how **advances in sustainable aquaculture** are helping the sector intensify and expand in different parts of the world to meet the growing demand for aquatic foods. These advances are supported by regional cooperation and effective governance, innovation, technology and improved management practices, investment in resource-efficient and low-impact aquaculture operations, improved biosecurity, equitable access to resources and services, and science-based, data-driven, and sustainable aquaculture growth.

Regarding **advances in sustainable fisheries**, the section illustrates how improved fisheries governance and effective management are enabling the recovery and maintenance of healthy stocks, while securing livelihoods and sustaining the benefits aquatic ecosystems provide. Progress in this area is being driven by institutional and legal reforms that reinforce fisheries governance to combat illegal, unreported and unregulated (IUU) fishing; equitable access to resources and services that empower small-scale fishers; and innovation and technology that promote environmentally improved vessel and gear design and responsible practices. The section

FIGURE 2.1 OBJECTIVES AND OUTCOMES OF BLUE TRANSFORMATION

AQUACULTURE

OBJECTIVE: Sustainable aquaculture intensification and expansion satisfies global demand for aquatic foods and distributes benefits equitably.

OUTCOMES:

- Sustainable aquaculture production grows by at least 35 percent by 2030,* especially in food deficit regions.
- Growth of the sector creates employment and skills that improve income and livelihoods.
- Full and productive employment and decent work for men and women is achieved by 2030.**

FISHERIES

OBJECTIVE: Effective management of all fisheries delivers healthy stocks and secures equitable livelihoods.

OUTCOMES:

- One hundred percent of marine and inland fisheries are placed under effective management.
- All illegal, unreported and unregulated activities are phased out.
- Full and productive employment and decent work in the fisheries sector is achieved for women and men by 2030.

VALUE CHAINS

OBJECTIVE: Updated value chains ensure the social, economic and environmental viability of aquatic food systems.

OUTCOMES:

- Global per capita availability of aquatic foods for human consumption is significantly increased, especially in the Global South.
- Food loss and waste in the sector is reduced by half by 2030.***
- Exporters in developing countries comply with import requirements by major import countries.
- All forms of discrimination and abuse against women, young people and men throughout the value chains are eradicated.****

NOTES: * Based on medium-term FAO fish model projections using 2018 as the baseline year. ** Based on SDG Target 8.5: By 2030, achieve full and productive employment and decent work for all women and men, including for young people and persons with disabilities, and equal pay for work of equal value. *** Based on SDG Target 12.3: By 2030, halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including post-harvest losses. **** Based on SDG Target 5.1: End all forms of discrimination against all women and girls everywhere, and SDG Target 5.2: Eliminate all forms of violence against all women and girls in the public and private spheres, including trafficking and sexual and other types of exploitation.

SOURCE: Adapted from FAO. 2022. *Blue Transformation Roadmap 2022–2030: A vision for FAO's work on aquatic food systems*. Rome. https://doi.org/10.4060/cc0459en

also highlights the contribution of regional fishery bodies (RFBs) in enhancing cooperation and fostering science-based, data-driven and sustainable fisheries management.

It further illustrates how **upgrading aquatic food value chains** ensures their social, economic and environmental viability through local and regional action. This is made possible through improved access to sustainable finance; participatory and inclusive approaches that strengthen stakeholder engagement; advances in value-added processing and product development to expand market access and diversification; and integration of aquatic foods into school meal programmes and local economies to boost children's nutrition and community resilience.

These examples demonstrate how FAO's unique global network of Decentralized Offices, with their strong presence and contextual know-how, together with the multidisciplinary, technical expertise and knowledge base of headquarters, supports aquatic food systems transformation at all scales, while addressing the challenges that constrain the path towards sustainability. Equally important, these examples also reflect the collective efforts of Members, stakeholders and partners at all levels, whose collaboration and commitment are delivering on the promise of Blue Transformation, paving the way for more resilient and sustainable aquatic food systems.

In 2024, the G20 Agriculture Working Group Ministerial Declaration[r] recognized FAO's Blue Transformation Roadmap 2022–2030 as a key framework for achieving long-term sustainability in the fisheries and aquaculture sectors. The declaration also underscored the importance of key FAO instruments, including the Guidelines for Sustainable Aquaculture,[3] the Voluntary

r For the full text of the declaration, see: https://g20.utoronto.ca/2024/G20_Agriculture_Ministers_Declaration_2024.pdf

Guidelines for Sustainable Small-Scale Fisheries in the Context of Food Security and Poverty Eradication,[4] and the Agreement on Port State Measures to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing.[5]

FAO will continue to work with stakeholders and partners to chart a sustainable future for the world's aquatic food systems. This requires advancing clear objectives and strengthening policy advocacy, scientific research, capacity building, innovation, sustainable practices, and community involvement. The Blue Transformation Roadmap provides an effective frame to do this. ■

TOWARDS SUSTAINABLE AQUACULTURE DEVELOPMENT

Regional approaches for sustainable aquaculture development

The Blue Transformation Roadmap has prioritized actions to support the development and implementation of national, regional and global governance processes that enable sustainable aquaculture development, facilitate financial investment and integrate the aquaculture sector in cross-sectoral policies and plans. This is illustrated in the following FAO initiatives implemented in the East Africa, Asia and Pacific, and Mediterranean and Black Sea regions.

Science-based aquaculture zoning in Lake Victoria

Cage farming of Nile tilapia (*Oreochromis niloticus*) in Lake Victoria, East Africa, has expanded rapidly since the early 2000s. Production was estimated at 134 000 tonnes in 2024, a more than fourfold increase compared to 2015. However, this rapid development of aquaculture in the lake is set against a backdrop of environmental risks, biosecurity threats and socioeconomic conflicts. Evolving governance frameworks, variable quality inputs, limited access to financing and shortages of skilled professionals further constrain the sector. Solutions require community engagement, responsive planning, harmonized transboundary policies, improved enforcement and stronger extension services.

To jointly address these challenges, a Zoning Working Group (ZWG) was established in 2021 under the Lake Victoria Fisheries Organization (LVFO). Kenya, Uganda and the United Republic of Tanzania were active participants, while Burundi and Rwanda were observers. The LVFO provided regional leadership, ensuring that zoning and regulatory efforts were anchored in a transboundary and basin-scale governance framework.

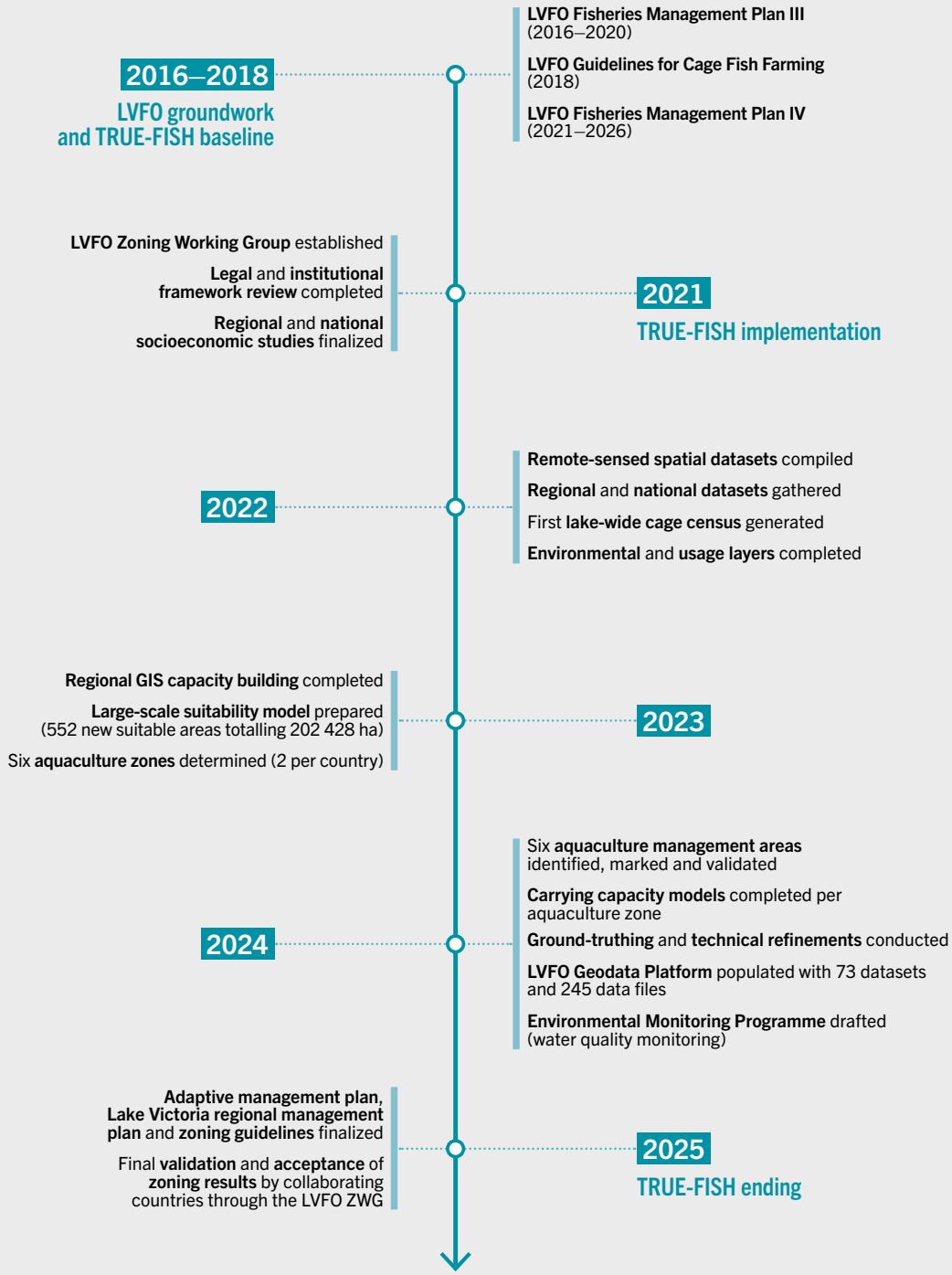
Methodology and implementation strategy

In 2021, TRUE-FISH[s] – an FAO project funded by the European Union – in close collaboration with partners, initiated a review of institutional, legal and data gaps. Socioeconomic surveys captured community perceptions, mapped conflict levels between cage farming and other lake uses, and integrated gender considerations. Structured stakeholder consultations and focus group interactions informed the prioritization of issues and the design of the modelling method. The survey results confirmed the need for a harmonized approach aligned with East African Community (EAC) frameworks for fisheries and aquaculture governance and management.

Government aquaculture data and open access sources were consolidated into forty datasets and twelve geographic information system (GIS) layers, complemented by remotely sensed information for zoning gathered by the project. Collaborating with stakeholders, the project led the selection of model architecture and parameterization for a cage culture suitability analysis, which was run under two scenarios: (i) expansion into new sites; and (ii) consolidation around existing farms. Carrying capacity modelling then determined sustainable production limits for each aquaculture management area (AMA). All inputs and outputs were integrated into the LVFO Geodata Platform. The LVFO guided development and curation to ensure alignment with regional data management priorities. This participatory, evidence-based process embedded ownership among national authorities and users, while documenting methods to support replication. Figure 2.2 presents the timeline of the zoning process.

s For further details, see: https://www.fao.org/in-action/aquatic-health-management-biosecurity/projects/projects-detail/eu-eac-true-fish-farming-story-in-lake-victoria-basin-(true-fish)/en

FIGURE 2.2 TIMELINE OF THE AQUACULTURE ZONING PROCESS IN LAKE VICTORIA IN THE CONTEXT OF THE TRUE-FISH PROJECT DEVELOPMENT



NOTE: GIS – geographic information system; LVFO – Lake Victoria Fisheries Organization; ZWG – Zoning Working Group.

SOURCE: Authors' own elaboration.

Impacts and replicability
TRUE-FISH identified approximately 240 000 hectares as suitable for cage culture, within which six AMAs were designated – two for each country bordering the lake (Figure 2.3). For each AMA, production thresholds were defined based on ecological thresholds, and a water quality monitoring plan was piloted. Training sessions equipped officers with standardized protocols for data collection, sample analysis and on-site inspections, improving consistency and compliance. In 2025, the LVFO coordinated the drafting of a regional aquaculture management plan (RAMP) and model regulatory frameworks.

The results were iteratively reviewed through national and regional consultations to reflect local priorities while ensuring regional consistency. Technical reviews by the LVFO ZWGs were convened virtually (ZWG 3, April 2024), and in person in Uganda – in Entebbe (ZWG 4, June 2024) and Kampala (ZWG 5, September 2025). Additional dissemination and peer exchange occurred during the Aquatic Resources and Blue Economy Conference (ARBEC) II in Kisumu, Kenya (June 2024), and the World Aquaculture Safari organized by the World Aquaculture Society in Entebbe, Uganda (June 2025). These milestones strengthened stakeholder buy-in and positioned the basin process within continental dialogues on the Blue Transformation.

Capacity development was central to the TRUE-FISH approach (ZWG 2, Kisumu, Kenya), strengthening the capacities of the LVFO and national technical staff in GIS, spatial planning, field monitoring, carrying capacity modelling, and regulatory analysis. This effort also promoted gender-balanced participation and structured roles for ministries, private operators, and community groups. Collectively, these achievements constitute a comprehensive, science-based inland aquaculture zoning exercise in Africa, providing a practical governance framework for implementation and replication.

TRUE-FISH piloted innovative digital tools to enhance aquaculture oversight. Pilots on drone-based cage verification combined with integrated water sampling enabled cost-effective water monitoring. Remote sensing and GIS models supported near real-time water quality diagnostics, while a regional recirculation model was developed in conjunction with disease risk assessments. A data dashboard was created to support decision-making and to prepare for upcoming coordination on biosecurity under the Regional Aquatic Organism Health Strategy (RAOHS) (Box 2.1).

Way forward
TRUE-FISH demonstrates how regulatory, spatial and environmental tools can be combined to guide sustainable cage aquaculture in a transboundary ecosystem. By aligning national regulatory reforms with a basin-wide aquaculture management plan, it advances FAO's Blue Transformation Roadmap by strengthening regional cooperation and planning and promoting science-based governance. The approach also supports One Health objectives by linking biosecurity, water quality monitoring, and awareness of antimicrobial resistance.

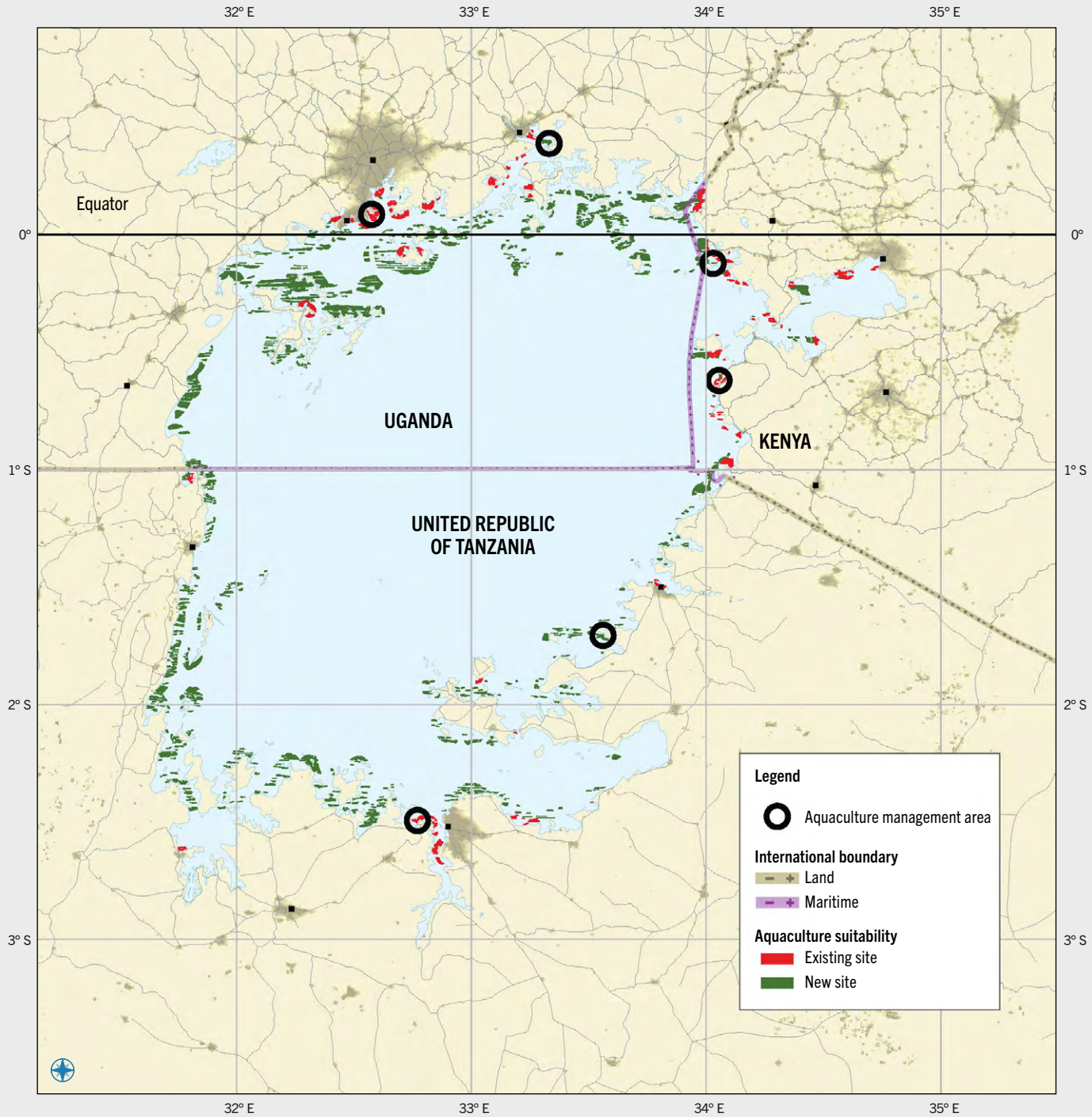
Looking ahead, priorities for 2025–2030 include the formal endorsement of the RAMP by LVFO, the incorporation of AMAs and related management measures into national regulations, and the continuous updating of the LVFO Geodata Platform.

Continuing on the theme of community-focused awareness raising and inclusive capacity development, FAO is promoting youth- and gender-sensitive aquaculture growth in the Mediterranean and Black Sea region (Box 2.2).

Innovative approaches for sustainable aquaculture development

Sustainable aquaculture intensification and expansion to support an increasing global demand for aquatic foods and distribute benefits equitably requires the adoption of comprehensive policies and innovative technology and management solutions, particularly in areas with high aquaculture development potential. Successful examples can be disseminated and upscaled through South–South and triangular cooperation programmes and public–private partnerships.

FIGURE 2.3 AQUACULTURE MANAGEMENT AREAS AND AQUACULTURE ZONES, LAKE VICTORIA



Refer to the disclaimer on the copyright page for the names and boundaries used in this map.

SOURCE: Authors' own elaboration.

BOX 2.1 REGIONAL AQUATIC ORGANISM HEALTH STRATEGIES FOR SUSTAINABLE AQUACULTURE AND BIOSECURITY

Since 2017, FAO, in collaboration with the World Organisation for Animal Health (WOAH), the Network of Aquaculture Centres in Asia-Pacific (NACA) and regional partners, has advanced the Progressive Management Pathway for Aquaculture Biosecurity (PMP/AB)* – a structured, risk-based framework combining bottom-up and top-down approaches with strong stakeholder participation. The PMP/AB provides governments and producers with practical tools to strengthen disease prevention, early detection and response systems, thereby reducing losses, mitigating antimicrobial resistance (AMR), and safeguarding livelihoods.

Guided by recommendations from the Committee on Fisheries Sub-Committee on Aquaculture, FAO and NACA developed the Regional Aquatic Organism Health Strategy (RAOHS) as the first stage of PMP/AB implementation in Asia and the Pacific. Endorsed in 2023 by the NACA Governing Council, the Asia-Pacific RAOHS comprises 20 members, including several of the world's largest aquaculture producers. It sets out 17 programmes and 40 activities spanning policy harmonization, diagnostic capacity, risk analysis, farm-level biosecurity, AMR mitigation, and emergency preparedness. The Asia-Pacific RAOHS provides a coordinated platform for concerned countries at different stages of aquaculture biosecurity development to progress along the PMP/AB pathway while aligning with international standards.

Building on this success, TRUE-FISH, an FAO project funded by the European Union, partnered with the Lake Victoria Fisheries Organization (LVFO) to develop the Lake Victoria Basin RAOHS, endorsed in 2024 by five East African countries: Burundi, Kenya, Rwanda, Uganda and the United Republic of Tanzania. Addressing the challenges of transboundary diseases and shared water systems, this RAOHS defines 16 programmes and 42 activities focused on harmonized disease surveillance, risk assessment, border inspection and regional capacity development.

As of September 2025, over 1 000 people from government, academia and industry had successfully completed FAO e-learning courses on aquaculture disease risk management and emergency preparedness. Regional risk analysis training has strengthened institutional coordination, while farm-level adoption of good aquaculture practices – including pond sanitation, seed screening and prudent veterinary drug use – has contributed to reducing mortalities and antibiotic dependence.

Beyond Asia and the Pacific and East Africa, relevant elements of PMP/AB and RAOHS are now informing initiatives in Latin America and West Africa, demonstrating the framework's adaptability across production systems, countries and regions. These experiences clearly demonstrate that the RAOHS approach improves aquatic organism health management, operationalizes One Health in aquaculture and contributes to achieving FAO's Blue Transformation objectives, enhancing resilience to aquatic diseases and reinforcing sustainable aquaculture and livelihoods.





Sample preparation for histopathology and disease detection
© FAO/Danny Altamirano

NOTE: * For further details, see: https://doi.org/10.4060/cc6858en

BOX 2.2 EMPOWERING YOUTH AND COMMUNITIES TO PROMOTE SUSTAINABLE AQUACULTURE IN THE MEDITERRANEAN AND THE BLACK SEA

Engaging youth, women and communities is a key feature of the work of the General Fisheries Commission for the Mediterranean (GFCM). As part of its 2030 Strategy for sustainable fisheries and aquaculture in the Mediterranean and the Black Sea – particularly Target 3 "Aquaculture: a sustainable and resilient sector growing to its full potential"[6] – the GFCM has designed a series of initiatives aimed at improving people's perception of aquaculture, its competitiveness and its resilience, while ensuring that it is fair and inclusive of women and youth.

The GFCM programme for the empowerment of women in aquaculture provided technical and hands-on training to some 50 young women from the region. They acquired the necessary knowledge and skills to support their full and effective participation at all levels of decision-making in the aquaculture sector. Launched in Tunisia in 2022, the programme was then rolled out in Greece (2023) and Spain (2024). It generated strong engagement within and beyond the region, culminating in the creation of the Network of Women in Aquaculture,* a dedicated international network for gender equality and sustainability in aquaculture, with more than 2 000 followers on social media and a wide range of activities in regional and international fora.

The educational toolkit, *Farmers of the water*,[7] targets youth and aims to prepare a new generation of young leaders for sustainable aquatic food systems. This educational journey highlights the environmental, social and economic benefits of farmed aquatic food systems, with activities centred around entertainment, teamwork and critical thinking. In cooperation with aquaculture associations, the toolkit was disseminated in several schools in Egypt, Georgia, Lebanon and Tunisia, leading to a series of awareness-raising initiatives involving more than 1 000 children from the region.

Likewise, the cultural dimension of aquaculture was widely promoted following the publication by GFCM of *Farmed aquatic food for all tastes*.[8] Produced in partnership with young chefs and in collaboration with pioneering farmers, it presents a journey through Mediterranean and Black Sea aquaculture, highlighting its benefits, debunking myths, and showcasing gastronomic traditions that best enhance the culinary value of the region's farmed species. The publication won the Best Free Culinary Book in the World category at the Gourmand World Cookbook Awards, shining a spotlight on the region's 35 000 fish farms and the 500 000 people they employ.

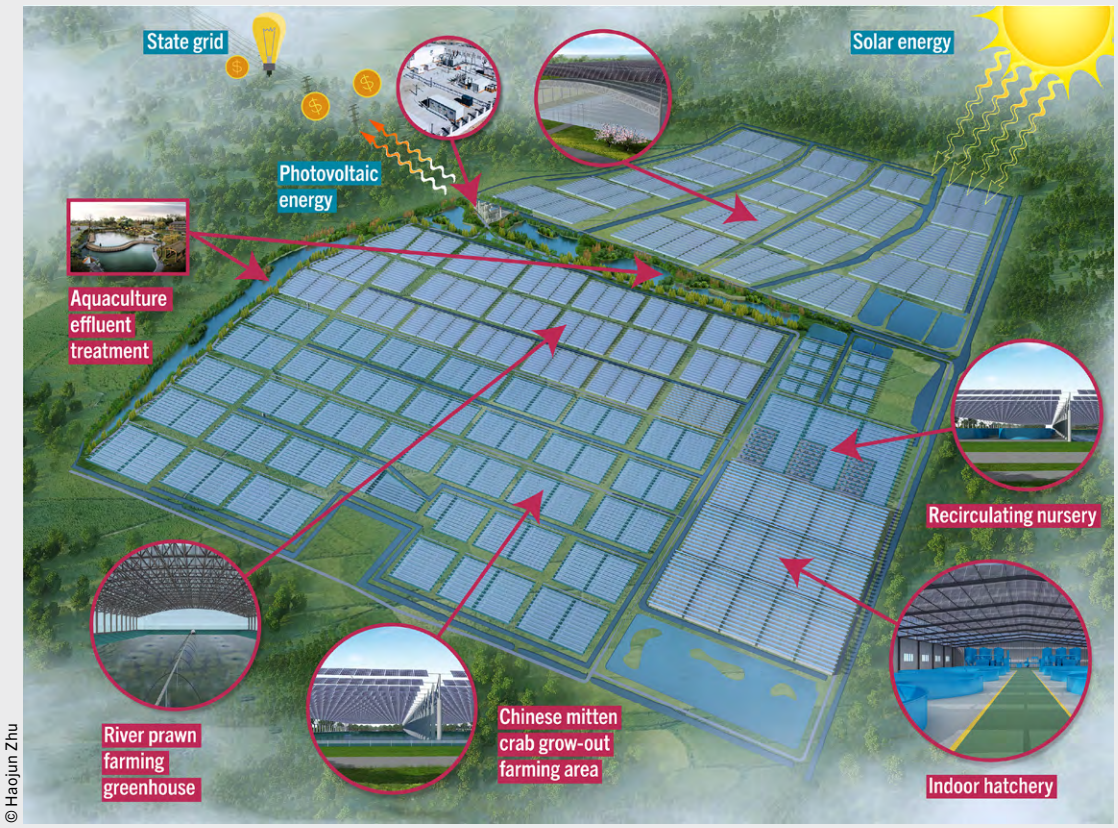
These GFCM initiatives have improved people's perception of aquaculture and broadened its outreach, enhancing access to knowledge, employment and leadership pathways, especially for women and youth. They have laid down the foundations for a new generation of informed leaders and consumers to shape the future of sustainable aquaculture.



Children using the *Farmers of the water* toolkit, Georgia
© Georgian Fish Farmers Association

NOTE: * For further details, see: https://www.nowaquaculture.org/about

FIGURE 2.4 A MODEL FOR SUSTAINABLE AQUACULTURE IN CHINA THROUGH AQUACULTURE–SOLAR ENERGY INTEGRATION



SOURCE: Authors' own elaboration.

Innovations supporting sustainable intensification of aquaculture in China

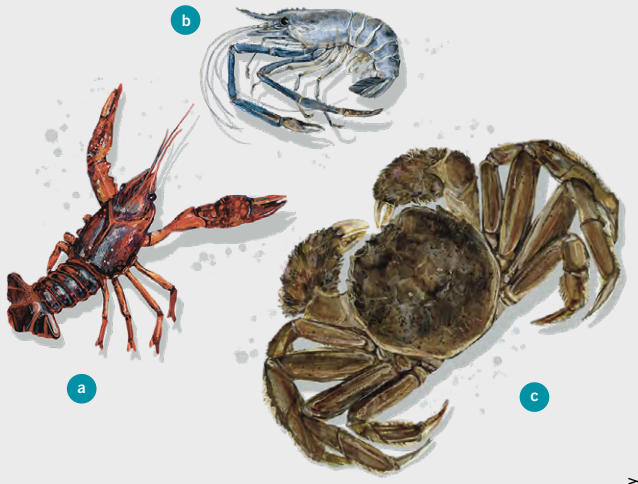
China, the world's largest aquaculture producer, has pioneered aquaculture–solar energy integration to advance its climate goals and reduce the ecological footprint of aquatic food production. Installing photovoltaic panels above ponds where aquatic species are cultivated integrates the co-production of clean electricity and nutritious food. It exemplifies multifunctional land and water use that enhances productivity without additional environmental pressure. These interventions support FAO's Blue Transformation by demonstrating how innovation, technology and improved management can drive sustainable intensification of aquaculture.

Jiuzhou Noah project

Located in Changzhou, Jiangsu Province, the Jiuzhou Noah Aquaculture–Solar Energy Integration project spans 187 hectares with an investment estimated at USD 140 million. It integrates aquaculture, solar power generation, processing, research, cold chain logistics, training and ecotourism.

The project makes dual use of space. Photovoltaic solar panels are installed above aquaculture ponds, capturing solar energy and converting it into electricity, while aquatic species are farmed beneath the panels (Figure 2.4). Not only do the panels generate clean energy, but they also create a more favourable aquatic environment by reducing light intensity and curbing temperature

FIGURE 2.5 SELECTION OF AQUATIC SPECIES FARMED USING AQUACULTURE–SOLAR ENERGY INTEGRATION



NOTE: a) Crayfish (*Procambarus clarkii*); b) giant river prawn (*Macrobrachium rosenbergii*); c) Chinese mitten crab (*Eriocheir sinensis*).

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fluctuations. Studies show that evaporation can be reduced by up to 85 percent, helping conserve water resources and stabilize growing conditions in the ponds. Aquatic species raised include high-value and shade-tolerant varieties (Figure 2.5) such as Chinese mitten crab (*Eriocheir sinensis*), giant river prawn (*Macrobrachium rosenbergii*) and crayfish (*Procambarus clarkii*). These species thrive in environments with the moderate light and temperature conditions naturally created beneath the solar panels.

In recent years, prolonged heatwaves in Jiangsu during July–August have severely affected mitten crab farming, causing sharp declines in production. By providing shade, solar panels can lower the water temperature by 1–2 °C, offering a buffer against extreme weather and supporting more stable production.

The Jiuzhou Noah project features the following key innovations and impacts:

- **Intelligent aquaculture systems.** Smart sensors monitor critical variables such as water temperature, dissolved oxygen, ammonia levels, and feeding behaviour. These data feed into automated management systems that control aeration, feeding schedules and water quality, optimizing both productivity and animal health.
- **Clean energy production.** The solar energy infrastructure generates approximately 160 million kilowatt-hours of electricity annually, reducing CO_2 emissions by around 135 000 tonnes and saving an estimated 49 000 tonnes of coal per year. Energy can be used on site or sold to the grid, providing an additional revenue stream.
- **Strong economic outcomes.** The aquaculture component yields an annual production value of approximately USD 8.75 million, with additional returns from energy sales.
- **Ecological restoration.** The facility combines wetland filtration, nutrient recycling, and biodiversity conservation with pond management. These measures complement the shading and water-saving functions of solar panels, reducing nutrient loading, improving water quality, and ensuring that energy generation and aquaculture operate within a balanced ecosystem.
- **Socioeconomic impact.** The project supports rural revitalization by generating jobs in farming, logistics and maintenance. Its research and training centres, including postdoctoral stations and student internships, promote knowledge transfer and skills development. Cultural activities such as crab festivals and agricultural exhibitions further raise public awareness of sustainable agrifood systems, while creating new income streams for local communities.

The Jiuzhou Noah case illustrates how synergistic systems – combining food production with clean energy and environmental restoration – can support multiple Sustainable Development Goals (SDGs). It provides a replicable project for countries seeking to optimize land and water use while addressing climate change, biodiversity loss, and rural inequality. By combining ecosystem-based approaches with digital innovation, aquaculture–solar energy integration provides a practical pathway towards a low-carbon, efficient and resilient aquatic food future.

Chongming Island project
Developed by Shanghai Urban Power Development, the Chongming Chenjia Town aquaculture–photovoltaic ecological base (226 hectares) integrates sustainable aquaculture with solar power generation (110 megawatts or 140 million kilowatt-hours per year). This reduces annual CO_2 emissions by around 124 000 tonnes. Operating since May 2021, the base features advanced water purification systems, 18 hectares of greenhouses, and a 5 000 m^2 genetics and breeding research centre with numerous specialized pools. It also serves as an education, tourist and leisure destination, while at the same time making a positive impact on Chongming's ecology and contributing to China's climate goals.

FAO–CAFS partnership
Building on case studies such as the Jiuzhou Noah and Chongming Island projects, FAO's partnership with the Chinese Academy of Fishery Sciences (CAFS) provides an institutional framework for the international dissemination of innovative practices, adapting them to country contexts.

A five-year memorandum of understanding between FAO and CAFS (2023–2028) has reinforced a strong collaboration on technology transfer, capacity development and knowledge exchange in sustainable aquaculture. The Freshwater Fisheries Research Centre of CAFS serves as an FAO Reference Centre for aquaculture and inland fisheries research and training at the service of FAO Members. As part of the Global Sustainable Aquaculture Advancement Partnership meeting held in Shanghai in 2023, participants from 16 countries visited aquaculture sites in Chongming to learn from practical demonstrations of China's innovative practices and experiences for global sustainable aquaculture development.

Inclusive aquaculture value chain development in Kyrgyzstan

The revival of aquaculture in Kyrgyzstan shows how an inclusive value chain approach can transform a declining sector into one of the fastest-growing food production systems in the region. Initiatives focused on upgrading the entire value chain have expanded production, empowered women and youth, introduced innovative technologies, and strengthened resilience to social and environmental challenges.

During the Soviet era, aquaculture production in Kyrgyzstan averaged approximately 1 050 tonnes per year, dominated by extensive carp production, including common, grass carp (*Ctenopharyngodon idella*) and silver carp (*Hypophthalmichthys molitrix*), and supplemented by Sevan trout (*Salmo ischchan issykogegarkuni*) and whitefish (*Coregonus lavaretus ludoga*); it supported capture fisheries in Lake Issyk-Kul and other major waterbodies. Aquaculture was fully integrated into the centralized agricultural system and benefited from well-developed infrastructure and institutional capacity. After the Soviet Union dissolved in 1991, the sector underwent a sharp decline: state-run fish farms were dismantled or privatized, management structures eroded, and financial and technical support vanished. By 2000, critical infrastructure including broodstock systems, hatcheries, grow-out systems, feed production sites and research institutes were largely abandoned, and national aquaculture production fell below 58 tonnes per year.

Recognizing the potential of aquaculture in Kyrgyzstan, FAO launched a comprehensive revitalization programme in 2009. Over 16 years, more than 500 farms were established, and national production rose from 58 tonnes in 2000 to 19 400 tonnes in 2024 – an average annual growth rate of 30.6 percent, among the fastest worldwide. Kyrgyzstan now ranks third in Central Asia and the Caucasus and eighth among all Landlocked Developing Countries (LLDCs). This remarkable expansion reflects policy reforms, capacity development and investment in technology, facilitated by FAO in close collaboration with government, farmers and local communities.

FAO's work in Kyrgyzstan has focused on strengthening aquaculture value chains with particular attention to equity and inclusivity. Aligned with FAO's Blue Transformation, interventions have enabled small- and medium-scale farmers, including women and youth, to access knowledge, technologies and resources across the value chain, from seed production to processing and marketing. This integrated approach ensures that the benefits of sector growth are shared equitably within communities.

To support gender equity, FAO helped establish three women's groups on sustainable aquaculture. Women were trained to manage fry and fingerling production ponds, and they participated in dedicated courses to improve technical and business skills. These initiatives promoted active involvement throughout the value chain, generating new livelihood opportunities. The income of households benefiting from FAO support was boosted, with aquaculture contributing 20–40 percent of earnings.

FAO has also engaged youth to secure the sector's long-term sustainability through curriculum development and outreach programmes in schools, national universities and vocational colleges, and promotion of aquaculture at public events such as the annual World Food Day celebrations. There is a particular emphasis on encouraging girls to pursue education and careers in aquaculture, nurturing the next generation of female specialists, researchers and entrepreneurs.

In just over a decade, Kyrgyzstan has transformed its aquaculture from a struggling sector into one of the fastest-growing food industries in Central Asia. Integrating women and youth into aquaculture value chains demonstrates how the sector can drive economic growth, while promoting equitable livelihoods, social transformation and environmental stewardship. Continued empowerment, upgraded value chains, and natural resource protection position Kyrgyzstan to consolidate its achievements and become a regional leader in socially inclusive, environmentally responsible aquaculture.

Improving value chains through multifaceted interventions focused on inclusivity, socioeconomic benefits and innovation has demonstrated aquaculture's contribution to national development goals. Along these same lines, FAO is supporting initiatives to expand trout farming in Lesotho (Box 2.3) and promote integrated rice–fish culture in Uganda (Box 2.4).

Resource-efficient, inclusive and low-impact aquaculture

Sustainable use of resources and effective ecosystem and farm management – supported by adequate integration of aquaculture into socially and environmentally responsible agrifood systems – constitute major drivers for sustainable aquaculture development. Expansion of fed aquaculture requires the diversification of sustainably sourced feed ingredients, improved feeding strategies and better practices (Box 2.5). Likewise, promoting the advantages and cultivation of extractive low-trophic aquatic species, such as oysters and algae, has gained momentum.

Seaweed farming in Latin America and the Caribbean

FAO has supported initiatives aligned with its Guidelines for Sustainable Aquaculture (GSA) to foster inclusive, sustainable seaweed aquaculture value chains in Latin America and the Caribbean (Figure 2.6).[9] These efforts have created employment opportunities for women and youth, strengthened their leadership roles, and improved access to technologies, resources and infrastructure that support resilient and profitable enterprises. FAO has also provided organizational, technical and business training for marginalized groups, while enhancing communication, advocacy and outreach for small- and medium-scale aquaculture.

Sea moss is a staple for many Caribbean islands, and some countries have built lucrative industries. FAO recently worked with Dominica and Grenada to develop sea moss value chains and implement industry upgrading strategies. Local ownership of these processes expanded sea moss programmes, increased productivity, encouraged public–private partnerships, and promoted coordination across the value chain and support services within public institutions.

In 2022, with FAO's support, Dominica introduced a commercial variety (*Eucheuma cottonii*) to improve yields and quality. The adoption of improved practices resulted in the production of over 2 300 kg of wet moss. Representing 48 percent of the workforce, women are actively involved in farming and post-production. With support through FAO's training-of-trainers approach, and increased coordination and investment from the public and private sectors, the industry is positioned for future growth. »

BOX 2.3 COMMERCIAL TROUT FARMING IN THE LESOTHO HIGHLANDS PAVES THE WAY FOR SECTOR DIVERSIFICATION AND EXPANSION

Lesotho is a small landlocked, high-altitude country, surrounded entirely by South Africa. Its economy is heavily dependent on South Africa, with large numbers of Batho women and men migrating to work there. The recent crisis in the country's export-oriented textile trade has left tens of thousands of people – mostly women – jobless, worsening the already fragile food security situation resulting from limited agricultural infrastructure, insufficient access to quality inputs (seed, feed, fertilizer), weak institutions, and droughts and erratic rainfall. As a result, Lesotho imports 80 percent of its food needs.

To address these challenges, FAO is supporting the Government of Lesotho through a multifaceted programme (2025–2028) for agrifood systems transformation. The programme aims to build technical and institutional capacities and foster equitable participation in agrifood value chains. It leverages Lesotho's waterbodies and agricultural land to catalyse climate-resilient agricultural practices, improve food security and create employment opportunities. Aquaculture is an important element of the programme.

Over the past two decades, the aquaculture sector in Lesotho has demonstrated its role in food security, employment and economic growth. Broadly, the country is divided into the Highlands (2 000–3 400 m) and the Lowlands (1 400–2 000 m). Driven largely by private sector trout farming in the Highlands (two large cage operations in Katse Dam and one small pond operation in the Thaba-Tseka District), aquaculture is today a key contributor to export revenue and employment. Since 2006, aquaculture production has increased by approximately 50.2 percent per year, reaching a total production of 2 107 tonnes (valued at USD 22.5 million in 2024). Rainbow trout (*Oncorhynchus mykiss*) represents a good share of the production and is a major source of export revenue (estimated at USD 8.6 million in 2024) from South Africa (89 percent) and the United States of America. Despite the increase in aquaculture production in the Highlands, the country continues to be a net importer of food products, with a low and declining degree of nutritional self-sufficiency and low annual per capita availability of aquatic animal foods (2.2 kg) in 2023.

In contrast, the potential of the aquaculture sector remains underutilized in the Lowlands, where the biophysical environment favours warm water species. In order to counter weak institutional frameworks, limited investment and lack of technical capacity, support is required, building on the sector's successes and lessons learned in the Highlands.

The ongoing FAO programme in the Highlands aims to expand its support to develop aquaculture in the Lowlands – increasing domestic food security, creating employment, diversifying livelihoods, and improving nutrition for vulnerable communities. The programme is addressing: (i) fisheries and aquaculture policy; (ii) national aquaculture development strategy; (iii) aquatic animal health; (iv) aquatic food safety regulatory framework; (v) identification of an aquaculture development zone in the Lowlands; (vi) training programmes on sustainable aquaculture practices for government officials and extension workers; and (vii) the establishment of farmer mentorship programmes for selected farmers with provision of essential equipment and inputs to enable their transition from subsistence to small-scale commercial farmers.



Fish cages at Kase Dam in the Lesotho Highlands
© Advance Africa Management Services



Fish pond in Mohale's Hoek District in the Lesotho Lowlands
© FAO/James McCafferty

BOX 2.4 INTEGRATED RICE–FISH CULTURE IN UGANDA

Uganda is pioneering integrated agriculture–aquaculture through the FAO–China South–South cooperation (SSC) project, which introduces the ancient Chinese tradition of integrating rice cultivation and fish farming. This practice, recognized by FAO as a Globally Important Agricultural Heritage System, has been used in China for over 2 000 years. It provides multiple environmental and economic benefits: rice paddies create a natural habitat and protection for fish, and in turn the fish fertilize and oxygenate the soil, feed on weeds and pests, and help maintain an ecological balance, reducing or eliminating the need for chemical fertilizers and pesticides.

Chinese aquaculture experts introduced the practice through hands-on demonstrations and training of Ugandan farmers. Fifty rice–fish demonstration sites have been established across more than 10 districts in the country. Over 1 200 farmers and 20 extension workers have received training in pond construction, water management, stocking, fish feeding using locally available materials, disease detection, and harvesting. As of September 2025, several farmers reported significant improvements in fish yields, producing over 100 kg of catfish and tilapia per aquaculture pond (average size 500 m^2), while simultaneously boosting rice harvests.

A scientific survey of Lake Albert successfully identified parent stocks of African sharptooth catfish (*Clarias gariepinus*) and Nile tilapia (*Oreochromis niloticus*) as best suited for rice–fish systems. A comprehensive fish farming technology manual – covering pond culture, disease control, organic feed and fertilizer use – has been published and distributed to farmers, ensuring that knowledge remains accessible and scalable.

Capacity building has also extended to national institutions. At the Aquaculture Research and Development Centre in Kajjansi, a resident Chinese expert works closely alongside Ugandan scientists to adapt the technology to local conditions. Three trials conducted on 1 215 m^2 parcels produced impressive results, yielding, respectively, 1 tonne of rice and 350 kg of catfish, 700 kg of rice and 650 kg of fish, and 750 kg of rice and 520 kg of fish.

The results demonstrate how SSC can facilitate knowledge exchange and accelerate sustainable transformation. Rice–fish culture not only increases food production and farm income, it enhances resilience by reducing dependence on costly inputs and promoting biodiversity. Building on the success of this pilot project, Uganda plans to scale up the technology nationwide, contributing to more sustainable aquaculture, increased food security, and improved rural livelihoods.



Fish pond with hapa nets at the Aquaculture Research and Development Centre, Kajjansi, Uganda
© FAO/Stuart Tibaweswa



An aquaculture expert advises Ugandan farmers, Butaleja District, Uganda
© FAO/Stuart Tibaweswa

BOX 2.5 IMPROVING AQUAFEED WITH LOCALLY AVAILABLE INGREDIENTS

Addressing feed availability, quality and management is fundamental to improve aquaculture production in many developing countries, in particular in Africa, which has significant, yet untapped potential. The FAO Blue Transformation calls for the adoption of "innovative technology and management to support the intensification and expansion of sustainable and resilient aquaculture systems".[2]

Key challenges faced by small-scale farmers include limited access to high-quality feed ingredients and suboptimal feeding management practices. To improve access to good quality and affordable feed, FAO has implemented targeted technical assistance projects to empower farmers with innovative feeding practices and feed management techniques, promoting locally sourced and affordable feed ingredients. These efforts foster efficient resource use, reduce reliance on imported feeds, and promote circular economy approaches in aquaculture.

Such FAO-supported interventions, complemented with stronger sectoral policies, have improved feed formulation, feed quality, nutrition and on-farm feed management. This has increased the availability of safe, affordable and high-quality aquafeeds, improved farm management, and reduced reliance on wild fish for feed. FAO's support for sustainable aquaculture development spans some 24 countries in Asia, Africa and Latin America, and has resulted in enhanced fish growth and farm profitability.

Furthermore, FAO has facilitated strong stakeholder collaboration during the implementation of these projects, bringing together government agencies, private sector actors, research institutes and local communities to catalyse the dissemination and scaling up of sustainable feed solutions. Concrete actions include strengthening regulatory frameworks and fostering public–private partnerships to accelerate the adoption of innovative technologies, such as precision feeding systems and ecofriendly feed formulations. These advances can support the transition towards more intensive aquaculture systems that are environmentally sustainable and economically viable.

The impact of these interventions is evident in improved livelihoods for smallholder farmers, increased food security, and the creation of aquaculture systems resilient to climate change and market fluctuations. However, to fully realize this potential, increased investment from the private sector, donors and governments is essential to expand access to finance, support local feed production, and leverage local knowledge.



Fish feed factory in Rwamagana District, Rwanda
© FAO/Jean Baptiste Nkurunziza



Microalgae production to feed rotifers in Al Wathba, United Arab Emirates
© FAO/FameMedia

FIGURE 2.6 SELECTION OF CULTURED SPECIES OF SEAWEED IN LATIN AMERICA AND THE CARIBBEAN



NOTE: a) Gracilaria (*Gracilaria* spp.); b) sea moss (*Eucheuma* spp.).

© FAO/Ali Elly

» In Grenada, long-time *Eucheuma cottonii* farmers strengthened their technical capacity through FAO trainings in production, post-harvest operations and drying. Application of the acquired best practices and techniques increased yields, efficiency and quality, attracting more farmers: the number of registered farmers rose from 35 in 2023 to 78 in 2025, of which 35 percent were women. This strong interest encouraged farmers to establish the first commercial sea moss farming association in 2024. Grenada's strategic plan includes the introduction of safety at sea measures, site mapping, and initiatives to support youth engagement and research and development. Combined efforts from all stakeholders have boosted investment and coordination, promoting the industry's continued growth.

To further support investment in the sea moss industry and its contribution to the growth of the region's blue economy, FAO developed materials including a regional production manual, instructional videos and guides, and business investment profiles and models. Stories of sea moss success were disseminated to showcase the impact of these initiatives.

In Brazil, seaweed harvesting of native species such as *Gracilaria* spp. can be traced back to the 1940s. However, overexploitation eventually depleted natural stocks. Between 2001 and 2006, FAO-supported projects promoted seaweed cultivation, but commercial success was limited due to seed shortages and costly laboratory-based production. Despite these setbacks, native seaweeds such as *Hypnea* spp. and *Gracilaria* spp. show strong potential for use in high-value-added products, including biocomposites (e.g. bioplastics for packaging and biomedical applications), cosmetics and nutraceuticals. In parallel, Brazil has focused on cultivating *Kappaphycus alvarezii*, a species currently grown in the states of Rio de Janeiro, São Paulo and Santa Catarina, where over 40 farms are active. These initiatives support diversification, enhance seaweed farming profitability, and encourage the sustainable use of marine biodiversity through science, innovation and local development.

Chile leads the seaweed farming sector in Latin America, particularly with *Gracilaria chilensis* cultivation. Although harvesting from natural beds still predominates, sustainable techniques and regulations have been introduced to support repopulation and diversification with species like *Macrocystis pyrifera*, *Sarcopeltis skottsbergii* and *Sarcothalia crispata*. To address persistent challenges in biosecurity, administrative procedures and genetic improvement, FAO and national counterparts launched projects on climate change adaptation in fisheries and aquaculture (2017–2021) and on marine-coastal governance (2022–2026) to promote restorative farming practices that offer environmental, social and economic benefits. FAO's support focuses on training, technology transfer, and promoting seaweed as a functional food, emphasizing the role of women and Indigenous Peoples. The FAO–Chile collaboration highlights the potential of seaweed farming for environmental sustainability, social equity and productive diversification.

In the Bolivarian Republic of Venezuela, the cultivation and commercial use of seaweed dates back to the early 1990s. In 1996, with FAO

FIGURE 2.7 MANGROVE OYSTERS (*CRASSOSTREA TULIPA*)



© FAO/Ali Elly

support, a workshop on seaweed cultivation and biotechnology was held in Cumaná. That same year, *Kappaphycus* cultivation was introduced; it was later exported for use in the carrageenan industry. Recent legal frameworks and private sector involvement have helped the Venezuelan seaweed industry to become the second-largest producer in the region after Chile, generating over 900 direct jobs in eastern fishing communities. Private companies and the Ministry of Fisheries and Aquaculture are further engaging women and youth, promoting value-added products and improving food security.

These initiatives showcase how FAO supports Members to upgrade aquaculture value chains, advancing inclusivity by creating opportunities for women and youth, and to achieve the Sustainable Development Goals related to fisheries and aquaculture. These include SDG 1 (No Poverty), SDG 2 (Zero Hunger), SDG 13 (Climate Action), SDG 14 (Life below Water) and SDG 17 (Partnerships for the Goals). These case studies from Latin America and the Caribbean demonstrate the transformative potential of a value chain approach: they address all steps – from input supply to processing and market access – while ensuring inclusivity to improve sustainable production and foster equitable participation. By positioning women and youth at the centre of FAO's activities, aquaculture can become a vehicle for empowerment, innovation and community resilience.

Oyster farming in the Gambia

In the Gambia, many coastal communities harvest and sell boiled or steamed mangrove oysters (*Crassostrea tulipa*, Figure 2.7) in local markets. However, there is an untapped opportunity for these communities to rear oysters that can be sold fresh to visitors and tourists. Unlocking this potential requires a shift from traditional harvesting methods to modern oyster farming techniques.

FISH4ACP,[t] an initiative of the Organisation of African, Caribbean and Pacific States (OACPS), implemented by FAO with funding from the European Union and the German Federal Ministry for Economic Cooperation and Development (BMZ), is supporting the Gambia's transition to modern oyster farming. At the same time, it is ensuring that economic improvements go hand in hand with social inclusiveness and environmental sustainability.

The oysters are farmed in mangroves, which not only provide attachment surfaces but also support the oysters' growth through water quality regulation, protection, habitat provision, and nutrient cycling. Approximately 90 percent of the 1 200 people employed in the oyster sector in the Gambia are women. Traditionally, women travel long distances across the mangroves in small canoes to reach wild harvesting sites. Using machetes, they collect oysters from mangrove roots where they grow in clusters in all shapes and sizes. These oysters are then boiled or steamed before they are sold at relatively low prices in local markets.

A market study conducted by FISH4ACP between 2023 and 2024 revealed that there is potential to access a higher-value market and improve the livelihoods of those involved. Hotels and restaurants have shown interest in serving fresh oysters, provided they are of high quality and certified as safe to eat.

With suitable water conditions and innovative equipment, communities now have the means to farm oysters that are the required commercial size and shape. These can be sold fresh at a much higher price than traditionally harvested wild oysters, bringing in more income to women in the sector.

t For further details, see: https://www.fao.org/fish4acp/en

Developing new and improved oyster farming methods

FISH4ACP in partnership with TRY Oyster Women's Association (TRY) (Box 2.6) has set up four pilot farms – in Kartong, Bulok, Kubuneh and Memmeh – to train women in modern oyster farming techniques. At these sites, new equipment (e.g. spat collectors, buoys, lines and grow-out bags) is improving farming efficiency.

Farming allows women to align harvests with the tourist season from November to March. It also ensures mangrove roots are left untouched, contributing to the Gambia's work to restore and preserve its mangrove ecosystems.

Careful quality testing is required to ensure fresh oysters are safe for consumption. FISH4ACP works with the Gambia's Department of Water Resources to classify oyster growing areas and assess contamination risks based on continuous monitoring of water and oyster flesh safety and quality. A facility equipped with depuration units processes the oysters into high quality and safe products for human consumption.

Improving oyster resources, value addition and marketing

Efforts to strengthen the Gambia's farmed oyster sector require the development of adequate policies and regulations on wild harvesting; these are crucial to ensuring sustainable resource use and mangrove preservation.

FISH4ACP supported the revision of a cockle and oyster co-management plan for the Tanbi Wetlands, a key oyster production area at the mouth of the Gambia River. This collaborative agreement between local authorities and communities establishes clear rules for managing shellfish resources within the region. It promotes stronger community involvement, sustainable harvesting, mangrove ecosystem health, and enhanced monitoring measures.

FISH4ACP and TRY facilitated the validation of a co-management plan for cockle and oyster harvesting in the Foni region, which gives these harvesters a voice in how local resources are managed, with women playing a central role in conservation efforts.

FISH4ACP and TRY are also supporting alternative livelihoods in the Gambia's oyster sector by helping women create value-added products for new markets. Training in handicrafts and jewellery teaches how to transform discarded oyster shells into keychains, earrings, necklaces and bracelets. Five hotel chains have already requested these products to sell to their guests, turning waste into income.

In the bordering nation of Senegal, FISH4ACP is working to improve the productivity and sustainability of the oyster value chain. Taking advantage of Senegal's more advanced fresh oyster industry, FISH4ACP organized an exchange so that Gambians could visit Senegalese farms and depuration facilities, fostering knowledge sharing and collaboration.

Likewise, FISH4ACP's work in the Gambia – specifically the successful swimming programme launched in 2024 to help Gambian women oyster harvesters navigate waterways safely and confidently – has inspired Senegal to introduce similar swimming courses.

By supporting harvesters to transition to sustainable farming, FISH4ACP is building a more productive and competitive oyster sector in the Gambia. These efforts empower communities to safely and sustainably tap into the fresh oyster tourist market, thus improving the livelihoods of women across the value chain.

Assessing, monitoring and reporting impacts of aquaculture development

Reliable data and analyses are necessary to support decision-making on sustainable aquaculture planning and management, monitoring and reporting. They must cover interactions with ecosystems, particularly in vulnerable habitats, including impacts associated with land use change and the conversion of natural ecosystems, such as mangroves, to aquaculture; social impacts, including gender-specific impacts and trends; and the sector's economic and technical performance. These data and analyses are important for the global monitoring of sustainable aquaculture development and the implementation of related international instruments (Box 2.7).

BOX 2.6 WOMEN OF THE GAMBIA JOIN HANDS FOR SUSTAINABLE OYSTER FARMING

In the Gambia, women are central to the small-scale mangrove oyster fishery. Oyster harvesting, largely in the Tanbi Wetlands National Park and nearby coastal regions, provides food and income for hundreds of households. For decades, women harvesting oysters from mangrove roots at low tide to sell on local markets have faced limited recognition, unsafe working conditions and insecure livelihoods.

Community initiatives and institutional reforms have been key to igniting change towards more equitable and sustainable conditions for women oyster collectors. At community level, TRY Oyster Women's Association (TRY), which comprises over 500 members, advocates for collective management of oyster resources in the Gambia.

TRY has contributed to the implementation of targeted practices for mangrove restoration and the integration of seasonal closures, while promoting the collectivization of women with the overall target of safeguarding breeding habitats for oysters. The FAO FISH4ACP project, an initiative of the Organisation of African, Caribbean and Pacific States (OACPS), implemented by FAO with funding from the European Union and the German Federal Ministry for Economic Cooperation and Development (BMZ), has provided support to TRY to train women in new oyster farming methods, farm management and market diversification. In the same area of the country, thanks to the support of the Gambia Navy, women have had the opportunity to join swimming courses to increase personal safety and awareness during oyster collecting activities. These efforts contribute to making the country's oyster sector more socially, economically and environmentally sustainable.

Community action is fundamental to drive change at local level, while institutional support has proven vital to increase the impact of these initiatives: in 2023, a Gender Desk was established within the Ministry of Fisheries to mainstream gender into policies, create equitable mechanisms and expand women's decision-making power across the board. The Gender Desk permits ministry employees to acquire relevant skills and empowerment to act as gender champions, thus creating an enabling environment where women are recognized as resource managers and leaders in the Gambian fisheries sector.

The twin-track approach – specific interventions supported by projects combined with gender mainstreaming across ministries – demonstrates the potential of gender-responsive governance to support value chain development, equitable livelihoods and sustainable ecosystems. The restoration of mangroves not only leads to healthier and more productive oyster populations, but also protects coastlines and maintains biodiversity, while acting as a natural barrier against the effects of climate change. At the same time, women organized in collectives have greater visibility and gain bargaining power; they have a louder voice in resource management decisions and are empowered to engage as stewards of vital aquatic natural resources.

The case of TRY Oyster Women's Association provides strong evidence that inclusive approaches recognizing and supporting women are essential for sustainable fisheries and aquaculture. It is a striking example of women's role in sustainable agrifood systems and natural resource management – a central topic during the United Nations International Year of the Woman Farmer 2026, marked by celebrations and calls for action throughout the year.



Women learn how to swim in the Gambia River, Old Jeshwang, Gambia
© FAO/Jason Florio



Oyster harvester paddling her canoe in the Gambia River, Memmeh, Gambia
© FAO/Njapu Njie

BOX 2.7 MONITORING SUSTAINABLE AQUACULTURE DEVELOPMENT THROUGH THE CCRF AQUACULTURE QUESTIONNAIRE

The sustainable development of aquaculture requires effective governance, planning, cooperation and the ability to monitor environmental, social and economic outcomes. Since 2013, FAO has supported monitoring work through the Code of Conduct for Responsible Fisheries (CCRF) Aquaculture Questionnaire, a tool for tracking global implementation of Article 9 of the CCRF.

Recognizing the rapid evolution of the aquaculture sector since the CCRF's endorsement in 1995, FAO has revised the questionnaire to better reflect current priorities and orientations, such as those outlined in the Guidelines for Sustainable Aquaculture (GSA). The updated questionnaire aligns with the GSA's six key domains: performance and trends; governance and planning; ecosystem and farm management; social responsibility; value chains, market and trade; and support mechanisms and services for sustainable aquaculture development.

The revised questionnaire replaces the original 0–5 scoring system with clearer Yes/No responses and structured follow-up options. These improvements are designed to enhance consistency, comparability, and the capacity of Members and regional bodies to benchmark aquaculture governance and performance across jurisdictions. It also allows better integration of sustainability indicators relevant to the Sustainable Development Goals and FAO's Blue Transformation Roadmap.

Following the recommendations of the Sub-Committee on Aquaculture in 2023 to strengthen communication with the Secretariat, FAO invited Members to nominate national focal points (NFPs) to enhance coordination. As of July 2024, 65 NFPs had been nominated, with 14 providing detailed feedback on the draft revised questionnaire. Following an expert consultation workshop held in Bangkok (May 2024), the questionnaire was condensed into 70 questions across the six key domains. The revisions ensure it captures emerging issues such as biosecurity, climate change resilience, social equity, and integration within overall agrifood systems.

This revised monitoring approach is expected to support more responsive and data-driven decision-making by governments and stakeholders. It also enables a better regional and global understanding of aquaculture's progress and challenges. The questionnaire continues to be a foundational tool in assessing compliance with responsible and sustainable aquaculture principles, shaping national strategies, and guiding technical assistance, policy advice and investments.

The updated CCRF Aquaculture Questionnaire will be instrumental in FAO's work under the Blue Transformation Roadmap and Guidelines for Sustainable Aquaculture. Members, international and regional organizations and networks can jointly measure and strengthen sustainable aquaculture development globally.

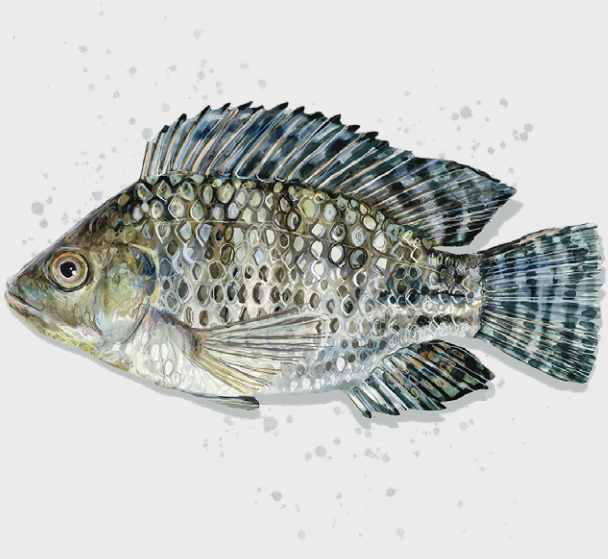


Cage fish farming in Antananarivo, Madagascar
© FAO/Rijasolo



Aquaculture farm in Limassol, Cyprus
© FAO/Giuseppe Carotenuto

FIGURE 2.8 NILE TILAPIA (*OREOCHROMIS NILOTICUS*)



© FAO/Ali Elly

Informed decision-making in the Zimbabwean tilapia value chain

Despite the abundant water resources of Zimbabwe, aquaculture remains underdeveloped and there is significant untapped potential to boost fish production, with direct benefits to enhance national food security and nutrition and improve rural livelihoods.

FISH4ACP, an initiative of the Organisation of African, Caribbean and Pacific States (OACPS), implemented by FAO with funding from the European Union and the German Federal Ministry for Economic Cooperation and Development (BMZ), is driving efforts to unlock this potential by developing Nile tilapia farming in Zimbabwe (Figure 2.8). By supporting small-scale tilapia farmers, particularly women, youth and marginalized groups, FISH4ACP aims to improve incomes and employment opportunities across the value chain.

Building a productive, socially inclusive, and sustainable aquaculture sector in Zimbabwe requires, among other things, informed decision-making guided by reliable data and evidence; public institutions and private operators need to be provided with up-to-date information on fish farmers and their specific needs.

An analysis of Zimbabwe's Nile tilapia value chain conducted from 2021 to 2022 revealed the need for stronger institutional capacity in collecting and analysing data. With the necessary information, the government would be able to identify fish farmers and provide them with the training, services and resources they need to improve their knowledge, businesses and operations.

To help bridge the information gap, FAO and Zimbabwe's Ministry of Lands, Agriculture, Fisheries, Water and Rural Development (MLAFWRD) joined forces to carry out landmark aquaculture sector surveys across the nation.

Efforts kicked off in 2023, with a pilot survey covering Manicaland Province. Supervisors and enumerators from MLAFWRD received training on how to collect and analyse data from the ground up. For ten days, they surveyed 500 farms, riding motorbikes along narrow roads and over rough rural terrain, collecting the necessary data, which were uploaded instantly via a mobile app. Inefficiencies and errors were addressed quickly thanks to real-time supervision and coordination via a mobile messaging app and through virtual and in-person meetings.

The survey gathered comprehensive data that mapped the location and number of farms, production volumes, species reared, fingerling supply, and feed usage.

It was found that the extent of tilapia farming in Zimbabwe had been dramatically underestimated. The survey identified around 2 000 farms in Manicaland alone, well over the previous estimate of 600 farms nationwide, indicating levels of fish production and consumption that far exceeded expectations.

The data also revealed the fast pace of aquaculture growth, confirming the need for increased support to small-scale fish farmers. While 27 percent of farms were established in the past five to ten years, a remarkable 62 percent had emerged in just two years, from 2022 to 2023.

Thanks to the strong leadership of MLAFWRD and the high level of participation among farmers in the region, the pilot survey was a success. It supports the provision of better services to small-scale fish farmers in Manicaland and serves as a model to expand nationwide.

Subsequently, MLAFWRD rolled out new regional aquaculture surveys in 2024 and 2025 to cover three additional provinces in Zimbabwe, with another three provinces set to follow. The data collected are already being used by FISH4ACP to target activities on the ground.

The surveys revealed that small-scale fish farmers are struggling with access to quality fingerlings and with the high cost of feed. To help overcome these issues, FAO is helping farmers both to source good quality fingerlings and to produce low-cost, sustainable feed using local ingredients.

Using data on fingerling demand and farm locations, FAO and the Zimbabwe Fish Producers Association, in collaboration with the Department of Fisheries and Aquaculture Resources, have established certified fingerling distribution hubs in key areas of Manicaland and Masvingo. These hubs help reduce transportation costs and fish mortality rates by bringing quality fingerling supply closer to fish farmers, thus supporting cost-efficient production.

In addition, FAO has partnered with Chinhoyi University of Technology to research and promote the use of larvae of black soldier fly (*Hermetia illucens*). This protein-rich alternative to fishmeal allows fish farmers to produce low-cost feed with minimal environmental impact (see Box 39 in the 2024 edition of this report).[10]

The data gathered through these field surveys lay the groundwork for better policies, targeted support, and stronger coordination within Zimbabwe's aquaculture value chain. With the foundations laid, both public and private institutions can coordinate tangible action to bring vital resources closer to small-scale fish farmers, provide hands-on training in sustainable practices, and increase participation among under-represented groups within the sector.

In conclusion, informed decision-making is key to unlocking the full potential of Zimbabwe's aquaculture sector. It empowers government institutions and fish farmers, facilitating the country's efforts to improve production and livelihoods across the tilapia value chain.

Smart aquaculture biosecurity: leveraging big data for sustainable shrimp farming in Peru

Shrimp farming in Peru has become an important source of livelihoods and export earnings, particularly along the northern coast. Yet, as in many shrimp-producing nations, the sector faces the threat of disease outbreaks that can significantly undermine production and income. Losses caused by white spot disease alone are estimated at up to 30 percent of annual output. Traditionally, farmers relied on visual observations and laboratory results that often arrived too late to prevent high mortalities once the disease had spread.

In 2025, Peru piloted a new digital system for early warning and risk management through FAO's Smart Aquaculture Biosecurity project, supported by the Republic of Korea. This initiative applies an integrated approach to detect risks early and address them effectively. In Peru, the project integrated multiple data streams: water quality sensors installed in ponds, mobile applications to allow farmers to record daily management and health observations, satellite data on rainfall and temperature anomalies, and diagnostic results from national laboratories. These data were consolidated in a digital platform operated by the Ministry of Production, with technical support from FAO and local universities. Using machine-learning models, the platform generates health risk alerts disseminated rapidly to farmers and the authorities for preventive action.

The impact has been tangible. "We used to find out about disease only when shrimp began dying, and by then, it was too late," explained a farmer from Tumbes. With the new system, farmers receive alerts in time to adjust feeding and water exchange. Farmers also report greater confidence in investing in preventive measures once the risks are more predictable.

The Peruvian experience confirms that preventive biosecurity enabled by digital tools is more cost-effective than crisis response. Farmers' participation and trust are essential for data-driven systems to succeed, and institutional commitment is essential to sustain national platforms and expand them beyond pilot areas.

This approach can have broader global application in other fish farming countries, and it aligns closely with FAO's Blue Transformation and the Guidelines for Sustainable Aquaculture. It demonstrates how big data can strengthen aquaculture biosecurity not only in large-scale operations, but also in small- and medium-scale farms, where disease risks are equally high. By showing how digital tools can reduce losses and increase competitiveness, the Peruvian case illustrates the potential of smart biosecurity approaches as a cornerstone of sustainable aquaculture worldwide. ■

TOWARDS EFFECTIVE MANAGEMENT OF ALL FISHERIES

Supporting regional cooperation to expand global fisheries management

Regional cooperation is essential for the effective management of global fisheries and for safeguarding livelihoods and food security. A significant proportion of global fish catches originate from migratory, transboundary, straddling and high seas fish stocks, and with climate change foreseen to drive increased movement and redistribution of stocks by the end of the century, cooperative management is becoming increasingly important.

Regional fishery bodies are key to facilitating state cooperation towards the adoption and implementation of measures for the effective conservation and management of transboundary aquatic species. These actions cover research, management, monitoring and enforcement in a broad range of areas, covering migratory and transboundary stocks, as well as deep-sea fisheries.[11] They support achieving the 2030 Sustainable Development Agenda, in particular SDG Target 14.4 aiming to "effectively regulate harvesting and end overfishing, illegal, unreported and unregulated fishing and destructive fishing practices and implement science-based management plans".

Regional initiatives supporting sustainable fisheries management

The number of RFBs has grown steadily over the past five decades (Figure 2.9) in line with the need to ensure global coverage and address the growing complexity of challenges faced by world fisheries. There are currently over 50 RFBs globally (Figure 2.10), including 22 regional fisheries management organizations (RFMOs) mandated to adopt legally binding conservation and management measures, and 34 regional fisheries advisory bodies (RFABs), which provide scientific and technical advice to member countries and facilitate cooperative management. Regional fisheries management organizations now cover around 95 percent of the catch taken in the high seas.

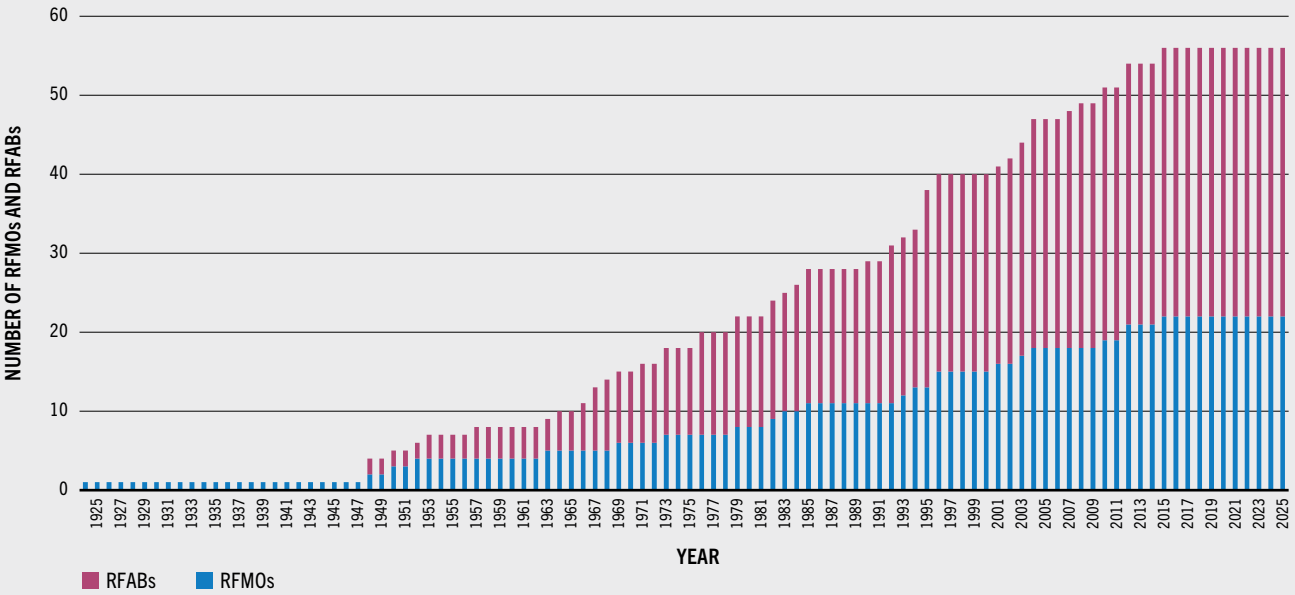
In addition to managing the secretariats of four RFMOs and seven RFABs,[u] FAO assumes the Secretariat of the RFB Secretariats' Network (RSN),[v] which fosters dialogue, coordination, and knowledge exchange among RFBs globally. FAO also promotes sustainable management of transboundary fisheries through the activities of the Fisheries and Resources Monitoring System partnership (FIRMS),[w] the Common Oceans Programme and the EAF-Nansen Programme (Box 2.8). Together, these initiatives underscore FAO's commitment to inclusive, science-based and cooperative regional approaches that ensure the long-term sustainability of fisheries and food security of the communities that depend on them. All these actions are guided and overseen by FAO – its Members and management – through the FAO Committee on Fisheries (COFI), and its

u RFMOs: Central Asian and Caucasus Fisheries and Aquaculture Commission (CACFish), General Fisheries Commission for the Mediterranean (GFCM), Indian Ocean Tuna Commission (IOTC), Regional Commission for Fisheries (RECOFI). RFABs: Asia-Pacific Fishery Commission (APFIC) (activity suspended until 2028), Fishery Commission for the Eastern Central Atlantic (CECAF), Committee on Inland Fisheries and Aquaculture of Africa (CIFAA), Commission for Small-Scale, Artisanal Fisheries and Aquaculture of Latin America and the Caribbean (COPPESAALC), European Inland Fisheries and Aquaculture Advisory Commission (EIFAAC), Southwest Indian Ocean Fisheries Commission (SWIOFC), Western Central Atlantic Fishery Commission (WECAFC).

v For further details, see: https://www.fao.org/fishery/en/rsn

w For further details, see: https://firms.fao.org/firms/home/en

FIGURE 2.9 ESTABLISHMENT OF REGIONAL FISHERIES MANAGEMENT ORGANIZATIONS AND ADVISORY BODIES OVER TIME



NOTES: RFAB – regional fisheries advisory body; RFMO – regional fisheries management organization. The number of RFMOs is based on the date of the entry into force of the convention or agreement, or where that is not available, the commonly understood year of commencement.

SOURCE: Author's own elaboration.

subcommittees on fisheries management and on fish trade, to help shape global and regional fisheries governance.

At the Thirty-sixth Session of COFI in 2024, Members reaffirmed the critical role of RFBs in achieving effective fisheries management, implementing international instruments, addressing climate change impacts, and integrating biodiversity concerns into the conservation and sustainable use of aquatic living resources. The following illustrates the work of RFBs and FAO in this respect.

Addressing overfishing in the Mediterranean and Black Sea

The General Fisheries Commission for the Mediterranean (GFCM) has made major strides in fisheries and aquaculture governance within a complex multispecies environment. Over the past decade, it has strengthened its science–policy interface, leading to the adoption of 11 multiannual management plans and the creation of 11 fisheries restricted areas (FRAs). These spatial measures, which include a large area comprising depths of over 1 000 m, now cover 60 percent of the Mediterranean and Black Sea. Together, multiannual management plans and FRAs have reduced fishing pressure by 30 percent, supporting the recovery of key species like European hake (*Merluccius merluccius*) and common sole (*Solea solea*). Despite ongoing challenges, the region is showing clear progress in reversing overexploitation of species under active management.[12]

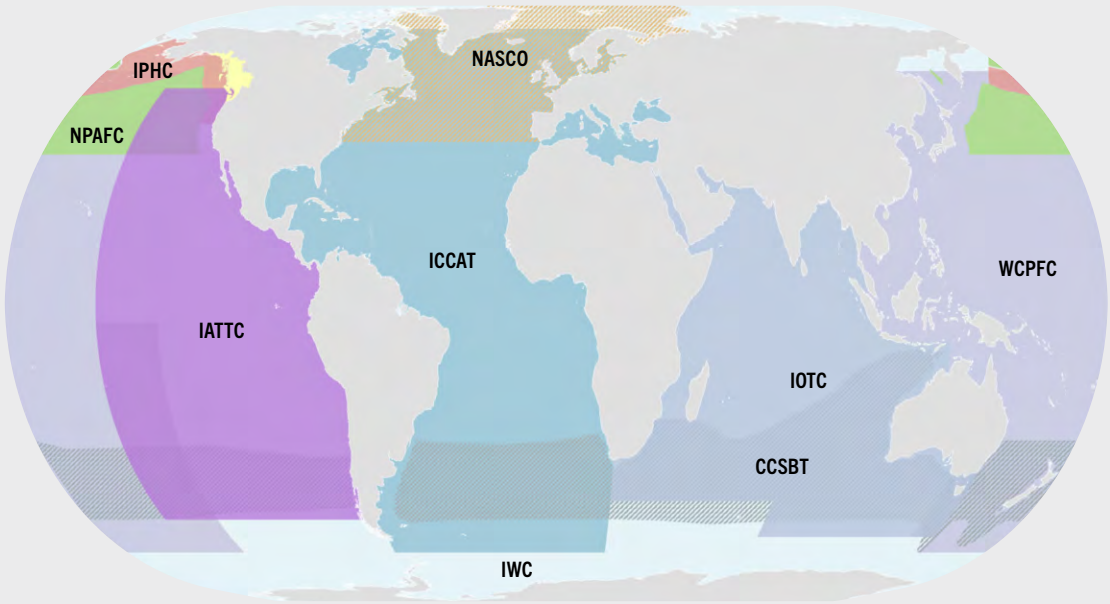
Advancing the management of deep-sea fisheries

Deep-sea fisheries[x] for species such as alfonsino *(Beryx decadactylus)*, orange roughy *(Hoplostethos atlanticus)* and Greenland halibut »

x Deep-sea fisheries are generally regarded as those fisheries where the total catch includes species that can only sustain low exploitation rates and that deploy gears that are likely to contact the seafloor during the normal course of fishing operations.[13]

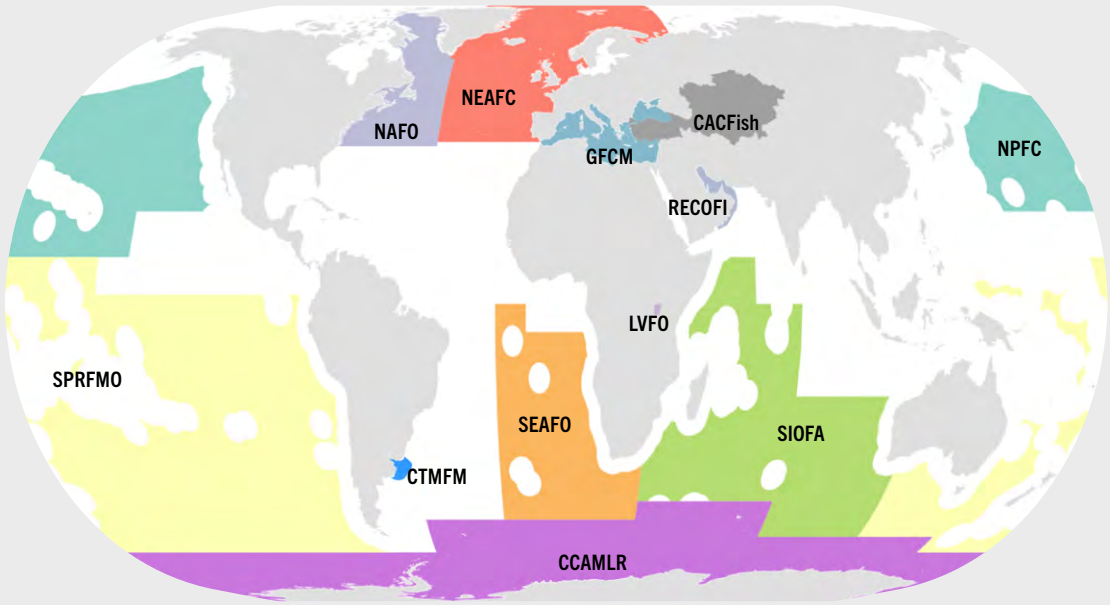
FIGURE 2.10 GEOGRAPHICAL COVERAGE OF THE MANDATES OF SPECIES-SPECIFIC AND GENERAL REGIONAL FISHERIES MANAGEMENT ORGANIZATIONS

A) SPECIES-SPECIFIC RFMOs



- International Commission for the Conservation of Atlantic Tunas (ICCAT)
- Commission for the Conservation of Southern Bluefin Tuna (CCSBT)
- Inter-American Tropical Tuna Commission (IATTC)
- Indian Ocean Tuna Commission (IOTC)
- International Pacific Halibut Commission (IPHC)
- North Atlantic Salmon Conservation Organization (NASCO)
- North Pacific Anadromous Fish Commission (NPAFC)
- Pacific Salmon Commission (PSC)
- Western and Central Pacific Fisheries Commission (WCPFC)
- International Whaling Commission (IWC)

B) GENERAL RFMOs



- Central Asian and Caucasus Regional Fisheries and Aquaculture Commission (CACFish)
- Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR)
- Joint Technical Commission of the Maritime Front (CTMFM)
- General Fisheries Commission for the Mediterranean (GFCM)
- Northwest Atlantic Fisheries Organization (NAFO)
- North East Atlantic Fisheries Commission (NEAFC)
- North Pacific Fisheries Commission (NPFC)
- Regional Commission for Fisheries (RECOFI)
- South East Atlantic Fisheries Organization (SEAFO)
- Southern Indian Ocean Fisheries Agreement (SIOFA)
- South Pacific Regional Fisheries Management Organisation (SPRFMO)
- Lake Victoria Fisheries Organization (LVFO)

Refer to the disclaimer on the copyright page for the names and boundaries used in these maps.

NOTE: RFMO – regional fisheries management organization.

SOURCE: Authors' own elaboration.

BOX 2.8 EAF-NANSEN PROGRAMME SUPPORTS THE MANAGEMENT OF SARDINELLA STOCKS IN NORTHWEST AFRICA

Sardinella species (*Sardinella aurita* and *S. maderensis*) represent important small pelagic fish resources in Northwest Africa, sustaining food security, nutrition and livelihoods for millions of people. These species are central to artisanal and industrial fisheries and constitute a key source of affordable animal protein and nutrients, especially for low-income households. The stocks migrate across the waters of Mauritania, Senegal, the Gambia and Guinea-Bissau, following the seasonal dynamics of the Canary Current upwelling system. Their transboundary nature makes regional cooperation essential for long-term sustainability. Recent scientific assessments by the Fishery Committee for the Eastern Central Atlantic (CECAF) confirmed the overexploited status of these stocks and recommended substantial reductions in fishing mortality.

The EAF-Nansen Programme* has been assisting CECAF and its Members and the Subregional Fisheries Commission (SRFC) to apply the ecosystem approach to fisheries and strengthen the science–policy interface for sustainable fisheries management. In 2021, the EAF-Nansen Programme launched the Shared Sardinella initiative** that combines regional and national actions for sustainable fisheries management in Northwest Africa. First actions were in the Gambia and Senegal in 2021, followed by Mauritania in 2023, and Guinea-Bissau and SRFC in 2024. The programme provides integrated support combining scientific research, fisheries data collection, capacity development and policy facilitation. Pelagic surveys by the Programme's research vessel *Dr. Fridtjof Nansen* have generated fisheries-independent data on sardinella stock status, distribution and environmental drivers. Technical assistance to CECAF has supported regular stock assessments, improving the scientific basis for management advice.

At the national level, the programme has facilitated the translation of scientific recommendations into concrete management actions. The Gambia and Senegal have developed EAF-aligned fisheries management plans for sardinella through participatory consultation processes. Mauritania has strengthened its biological and socioeconomic data collection systems to support implementation of its small pelagic species management plans. Guinea-Bissau is developing a management plan aligned with EAF, through extensive stakeholder consultations that have identified management priorities and risks.

In 2024, the programme partnered with SRFC to develop a regional management framework for sardinella stocks with the aim to coordinate management efforts, harmonize national measures, and operationalize CECAF's scientific recommendations across the subregion. A 2025 policy brief endorsed by the SRFC Conference of Ministers identifies coordinated measures to achieve a 60 percent reduction in fishing mortality, synchronized seasonal closures, an 18 cm minimum landing size, nursery area protection, fishing capacity control, and prioritization of catches for direct human consumption over fishmeal production. In parallel, a regional framework for management of shared sardinella stocks is under development.

This collaboration demonstrates how scientific evidence, institutional cooperation and stakeholder engagement can converge to address transboundary resource management challenges. The EAF-Nansen Programme's sustained support has been instrumental in bridging science and policy while building regional capacity for adaptive management. Moving forward, continued political commitment and alignment of national measures with the emerging regional framework will be critical for rebuilding sardinella stocks and securing their vital contribution to regional food security and economic stability.

NOTES: * The EAF-Nansen Programme, launched in 1975, is implemented by FAO in close collaboration with the Norwegian Institute of Marine Research and funded by Norway; it supports thirty-two partner countries in Africa and the Bay of Bengal in implementing an ecosystem approach to fisheries to achieve sustainable fisheries that improve food and nutrition security. See: https://www.fao.org/in-action/eaf-nansen/en. ** For further details, see: https://openknowledge.fao.org/handle/20.500.14283/cb3867en





Sardinella fishing with drift nets (left) and processing (right), Senegal
© FAO/Ibrahima Mbengue

» *(Reinhardtius hippoglossoides)* have been operating in areas beyond national jurisdiction (ABNJ) since the 1970s. To address biodiversity conservation concerns of deep-sea fisheries, expressed regularly at the United Nations General Assembly (UNGA) (e.g. Resolutions 59/25, 61/105), in 2008 FAO adopted the International Guidelines for the Management of Deep-sea Fisheries in the High Seas.[13] Since then, the number of RFMOs managing deep-sea fisheries has doubled and there has been a threefold increase in regulated areas in the ABNJ. Most ocean areas are now covered by international or regional instruments with general management or advisory mandates covering deep-sea fisheries.

Deep-sea RFMOs have adopted a variety of spatial and temporal measures, such as delimiting or closing bottom fishing areas. These measures have resulted in more than 80 percent of areas regulated by RFMOs being either permanently or temporarily not open to bottom fishing, and the establishment of 182 new vulnerable marine ecosystem sites to protect fragile habitats of deepwater corals and sponges.[14, 15] With support from the FAO Common Oceans Deep-sea fisheries project, deep-sea RFMOs are improving the implementation of the ecosystem approach to fisheries management. There is increased recognition of the benefits of dialogue between scientists and managers, cross-sectoral collaboration, longer-term management plans for priority stocks, and incorporation of impacts of climate change and species interactions into management and decision-making.

Driving improvements in tuna sustainability through the RFMOs

Tuna fisheries span the globe, support millions of livelihoods, and are vital for food security, especially in coastal and island nations. The global tuna market is worth around USD 40 billion annually,[16] with commercial tuna species landings estimated at 5.9 million tonnes in 2024, accounting for 6.5 percent of global marine capture fisheries production.

To manage migratory tuna stocks across exclusive economic zones (EEZs) and high seas, more than 85 governments cooperate through five tuna RFMOs[y] covering 23 major commercial tuna stocks. These RFMOs implement binding management and conservation measures including catch and effort limits, gear restrictions, monitoring (Box 2.9) and reporting obligations, compliance frameworks, spatial and temporal measures, and precautionary management procedures.

Tuna RFMOs have also made significant strides in science-based decision-making, including through the expansion of data collection and assessment efforts beyond major commercial stocks to include small-scale tuna fisheries. Over the past 20 years they have implemented management procedures (MPs), also known as harvest strategies, that use stock abundance indicators and pre-agreed reference points to guide management decisions.

Currently, eight commercial tuna stocks, representing more than half of annual global production, are managed under MPs, and development is underway for an additional eleven stocks. The adoption of MPs has led to more consistent, transparent, streamlined decision-making and effective management. The Common Oceans Tuna project[z] is supporting the development and implementation of MPs, including through the FAO elearning Academy course on management procedures for sustainable tuna fisheries.[aa] These efforts have resulted in significant improvements in the status of tuna stocks over the past two decades. At the turn of the twenty-first century, roughly 28 percent of tuna stocks were overfished and only about 66 percent of landings were from sustainable stocks.[14] According to the latest data, 91.3 percent of tuna stocks were sustainably fished in 2023, with 99 percent of catch volumes coming from biologically sustainable tuna stocks.

y Commission for the Conservation of Southern Bluefin Tuna (CCSBT), Inter-American Tropical Tuna Commission (IATTC), International Commission for the Conservation of Atlantic Tunas (ICCAT), Indian Ocean Tuna Commission (IOTC), and Western and Central Pacific Fisheries Commission (WCPFC).

z For details, see: https://www.fao.org/in-action/commonoceans/what-we-do/tuna-fisheries/en

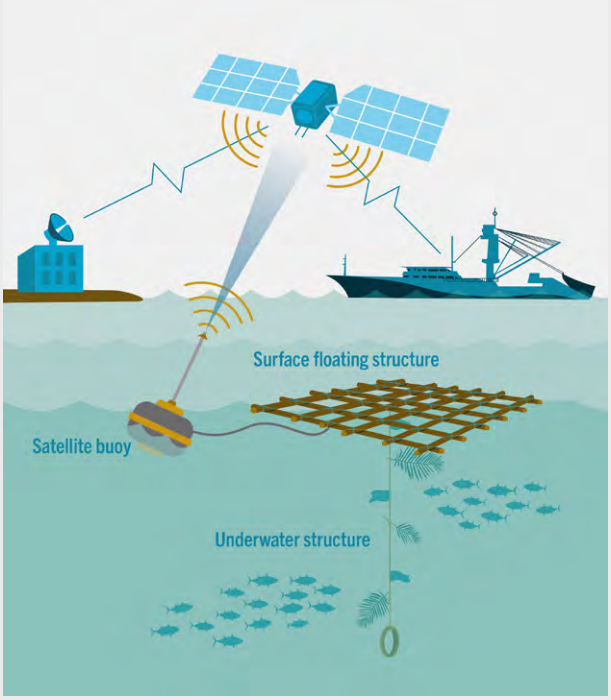
aa Released in October 2025, the course is available at: https://elearning.fao.org/course/view.php?id=1190

BOX 2.9 ADVANCING THE MONITORING AND MANAGEMENT OF DRIFTING FISH AGGREGATING DEVICES IN THE INDIAN OCEAN

Global production of tropical tunas has for years been steadily increasing, reaching around 5 million tonnes in recent years.[17] About one-third of this catch is taken by large-scale industrial purse seine vessels fishing on tuna schools associated with drifting fish aggregating devices (dFADs). These devices are floating structures of various designs and materials, equipped with satellite-linked buoys that transmit their position and echo-sounder estimates of fish biomass, enabling continuous remote monitoring and optimization of fishing activity.

The widespread use of dFADs has greatly enhanced the efficiency and productivity of purse seine fisheries worldwide. However, it has also raised concerns about their impact on tuna stocks, particularly high catches of juvenile tuna, as well as broader environmental effects. Lost or abandoned dFADs contribute to marine debris, can damage coral reefs when they strand, and may cause "ghost fishing" mortality of sharks and turtles through entanglement.

MAIN COMPONENTS OF A DRIFTING FISH AGGREGATING DEVICE



SOURCE: Adapted from ISSF 2019. Non-Entangling and Biodegradable FADs guide. Washington, DC. In: *ISSF*. [Cited 10 November 2025]. https://www.iss-foundation.org/about-issf/what-we-publish/issf-documents/non-entangling-and-biodegradable-fads-guide-english

Indian Ocean case study

In the Indian Ocean, large-scale purse seine fisheries have expanded substantially since the early 1980s, targeting tropical tunas for the canning industry. Most dFAD-associated catches occur in the western Indian Ocean and account for about one-quarter of total tropical tuna catches, or roughly 300 000 tonnes annually. Around 40–50 purse seine vessels, each about 90 metres in length, have operated in the region over the past decade.

Although dFADs have long been recognized as key components of purse seine fishing effort, little information on their design, deployment and use was initially available to the Indian Ocean Tuna Commission (IOTC), constraining its capacity to assess their contribution to fishing effort and tuna mortality. From the early 2010s, the IOTC adopted a series of dFAD-related resolutions to improve monitoring, limit fishing effort, and mitigate marine pollution, ghost mortality and coastal ecosystem impacts.

In 2012, the IOTC adopted its first resolution requiring Members operating purse seine vessels to develop national dFAD management plans by the end of 2013. The aim was to enhance data collection to inform management measures, such as temporary dFAD fishing closures, thus reducing the capture of juvenile bigeye (*Thunnus obesus*) and yellowfin (*T. albacares)* tunas and non-target species. Subsequent amendments introduced requirements for dFAD marking, detailed reporting on dFAD designs and activities, limits on buoy numbers, and promotion of non-entangling and biodegradable dFAD designs to minimize their ecological footprint (see figure).

Since 2020, Members have been required to report daily buoy positions to the IOTC Secretariat for dFAD tracking, and the Commission is developing recovery procedures for lost or derelict dFADs. To further strengthen monitoring and compliance, the IOTC is establishing a regional dFAD registry to enable near real-time tracking of authorized devices and provide a central platform for overseeing dFAD activities across the Indian Ocean.

The IOTC Working Group on FADs, established in 2017, has been instrumental in analysing dFAD data and providing technical advice to the Scientific Committee. Through a series of dFAD-related resolutions, the IOTC has positioned itself at the forefront of efforts to manage purse seine fisheries using dFADs, broadening its focus from tuna stock management to wider ecosystem considerations.

Improving inland fisheries through multisectoral collaboration

Inland fisheries face pressures beyond fishing itself: habitat degradation, altered water flows, pollution, and competing demands for water all shape their sustainability. Globally, there are 192 basin management organizations (BMOs), organized under the International Network of Basin Organizations (INBO), while eight RFBs specifically address inland fisheries. By embedding inland fisheries within existing basin management processes, countries can tap into these extensive networks and strengthen fisheries' role in water governance.

When combined with ecosystem-based approaches from other sectors (e.g. agriculture, forestry, water management), the ecosystem approach to fisheries can be a powerful tool to address these interlinked threats in a coordinated way. To support the integration of the ecosystem approach to fisheries (EAF) into land and water planning, FAO has developed an intersectoral framework that helps bring inland fisheries into basin governance, fostering collaboration among RFBs, BMOs and partners from other sectors. Pilot initiatives underway in Lake Victoria, the Amazon, the Mekong and Lake Titicaca have BMOs ready to actively engage in the integration of inland fisheries in their activities, to enhance sustainability and food security.

Fostering cooperative regional monitoring, control and surveillance approaches

Regional cooperation in fisheries monitoring, control and surveillance (MCS), including information sharing and joint enforcement, is an important component of managing shared stocks. Regional MCS frameworks target activities across flag, coastal and port states to combat IUU fishing at all stages, from pre-fishing to post-harvest and trade.

Ongoing initiatives being implemented by RFMOs include vessel monitoring systems (VMS), catch documentation schemes, and high seas inspection programmes. Activities of MCS are also implemented or supported by RFABs in some regions, and some RFMOs and RFABs have arrangements to share information, including for the purposes of vessel tracking and IUU vessel lists.

Regional MCS centres in the Gambia and Ghana support regional VMS, regular intelligence sharing and joint surveillance operations in the Member States of relevant RFBs in West Africa. Likewise, Pacific Island countries implement a regional MCS approach that includes data sharing, standardized requirements for vessel reporting, a regional observer programme, sharing of patrol assets, joint compliance operations, and a Regional Fisheries Surveillance Centre. These cooperative activities have resulted in notable reductions in IUU fishing activity in Pacific tuna fisheries.

Promoting equitable access to resources and services

Small-scale fisheries provide 90 percent of employment in capture fisheries and support the livelihoods of around 500 million people.[18] They continue to play a critical role in local food security and nutrition, sustainable livelihoods, poverty eradication, and healthy ecosystems. In 2014 the FAO Committee on Fisheries endorsed the Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries in the Context of Food Security and Poverty Eradication (SSF Guidelines), making it the first internationally negotiated instrument providing guidance on needs, policies and actions for the long-term social, economic and environmental viability of small-scale fisheries.

Implementation of the SSF Guidelines is fundamental for achieving SDG Target 14.b: "Provide access for small-scale artisanal fishers to resources and markets" by supporting equitable access of fishing communities to resources and livelihoods and active participation in management.

Implementing the SSF Guidelines through dedicated national plans of action

While global and regional policy processes and organizations have embraced the SSF Guidelines,[ab] frequently the lack of an enabling environment and adequate support impedes their application at national and local levels.

ab For details of global and regional milestones, see SSF Guidelines uptake and influence, available at: https://openknowledge.fao.org/server/api/core/bitstreams/14e7419c-d956-40e5-a468-0b94eaa92b4f/content

To address these gaps, FAO encourages the development of National Plans of Action for Small-Scale Fisheries (NPOAs-SSF) – a systematic and holistic national framework to adapt and implement the Guidelines at national level.

The NPOA process helps countries to identify and address key challenges and to develop a forward-looking roadmap to secure and improve the overall contribution of small-scale fisheries to sustainable development at the national level. While it is a country-driven process, FAO provides guidance, training and technical assistance to facilitate NPOA-SSF development and implementation.[ac]

The overall process starts with the country establishing a multistakeholder National Task Team (NTT) to oversee the design of the NPOA-SSF. This government-led team includes representatives from relevant authorities (including national fisheries administrations), fishers and fishworkers organizations and representatives of NGOs, research and academia. Including SSF representatives in the NTT is particularly important to ensure a participatory and human rights-based approach in line with the principles of the Guidelines.

The NTTs are encouraged to apply the fisheries characterization matrix, developed under the Illuminating Hidden Harvests (IHH) study,[18] to prioritize which fisheries and value chains should be covered by the NPOA-SSF. The matrix covers local terminology (e.g. artisanal, subsistence), types of fisheries (e.g. marine, inland), types of operation (e.g. vessels used, target species), policy frameworks,[ad] key stakeholders along the value chain (e.g. fishers, processors), and those with a direct or indirect role in the subsector (e.g. governments, non-governmental and civil society organizations).

The NPOA is drafted through extensive stakeholder consultations focused on establishing key actions and needs for five priority areas:[ae] (i) responsible governance of tenure and sustainable resource management; (ii) social development, employment and decent work; (iii) value chains, post-harvest practices and trade; (iv) gender equality; and (v) natural disaster and climate change risks. It is imperative that these consultations include small-scale fishers, fish processors and fishworkers, including women and Indigenous Peoples, to ensure that the plan reflects the concerns of the actors of the subsector.

Increasing uptake and commitment – shining a light on existing NPOAs

Between 2021 and 2025, seven countries: Indonesia, Madagascar, Malawi, Namibia, the Philippines, Uganda and the United Republic of Tanzania,[af] published NPOAs-SSF with FAO's support. FAO is also currently supporting consultation processes in Colombia, Ghana, and Members of the Bay of Bengal Programme Inter-Governmental Organisation (BOBP-IGO) (Bangladesh, India, Maldives and Sri Lanka) to draft their own national plans of action.

Experiences and lessons learned from developing an NPOA-SSF in the Philippines

The Philippines was the first country in Asia to develop and launch an NPOA-SSF. In October 2024, the Department of Agriculture's Bureau of Fisheries and Aquatic Resources (BFAR), in partnership with FAO, local fisherfolk and various government, non-governmental organization (NGO) and research partners officially published the action plan. The NPOA-SSF of the Philippines reflects a participatory and inclusive consultation that engaged stakeholders across the country in various fisheries management areas, including representatives from municipal and artisanal fisheries institutions, Indigenous Peoples, vulnerable workers across the value chain, NGOs, national government authorities, and researchers. This consultative process ensured that the challenges and needs of marginalized fisheries were included in the final document.

The Philippines' National Technical Working Group (NTWG) comprises government entities

ac For a range of available materials and published NPOAs-SSF, see: https://www.fao.org/voluntary-guidelines-small-scale-fisheries/npoa-ssf/about-npoa-ssf/en

ad For example, see the SSF Lex country profiles (https://ssflex.fao.org) and the SSF legal and policy diagnostic tool (https://openknowledge.fao.org/server/api/core/bitstreams/c6841088-5d0a-4804-9b34-71977f6ad524/content).

ae For further details, refer to Chapters 5–9 of the SSF Guidelines.

af The United Republic of Tanzania, Zanzibar has also developed an NPOA-SSF.

(BFAR, Department of the Interior and Local Government – Bureau of Local Government Supervision, local government units), research institutions, NGOs, fisherfolks, women, traders and Indigenous Peoples. The role and membership of the NTWG were formally recognized by BFAR as fundamental in the development of the NPOA-SSF.

FAO is currently working with the NTWG to strengthen its coordination role, supporting the establishment of an interministerial coordination mechanism to implement the NPOA-SSF, and developing a monitoring and evaluation framework to track, capture and foster collective NPOA-SSF implementation efforts across the country.

Prioritizing action through the NPOAs as a pathway to impact

Once published, NPOAs help countries prioritize the needs and challenges of their small-scale fisheries, by targeting key elements of the SSF Guidelines that are most nationally relevant.

The NPOAs of Malawi, the Philippines and Uganda, for example, codified the need to upgrade co-management processes. As a result, Uganda revised its legislation on operationalizing co-management systems, while the Philippines identified the key areas for improvement in the institutional and governance structure of existing co-management arrangements.

On the social side, enshrining the challenges and needs of women in the SSF value chain in NPOAs has helped to increase the attention they receive from governments and other institutional partners. For example, in Madagascar, Namibia, the Philippines, Uganda and the United Republic of Tanzania, SSF women's groups received training in post-harvest operations to improve their fish-processing techniques, and business and marketing skills, as well as leadership and organizational capacities. In Madagascar, trainings led by the National Network of Women in Fisheries and supported by FAO resulted in major improvements in fish drying and smoking techniques, reduction in post-harvest losses, and improved freshness and quality of their products at the market.[19] In Colombia, attention has focused on the social protection needs of women in the post-harvest sector (Box 2.10).

Existing NPOAs are also a conduit to highlight and prioritize actions to address the vulnerability of small-scale fisheries to the intensifying impacts of climate change and natural disasters. Uganda's NPOA-SSF includes a commitment to evaluate the potential impacts of climate change and establish specific adaptation and mitigation measures. It also identified the need, with FAO's support, to design a National Adaptation Plan (NAP) for fisheries to improve vulnerability awareness and mobilize adaptation efforts.

Long-term commitment to implement the SSF Guidelines

As we embark on the second decade of implementation of the SSF Guidelines, efforts at the national and local levels are crucial to achieving meaningful, long-term impact on small-scale fisheries and their contribution to sustainable development. The NPOA-SSF process is a long-term commitment that encourages national and local institutions and stakeholders to work hand in hand to achieve realistic objectives and targets, promoting participatory processes, fostering inclusiveness and collaboration, and encouraging strong political will to address issues facing small-scale fisheries. The country cases presented here demonstrate that NPOAs-SSF can be a successful mechanism to adapt the SSF Guidelines to national or local realities and encourage on-the-ground changes to secure the long-term sustainability of small-scale fisheries.

Strengthening effective fisheries governance

Effective governance, anchored in robust policies, laws and institutions, is necessary to support fisheries management, restore the health of fish stocks and combat IUU fishing. FAO pursues its efforts worldwide to mobilize resources and provide technical assistance for the implementation of international agreements aimed at strengthening global fisheries governance, including the 2009 Agreement on Port State Measures to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing (PSMA, Box 2.11). FAO also supports national governments to instill responsible fisheries governance and ensure inclusive, secure and equitable access to inland and marine resources.

BOX 2.10 EMPOWERING WOMEN FISH VENDORS IN COLOMBIA: THE TRANSFORMATIVE ROLE OF SOCIAL PROTECTION IN EQUITABLE BLUE TRANSFORMATION

In Buenaventura, a port city on Colombia's Pacific coast, "Platoneras" – Afro-Colombian women fish vendors who carry *platones* (large plates) of fresh fish on their head – bring essential, affordable and nutritious food to local families and markets. Their trade has been passed down through generations and remains at the heart of the local economy and culture.

Like many small-scale fishers and fishworkers, most Platoneras operate in the informal economy and face significant barriers to access social protection, despite its global recognition as a human right. Because of informality, seasonality and inconsistent income, it is difficult for them to contribute regularly to social insurance schemes covering, for example, unemployment, pensions, illness and maternity. While they do have access to public health care, Platoneras are among the estimated 70 percent of Colombian workers without social protection coverage for many other economic and life cycle risks.

To strengthen their collective voice, Platoneras established the Federacion de Platoneras de Buenaventura, which advocates for legal recognition of their activities and has proposed a national day to honour their cultural and economic contributions. The initiative has resulted in a draft law that recognizes the role of the Platoneras in upholding cultural and gastronomic traditions while promoting their economic inclusion by prioritizing them in state-led training, entrepreneurship programmes, access to microfinance, and productive support. The draft law is currently under consideration in the Colombian Congress.

At the same time, there has been progress at the policy level. The Inter-institutional Group on Social Protection for Fisheries and Aquaculture (GIPRO) was created, bringing together government, fishers, fish farmers, academia and other key stakeholders to co-design inclusive policies tailored to the sector's needs. The group contributed to the revision of Colombia's Law 2268 of 2022, which now enhances protection for artisanal, commercial and subsistence fishers, including minimum wage guarantees, payment for environmental services, safety at sea, formalization pathways, and unemployment insurance during closed fishing seasons.

Both the Federation of Platoneras and GIPRO received technical support from FAO through the Social Protection for Fisheries and Aquaculture (SocPro4Fish) project, funded by the Norwegian Agency for Development Cooperation.

The project ran from 2021 to 2024; it aimed to improve access to inclusive social protection in the sector by helping small-scale fishers move from informal to formal economic participation – a key step for eligibility in social protection schemes. The project partnered with Colombia's Marine and Coastal Research Institute to support over 100 women – including Platoneras and fish processors who often work outside formal systems – through training on entrepreneurship, financial literacy, and market access. These training sessions helped participants strengthen their ability to register and manage small businesses, understand financial services, and meet procurement requirements, enabling them to sell to institutions and enter official registries. Their boosted incomes gave access to social benefits, and gave visibility to fishers in government systems, critical for both social protection enrolment and effective fisheries management.

The experience in Buenaventura highlights the transformative potential of combining social protection with economic empowerment and organizational strengthening to transform small-scale fisheries management.



Platoneras have a longstanding tradition and contribute significantly to community nutrition and livelihoods
© FAO



The vital role of Platoneras is recognized nationally, with a dedicated day of celebration each December
© ConectadosColombia

BOX 2.11 GLOBAL CAPACITY DEVELOPMENT PROGRAMME TO COMBAT ILLEGAL, UNREPORTED AND UNREGULATED FISHING

The 2009 Agreement on Port State Measures to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing (PSMA) (hereafter "the Agreement") is one of three legally binding fisheries instruments adopted at the global level; the others are the 1993 FAO Compliance Agreement for the High Seas and the 1995 UN Fish Stocks Agreement. Sustainable fisheries management requires that laws and regulations are enforced to firmly tackle IUU fishing, instilling a culture of compliance where needed.

Under Part 6, Article 21 of the Agreement, the 86 parties, representing 113 states, endorsed a Global Capacity Development Programme, managed and implemented by FAO, as an integral part of the Part 6 Assistance Fund established under the Agreement.

Since its entry into force on 5 June 2016, the programme has raised more than USD 30 million, delivering assistance to over 55 states to strengthen their policy and legal frameworks, institutional set-up and operations, and training over 450 officials from developing states. As a result, several developing states can now meet their international fisheries requirements, and some are at the frontline of international fisheries governance carrying out bold actions against IUU fishing.

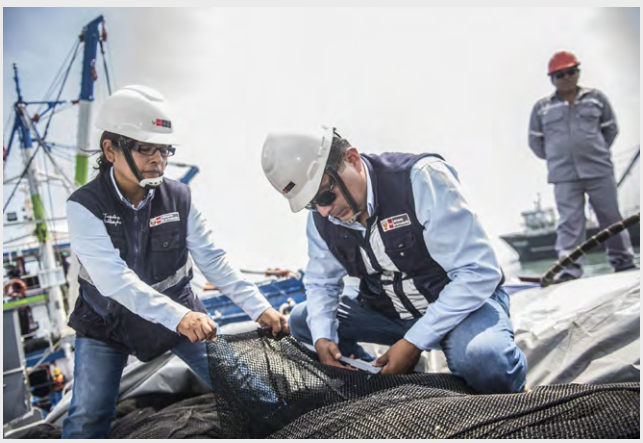
The global uptake of the PSMA has been exponential: it now covers 70 percent of the world's coastal states. However, developing countries which are parties to the Agreement require additional support to improve implementation towards realization of the PSMA's objectives.

This multilateral compliance control treaty has operationalized a unique Global Information Exchange System (GIES) facilitating access to the compliance history of foreign vessels, based on inspection and port denial reports drawn up by the parties. The system informs risk analysis and enables more efficient use of assets for targeting inspections. The GIES amplifies the effect of the PSMA, because it enhances states' actions on individual foreign vessels seeking to enter and use designated ports, and its multilateral concerted action supports port states with key information for decision-making.

In the first two years of operation of the GIES, over 3 000 port inspection reports were shared by half of the parties on over 1 000 vessels flagged to 55 flag states. These numbers are likely to rise further through capacity development and regional mechanisms, with all parties fulfilling their information exchange obligations under the PSMA before long.

The key impacts of the PSMA in combating IUU fishing include: (i) a dynamic international dialogue platform with regular meetings of the parties and subsidiary technical meetings; (ii) a comprehensive capacity development programme for developing state parties; and (iii) a unique operational tool for the electronic collection and dissemination of key compliance information to support decision-making on actions by the states concerned.

Parties to the Agreement are in the process of developing indicators to monitor the implementation and the effectiveness of the PSMA as per Article 24. These indicators aim to detect implementation weaknesses and gaps to be addressed to achieve the objectives of the Agreement. Furthermore, the PSMA supports the implementation of other international fisheries and ocean treaties, including the Agreement under the United Nations Convention on the Law of the Sea on the Conservation and Sustainable Use of Marine Biological Diversity of Areas beyond National Jurisdiction and the WTO Agreement on Fisheries Subsidies, by providing an effective operational control mechanism for the regulations applicable under these treaties.



Inspection aboard a fishing vessel in the port of Callao-Pesquera Diamante in Lima, Peru
© FAO/Ernesto Benavides



Officer at work in the Vigo Port Authority Headquarters, Spain
© FAO/Giulio Napolitano

The FAO–Cambodia capture fisheries partnership

Capture fisheries play an important role in Cambodia and the region. In 2024, landings were estimated at 139 310 tonnes for marine fisheries and 467 344 tonnes for inland fisheries, contributing approximately 3.3 percent of the GDP. Cambodia's inland fisheries are among the world's largest and cover around 70–80 percent of the country's animal protein needs.[20] The Tonle Sap–Mekong River system is a biodiversity hotspot with globally threatened species; Cambodia's fisheries are therefore key to global, regional and national targets for climate resilience and conservation of biodiversity. Community fisheries management has been a cornerstone of fisheries co-management in Cambodia since 2006. Cambodia community fisheries are local groups of small-scale fishers legally recognized to co-manage their fishing areas with the government. These groups work together to establish rules and enforce regulations for sustainable use and conservation of fishery resources.

CAPFISH Capture[ag] was a programme designed in partnership with FAO to address systemic challenges facing Cambodia's fisheries.[21] These included overfishing, habitat degradation, weak management, and lack of value addition. The aim was to ensure the long-term sustainability of Cambodia's living aquatic resources.

Sector reform and fisheries transformation

FAO, through the CAPFISH Capture complementary support programme,[ah] assisted the Government of Cambodia in upgrading and implementing its 2015–2024 strategic planning framework for fisheries[22] and in developing the 2025–2034 framework. In addition, it helped draft a new Law on Fisheries[23] and developed key subsidiary legislation to operationalize conservation and management measures for marine and inland fisheries and aquaculture. The 2025 law introduces measures aligned with international agreements – including the FAO Port State Measures Agreement – to combat IUU fishing, implement fishing control regulations, and enforce labour and safety standards for fishing crews.

Cambodia became a party to the PSMA, and in 2020, the Fisheries Administration (FiA) of the Ministry of Agriculture, Forestry and Fisheries (MAFF) adopted a National Plan of Action on IUU fishing (NPOA-IUU).[24] CAPFISH Capture, in collaboration with the FAO global PSMA team, also provided legal advice, training and capacity building. The FiA budget support component enabled the provision of patrol boats and the deployment of more than 1 500 vessel monitoring system units operated by FiA. A partnership with the Wildlife Conservation Society greatly expanded the use of digital reporting and planning systems with the adoption of the Spatial Monitoring and Reporting Tool for marine and inland fisheries patrols.

Advancing fisheries management through capacity development, digital innovation and habitat conservation

Fisheries management plans are an important enabling tool for achieving sustainable fisheries. In Cambodia, FAO supported capacity building of FiA staff and fishing communities to develop draft fisheries management plans for marine and inland domains for the first time. In addition, there are draft national plans for the control and inspection of both inland and marine fisheries, as well as provincial plans for the protection of critical inundated flooded forest areas of the Tonle Sap and the first Community Fisheries Strategic Plan.

Within its mandate to strengthen fisheries and aquaculture statistics, the project supported capacity building to develop sample-based fishery assessments;[25, 26] routine reporting on enforcement; assessments of community fisheries; and the use of VMS. A complete overhaul of the submission and reporting system for fishery statistical data was achieved, resulting in a national digital web-based platform: FishStat.[27] Available data and information were integrated into the online Fisheries Information Management System (FIMS),[28] contributing to an improved knowledge base. FIMS-FishStat includes data management, analysis and reporting dashboards to assess status and trends in the fishery, evaluate management interventions, and facilitate

ag Cambodia Programme for Sustainable and Inclusive Growth in the Fisheries Sector: Capture component (CAPFISH Capture).

ah Support was provided through the project "FAO Complementary Support to the Cambodia Programme for Sustainable and Inclusive Growth in the Fisheries Sector: Capture component (CAPFISH Capture)".

preparation of status and statistical reports at the provincial and national levels.

To address the challenges faced by the destruction of critical aquatic habitats, the project strengthened capacity at the national and provincial levels for marine and inland habitat monitoring. For marine environments, this support focused on training and building capacity to survey and map critical coral and seagrass habitats. For inland fisheries, the support focused on building capacity to protect inundated forest habitats around Tonle Sap. The Ministry of Environment, in partnership with the United Nations Educational, Scientific and Cultural Organization (UNESCO), established Tonle Sap Biosphere Reserve coordination committees and technical working groups and drew up its strategic workplan.[ai]

Fisheries research and community fisheries mechanisms

In partnership with universities and research institutes, the project assisted FiA in the identification of priorities and the development of strategic plans for inland and marine fisheries research. The Royal University of Agriculture, the Prek Leap National Institute of Agriculture, the Kampong Cham National Institute of Agriculture and the University of Kratie received support to update and upgrade fisheries degree curricula, introducing new disciplines in marine biology and post-harvest operations, as well as a programme of field trips. Support was provided to 89 students for fisheries-related theses and internships in 20 provinces, leading to the establishment of an annual internship programme linking universities and FiA.

FAO supported community fisheries (CFi) mechanisms, including community fish refuges (CFRs), by providing capacity building to FiA to strengthen its institutional mechanisms and legal frameworks, enhance capacity building tools, and facilitate sustainable financing. The status and effectiveness of CFi and CFRs were assessed and the results used to inform annual activity planning and improvement. Over 250 communities received annual grants and technical support through CAPFISH. Training and coaching were provided to FiA staff on grant and finance management, data collection and analysis, inclusive governance, sustainable financing, and the ecosystem approach to fisheries. The project supported the revision and drafting of the CFi subdecree and other regulations (or "Prakas"); in partnership with a regional NGO (Open Development Cambodia), it co-developed a national CFi/CFR database; a draft strategic plan (2025–2029); and a technical document to address the transition of CFi into "modern agriculture cooperatives". Furthermore, CAPFISH supported the hiring of specialists who played a key role in provincial capacity building and technical support.

The project, in partnership with the FiA working group on gender equality, promoted social equity and protection in the fisheries sector. This was supported by an FAO Technical Cooperation Programme (TCP) project which conducted a gender and child labour assessment to inform a new FiA strategic framework for 2024–2030 on the promotion of gender equality and elimination of child labour.[29] This was aligned and mainstreamed during key sectoral planning and the preparation of strategy documents.

Ongoing and emerging challenges for fisheries in Cambodia

This five-year, multidisciplinary and cross-sectoral programme enabled the government to undertake significant fisheries sector reforms, enhancing compliance with fishing control measures, improving conservation efforts, and strengthening overall management. The approach integrated budget support and complementary support. Budget support, an approach developed by the European Union,[30, 31] was implemented under the CAPFISH project, allowing the government to undertake sector reforms with the benefit of technical complementary support. Although comprehensive evaluations are ongoing, government data indicate that many policy targets have already been achieved, underscoring the effectiveness of this combined approach.

CAPFISH Capture illustrates a successful partnership between the Cambodian Government's Fisheries Administration, resource partners, fishing communities, UN agencies and

ai For details see: https://www.unesco.org/en/articles/national-conference-tonle-sap-biosphere-reserve-advancing-strategic-vision-and-charting-sustainable

FAO. The partnership has delivered positive results at different levels, encompassing data collection and analysis, enforcement of fishing measures, co-management and research. Looking ahead, declines in marine[32] and inland[33] fishery resources remain a serious challenge requiring strategic actions to monitor and restore Cambodian fishery stocks and add value to the sector in a sustainable manner.

Improving fishing technology and efficiency

Technological developments and innovations are producing a new generation of fishing fleets and techniques that are efficient, safe, profitable and at the same time eco-friendly. FAO has taken these innovations to the field to showcase how they are chartering the course for eliminating on the ground the impacts of fishing operations on aquatic biodiversity including ecosystems.

Eco-friendly fishing gear and vessel design innovations for a healthier ocean

Innovations in fishing gear and vessel design have become central to environmentally responsible fishing, reducing bycatch and minimizing marine pollution, while improving safety at sea. Around the world, scientists, industry and policymakers are collaborating to improve fishing practices and develop solutions that balance ecological sustainability with economic viability. From large-scale tuna fisheries to small-scale coastal operations, these efforts aim to mitigate the negative impacts of fishing gear on marine ecosystems, and to promote safer, energy-efficient and environmentally friendly fishing vessels (Box 2.12), as illustrated hereafter by selected FAO initiatives around the world.

Fishers–scientists collaboration on bycatch reduction and mitigation in tuna fisheries

Armed with decades of experience and know-how, tuna fishers are teaming up with researchers to protect marine life. A long-running series of "skippers workshops" brings together fishers and scientists to limit the environmental impact of commercial fishing on marine ecosystems – charting a course for the future of sustainable tuna fishing. Since 2009, the International Seafood Sustainability Foundation (ISSF) has organized 196 skippers workshops across 48 locations, in 24 countries, engaging over 5 800 participants (Figure 2.11).

The Common Oceans Tuna project has supported skippers workshops since 2014 and is now expanding their reach to longline and pole-and-line fisheries through partnerships with ISSF, the International Pole and Line Foundation, BirdLife International, and the Commission for the Conservation of Southern Bluefin Tuna.

These global workshops foster a two-way exchange of knowledge, where scientists present evidence-based mitigation techniques, and fishers contribute practical insights from their extensive at-sea experience. Fishing fleets vary widely – from larger vessels to small-scale independent operations; recognizing this diversity is essential to developing practical, scalable solutions. This well-rounded, collaborative approach has proven effective in addressing the unintended capture of non-target species such as sharks, rays, seabirds, turtles and cetaceans in tuna fisheries.

The workshops catalyse at-sea innovation and policy change through a three-pronged process: scientists develop and review potential mitigation strategies; skippers workshops facilitate dialogue to consider operational limitations and practical solutions; and sea trials test the co-developed mitigation techniques on commercial fishing vessels. The resulting mitigation methods are scientifically sound, operationally feasible, and widely accepted by fishers.

Key outcomes include the widespread adoption of best practices for safe handling and release of vulnerable species. For example, shark release protocols using release ramps can improve post-release survival rates from 50 to 70 percent. Skippers workshops have also facilitated the shift from conventional fish aggregating devices (FADs) to non-entangling and increasingly biodegradable FAD designs. Importantly, this work has enabled regulatory changes within tuna RFMOs, which now require the use of non-entangling FADs and have adopted management measures establishing timelines to transition towards biodegradable FADs, beginning in 2026. »

BOX 2.12 THE FAO FISHING VESSEL DESIGN DATABASE

The design of fishing vessels is central to fishers' safety, fishing efficiency, and resource sustainability. In 2022, FAO established the Fishing Vessel Design Database (FVDD) to support the fishing industry worldwide, enabling shipyards and naval architects to access proven and innovative design solutions.

The FVDD is an open repository of fishing vessel designs and drawings from around the world. It brings together over 250 designs and more than 1 700 associated drawings, covering a wide variety of vessel types, sizes and functions. These comprise artisanal canoes, small-scale open boats, medium-sized decked vessels, and large-scale industrial fishing boats. The database showcases general-purpose fishing vessels and specialized designs such as trawlers, purse seiners, longliners and gillnetters. It also contains many multipurpose and regionally adapted vessels, illustrating the diversity of fishing practices and the importance of tailoring designs to local conditions.

Each record provides essential technical information such as principal dimensions, hull form, construction material (wood, steel, fibreglass-reinforced plastic, aluminium, high-density polyethylene), deck layout and propulsion details. Most designs are accompanied by general arrangement plans, line drawings and construction details, making them highly valuable for naval architects, boatbuilders, fisheries authorities and training institutions. Many of the designs have been tested in practice, offering proven solutions that can be replicated. Some designs are accompanied by construction manuals.

Beyond serving as a technical library, the FVDD also promotes safety at sea, energy efficiency and responsible fishing practices. By providing access to reliable designs, the database supports countries and communities in modernizing their fishing fleets, improving working conditions on board, reducing fuel consumption, and minimizing the environmental footprint of fishing operations.

The database is freely accessible online within the FAO Fisheries and Aquaculture Knowledge Base (FishInfo).* Users can search by vessel type, size, gear, region or hull material, making it easy to access and download designs relevant to their needs. The FVDD is not a static archive: FAO encourages naval architects, designers, research institutes and governments to contribute new information or designs, ensuring the collection remains relevant and up to date, reflecting the evolving needs of the fishing sector.

The FVDD provides a practical tool to share knowledge, stimulate fishing vessel innovations and strengthen the capacity of countries to develop sustainable and resilient fleets that are safe, energy-efficient and eco-friendly.

By drawing on this unique global repository, stakeholders can benefit from decades of accumulated expertise while also contributing towards innovating the next generation of fishing vessel designs.

NOTE: * For further details, see: https://www.fao.org/fishery/en/collection/vesseldesign

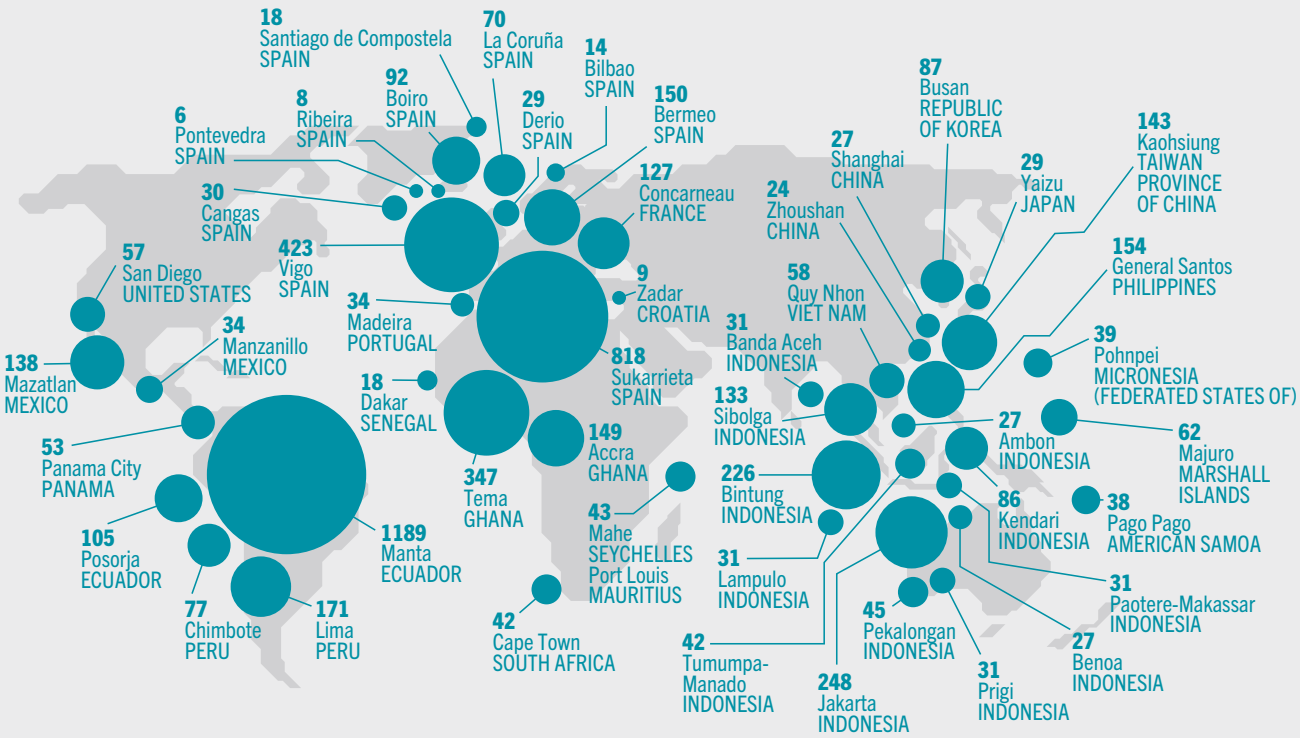


Testing of a longliner with an FAO-designed dihedral bow retrofit, Sri Lanka
© FAO/Francisco Pérez Arribas



FAO-designed climate-resilient fishing boat, Sri Lanka
© FAO/Dilshani Dias

FIGURE 2.11 INTERNATIONAL SEAFOOD SUSTAINABILITY FOUNDATION SKIPPERS WORKSHOP ATTENDANCE, 2009–2025



Refer to the disclaimer on the copyright page for the names and boundaries used in this map.

SOURCE: Adapted from ISSF. 2025. ISSF Skippers Workshop Locations with Attendance (2009-June 2025). In: *ISSF*. [Cited 10 November 2025]. https://www.iss-foundation.org/about-issf/what-we-publish/issf-documents/issf-skippers-workshop-locations-with-attendance-2009-june-2025

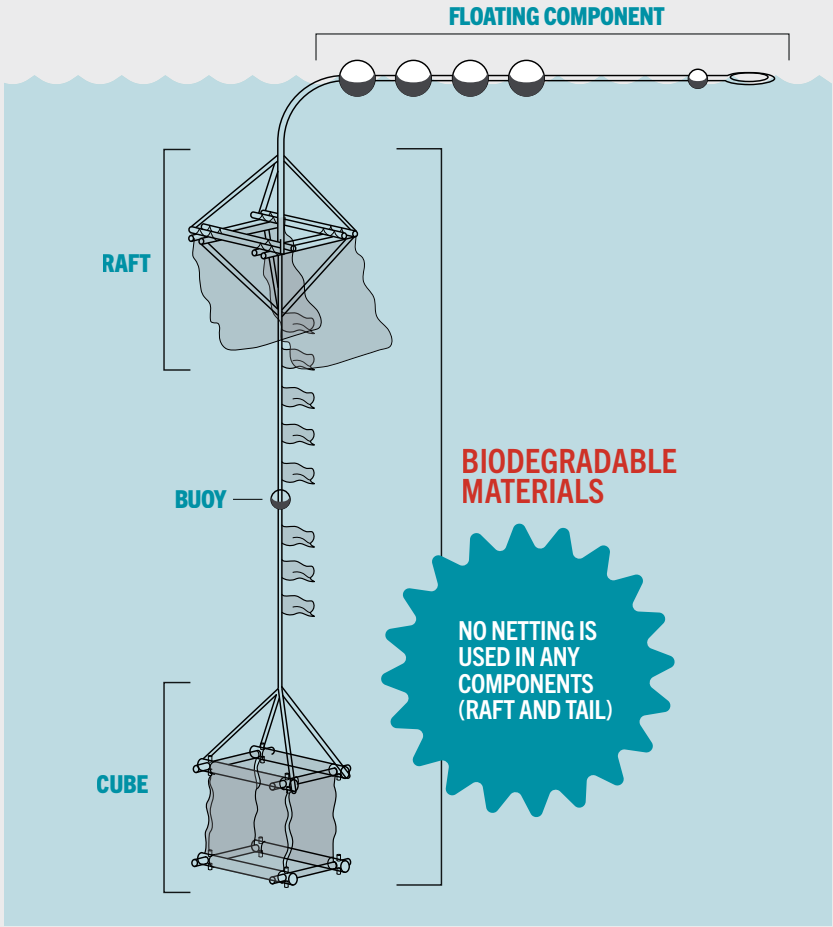
» The series' participatory approach fosters trust, stewardship and voluntary compliance among fishers, enhancing the legitimacy and effectiveness of conservation measures. Lessons learned emphasize the importance of tailoring workshop formats to fisher schedules, maintaining continuity in scientific personnel, and ensuring transparent feedback loops. The global scope of the workshops has encouraged equitable participation and peer learning across fleets, further accelerating the uptake of sustainable practices.

Skippers workshops exemplify how collaborative, science-based approaches can drive meaningful change in global fisheries, offering a replicable model for other sectors seeking to balance ecological sustainability with the operational realities of commercial fishing.

Jelly-FADs: a breakthrough towards sustainable tuna fishing

Drifting fish aggregating devices (dFADs) are widely used in tropical tuna purse seine fisheries to enhance fishing efficiency by aggregating tuna. These human-made floating structures, tracked by satellite-linked buoys, drift with ocean currents and create artificial habitats that mimic natural floating debris. Their use has significantly increased tuna catches, particularly for skipjack, yellowfin and bigeye tuna, making them a cornerstone of modern industrial tuna fishing operations.

FIGURE 2.12 BIODEGRADABLE JELLY-FAD

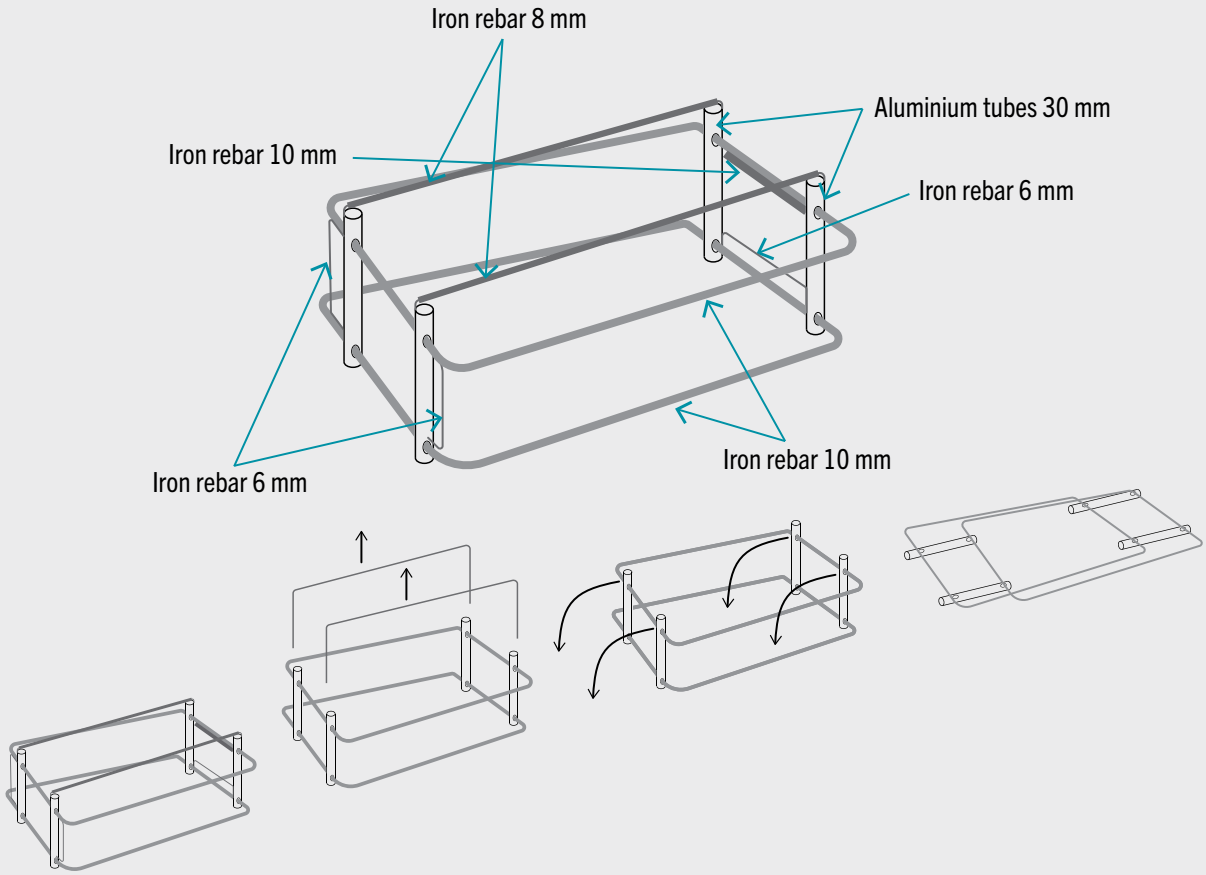


SOURCE: Adapted from ISSF. 2024. Jelly-FAD Construction Guide. In: *ISSF*. [Cited 5 March 2026]. https://www.iss-foundation.org/about-issf/what-we-publish/issf-documents/jelly-fad-construction-guide

However, the widespread use of dFADs has raised concerns regarding their impact on the marine ecosystem. Conventional dFADs are traditionally made from synthetic materials and netting that can entangle non-target species such as sharks and turtles and contribute to ghost fishing. The Common Oceans Tuna project, led by FAO and funded by the Global Environment Facility (GEF), brings together governments, regional fisheries management organizations, industry, and civil society to promote sustainable management of tuna and biodiversity conservation. The project and its partner, the International Seafood Sustainability Foundation, developed the biodegradable jelly-FAD in a pioneering step towards reducing the environmental footprint of tuna fisheries.

The jelly-FAD is an innovative dFAD model that is both biodegradable and non-entangling (Figure 2.12). Constructed from natural, affordable materials such as bamboo and cotton, jelly-FADs are accessible to fishers without the need for specialist tools or skills. Their lightweight,

FIGURE 2.13 ECO-TRAP WITH ANTI-GHOST FISHING DEVICE



NOTE: Steps 1–4 represent the dismantling sequence.

SOURCE: Adapted from Oliveira, V.S., Mattos, S.M.G., Richardson, K.P., Santos, J.C.P., Sá, R.V.M. & Magalhaes, T.A. 2025. Desenvolvimento de dispositivo para reduzir a pesca fantasma nas pescarias com covos de lagosta no Brasil / Development of a device for reducing ghost fishing in Brazilian lobster trap fishery. *ActaPesca*, 23: 55–82. https://doi.org/10.46732/Actafish.23.66-93

modular design includes a submerged raft from which hangs a tail culminating in a cube made from panels; the device is able to remain within targeted fishing zones while avoiding the entanglement of vulnerable species like sharks and turtles.

The jelly-FAD is the result of a process that began in 2019; the prototype design was refined under real fishing conditions. Collaborative work between tuna fleets, ISSF and oceanographers from the Marine Science Institute of the Spanish National Research Council was instrumental in improving the model, developing and promoting best practices for its use. This participatory approach ensured that the device was not only ecologically sound but also practical and effective for fishing. In 2024, ISSF published the *Jelly-FAD Construction Guide*.[aj] The guide builds on ISSF's broader efforts since 2009 to promote sustainable FAD management, including earlier work on non-entangling and biodegradable FADs.

aj For details, see: https://www.iss-foundation.org/about-issf/what-we-publish/issf-documents/jelly-fad-construction-guide

By offering a scalable, low-impact alternative to conventional dFADs, jelly-FADs represent a significant advancement in sustainable tuna fishing. Their adoption supports sustainable certification goals and aligns with global efforts to reduce bycatch, marine debris and ecosystem impacts – demonstrating how cross-sector innovation and collaboration can drive meaningful change in ocean stewardship.

Trials to reduce ghost fishing in small-scale fisheries

Lost or abandoned fishing nets can continue capturing fish and harming marine ecosystems, a phenomenon referred to as ghost fishing, with serious implications for sustainable fisheries. Three trials on fishing gear innovations to reduce ghost fishing from abandoned, lost or discarded fishing gear (ALDFG) have been undertaken under the GloLitter Partnerships project, implemented by the International Maritime Organization (IMO) in collaboration with FAO.[ak]

In Brazil, trials focused on the lobster fishery, with the development of "eco-traps" equipped with an anti-ghost fishing device (AGFD). The AGFD uses biodegradable cotton or sisal twines tied to an iron rebar. When the twines degrade (after 3–6 months, depending on knots and material), the rebar opens a panel, allowing trapped animals to escape (Figure 2.13). The design process involved collaboration with fishers, and the AGFD was moved from the bottom to the top panel to avoid catch loss during recovery. Although adverse weather conditions prevented confirmation of fishing efficiency, results showed the device could effectively end ghost fishing after trap loss.

In Indonesia's blue swimming crab fishery, pots were modified by replacing polypropylene entrance ties with biodegradable cotton twines. Field tests of 500 modified pots alongside 500 conventional pots during 30 fishing trips showed no significant differences in catch quantity, species composition, or crab size. The modification, despite the need for slightly more maintenance, was well accepted by fishers.[34, 35]

In Kenya, multifilament gillnets were modified by replacing synthetic headrope ties with biodegradable cotton twines identified in laboratory tests as optimal (2 mm diameter, degrading after 8–16 weeks). When the twine degrades, the net collapses and loses fishing capacity; a buoy-marked headrope floats to facilitate retrieval. Fishing trials found no significant catch differences between modified and conventional nets.[al] Awareness-raising campaigns in fishing communities emphasized the negative impacts of ALDFGs and stressed the value of gear innovations.

Across all trials, biodegradable components effectively reduced ghost fishing without altering catch performance; fisher engagement was key to acceptance and adaptation. These innovations show promise for scaling in both large- and small-scale fisheries to protect marine ecosystems and livelihoods. ■

TOWARDS EFFICIENT, INCLUSIVE AND ENVIRONMENTALLY RESPONSIBLE AQUATIC FOOD VALUE CHAINS

Innovating and upgrading in aquatic food value chains

Achieving efficient, inclusive and environmentally responsible aquatic food value chains is necessary to support sustainable agrifood systems. This requires participatory approaches to assess needs in technological innovation, capacity building, equitable access to services, finance and infrastructure, and the distribution of economic, social and environmental costs and benefits along value chains. This is especially important for developing countries and Small Island Developing States (SIDS), requiring targeted interventions, and collaborative thinking for a shared understanding of challenges, opportunities and solutions to increase

ak For details, see: https://glolitter.imo.org/project/the-oceanlitter-programme

al For further details, see: https://www.kmfri.go.ke/images/2025/pdf/KMFRI%20gear%20midification%20Project%20FINAL%20report.pdf

value adding and expand market shares, while preserving the sector's contribution to national food security.

A participatory approach for upgrading black mackerel and tuna-like species value chains in Cabo Verde

Cabo Verde is an African small island developing state located in the Atlantic Ocean and endowed with an exclusive economic zone 200 times greater than its land surface area. Fisheries play a vital role in food security, employment and economic development. The semi-industrial fishing fleet, targeting mackerel scads and tuna-like species, represents a critical component of the national economy, generating approximately 9 000 direct and indirect jobs, while contributing significantly to national revenues through the export of canned fish.

The Sustainable Fish Value Chains for Small Island Developing States (SVC4SIDS) programme, implemented by FAO with funding from the Republic of Korea, established an innovative multistakeholder platform to support sustainable value chain transformation in Cabo Verde. At its inception in January 2023, the National Value Chain Task Force (NVCTF) brought together representatives from government institutions, research and education, as well as private sector companies and professional associations.

The platform is designed to enable collaborative thinking and development of solutions based on a shared understanding of challenges and opportunities, rather than being dictated in a top-down manner. Through intensive workshops, focus groups and validation sessions, stakeholders moved beyond consultation to active co-development of strategies.

Building on comprehensive analysis that revealed both strengths and critical challenges, the platform developed an ambitious upgrading strategy spanning the period 2023–2033. The analysis identified how Cabo Verde benefits from a modern processing infrastructure and competitive canning industry, but is constrained by ageing vessels, limited access to supplies, price information (Box 2.13), services and cold chain facilities, and insufficient value addition opportunities. The strategy addresses these challenges through three interconnected pillars to simultaneously strengthen environmental sustainability, enhance socioeconomic inclusion, and improve technical and economic performance.

Thanks to this collaborative strategy, involving fieldwork conducted through stakeholder consultations, opportunities have been identified to expand markets and value-added initiatives beyond traditional canning, including innovative fish products developed by local entrepreneurs. Building on these findings, the project is implementing comprehensive technical and market studies to identify alternative species that could support the long-term sustainability of the value chains, thereby diversifying opportunities and reducing dependence on traditional target species. Small-scale processing units meeting international food safety and quality standards are being established to supply domestic markets and create new income streams for fishing communities. In addition, comprehensive feasibility studies aim to modernize fish auction systems in São Vicente and São Nicolau islands, addressing the market efficiency challenges identified collectively by stakeholders.

The platform enables targeted capacity building. Between July 2024 and February 2025, comprehensive training sessions benefited 178 participants from six fishing communities across three islands. These sessions focused on entrepreneurship, business and financial management of micro-, small- and medium-sized enterprises (MSMEs), fisheries technology, and environmental sustainability. The participants comprised 99 women, including 25 women heads of household who received certificates in entrepreneurship and business management in Calheta de São Miguel. These activities foster inclusive development reaching traditionally marginalized groups; they promote the increased formalization, leadership and efficiency of existing and new organizations, embedding the principles of social responsibility.

The platform has been effective in driving technological innovation and climate adaptation planning. For example, a vessel monitoring system has been implemented through collaborative stakeholder engagement, with »

BOX 2.13 THE FAO GLOBEFISH EUROPEAN PRICE DASHBOARD

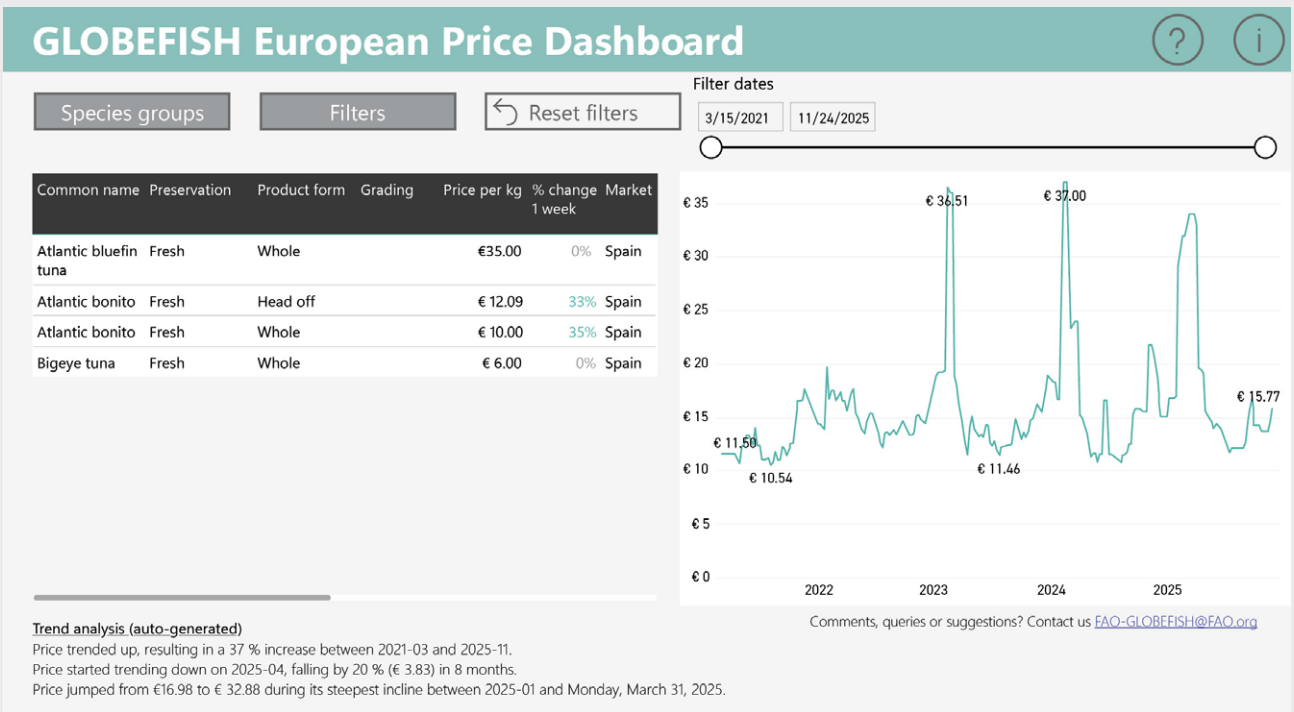
Food prices underpin daily business and trading choices and decisions, but are often scattered across many sources, in different languages, currencies and product grades, and in various forms of presentation. This is particularly the case for aquatic products, which are among the most globally traded food commodities (see **Trade of aquatic products**). The FAO GLOBEFISH project is continually improving the quality and relevance of its market information products to facilitate transparent and predictable trade and to support sustainable fisheries and aquaculture value chains.

To enable decision-makers and operators, particularly in developing countries, to access reliable and timely information on fish prices, GLOBEFISH supports the FAO Fish Price Index* and has developed a price monitoring framework that delivers regular market intelligence reports, as well as the European Price Dashboard.**

The GLOBEFISH European Price Dashboard is an automated system that extracts, transforms and presents prices for aquatic products across Europe in a single interactive interface (see figure). It serves as a practical tool that brings timely fish price information into one place, so that traders, analysts and policymakers can make comparisons and perform analyses to support faster and better-informed decisions. The dashboard complements the prices published in the monthly European and quarterly Chinese price reports, which together cover around 1 000 aquatic products. The dashboard provides weekly prices for 350 distinct products, ranging across 102 aquatic species and 73 product forms.

Data inputs for the dashboard are drawn from multiple sources, including auction houses, wholesalers and market bulletins published in different countries,

EXAMPLE OF GLOBEFISH EUROPEAN PRICE DASHBORD INFORMATION DISPLAYED ON 24 NOVEMBER 2025



SOURCE: Authors' own elaboration based on FAO. 2025. FAO GLOBEFISH. In: *FAO*. [Cited 27 November 2025]. https://www.fao.org/in-action/globefish/prices/en

BOX 2.13 (Continued)

languages and currencies. The main markets include Mercamadrid in Spain, the second largest wholesale market for fish sales after Tokyo's Toyosu market; Rungis International Market in Paris, the largest wholesale market in the world by turnover; Hanstholm Fish Auction in Denmark; and Grimsby Fish Market in the United Kingdom of Great Britain and Northern Ireland. The latest available information is automatically retrieved, cleaned to remove incorrect, incomplete or duplicate entries, translated into English, and harmonized across classifications (species, species group, product form, preservation method, size, origin). Prices are converted into euros from the original currency using exchange rates at the time of price collection. Automation reduces delays and errors inherent in manual compilation, cuts routine workload for data entry, and enables a wider coverage of products, with more regular updates.

The database of prices is linked to a publicly available web interface that combines a comprehensive price table with interactive time series graphics. Users can filter by period, market, country of origin, species or species group, product form or size, and preservation method. They can search the database by common or scientific name. Selections instantly reshape both the price table and the price time series, enabling quick checks of current levels as well as time series analysis of products. An embedded AI plug-in generates analysis of recent price movements, summarizing trends, and further elevates the dashboard beyond a passive repository.

NOTES: * The FAO Fish Price Index (FPI) tracks monthly changes in international prices of fisheries and aquaculture commodities. It averages 15 price series across five key species groups: pelagic, salmon, shrimp, tuna and whitefish. For further details, see: https://www.fao.org/fishery/fishstat/fishpriceindex/en. ** For further details on the GLOBEFISH European Price Dashboard, see: https://www.fao.org/in-action/globefish/prices/en

» tracking devices to be installed on semi-industrial vessels; this initiative emerged from collective problem-solving discussions and has generated strong stakeholder buy-in. Future plans include the installation of renewable energy systems on vessels and processing facilities, seawater desalination, and water recycling solutions to enhance climate resilience and reduce environmental footprint.

Other environmental protection initiatives target the systematic implementation of the ecosystem approach to fisheries, supported by training programmes to enhance bioeconomic assessments and modelling by developing local expertise and ensuring scientific and local relevance.

More importantly, thanks to the platform and its collaborative problem-solving methodologies, participatory planning techniques, and inclusive governance structures, stakeholders have been empowered with knowledge and skills that apply not only to mackerel scad and tuna value chains, but to other fisheries and marine resource management challenges. They demonstrate greater confidence and increased ability to analyse problems, develop solutions, and implement interventions adapted to different contexts.

The success of the multistakeholder platform has generated strong institutional momentum that extends beyond the project timeline. The NVCTF will continue to function as an active coordinating body, ensuring alignment between government priorities, private sector needs, and community interests. Cabo Verde's institutional sustainability marks a shift from fragmented fisheries management to integrated collaborative governance.

Early results confirm the platform's effectiveness, with measurable improvements in capacity building, institutional strengthening, and technology adoption in participating communities. Thanks to the collaborative approach, stakeholders

are able to reach a consensus, finding solutions that are technically sound, economically viable and socially acceptable.

The Cabo Verde example illustrates that inclusive, multistakeholder platforms can effectively drive transformative change in complex fish value chains. The enabling environment for collaboration and co-creation has allowed stakeholders to acquire the knowledge, skills and governance capabilities necessary to address sustainable development challenges. This integrated and inclusive approach offers long-term solutions to improve resource management, strengthen value chains, and increase resilience. It serves as a model that can be replicable and scalable in other SIDS and developing countries.

Building a sustainable blue future in Kiribati

The small island developing state of Kiribati boasts a large exclusive economic zone and one of the most productive tuna fishing grounds in the Pacific. Fisheries play a crucial role in the country's economy with over 65 percent of government revenue derived from fishing licences for foreign vessels.[36] The artisanal sector, on the other hand, is very important for food security and subsistence, being the primary provider of animal proteins, accounting for 60 to 70 percent of the coastal fisheries catch, while 30 to 40 percent covers small-scale commercial operations.[37, 38]

Similar to other Small Island Developing States, Kiribati relies heavily on food imports. Valued at USD 40.5 million, food items accounted for almost 37 percent of total imports in 2020.[39] Despite being a major tuna producer, the country still imports many processed foods that offer convenience and a long shelf-life, including canned tuna, mackerel and sardines.

Inclusive strategy for value chain upgrading

Kiribati faces significant challenges that undermine the growth of fishery products in both domestic and international trade. In particular, MSMEs involved in the fish export trade have limited technical capacity and weak relationships with potential buyers. In addition, the development of reliable, sustainable and cost-effective value chains is hindered by limited access to funding, knowledge and support services for value addition, business planning and development.

To address these challenges, the FAO SVC4SIDS project[am] conducted a sustainable tuna value chain analysis and development study[40] in Tarawa, Makin and Nikunau in the Gilberts Islands. Using a highly inclusive and participatory approach, the project co-developed a comprehensive ten-year (2023–2033) strategy for the Kiribati domestic tuna value chain. National partners and value chain stakeholders formulated a common vision for the establishment of a competitive and reliable domestic tuna value chain with diversified products as a stepping stone to accessing international markets and addressing the impact of climate change on the tuna resources.[41]

Promotion of revenue-generating activities in South Tarawa

The SVC4SIDS project has been working closely with women and youth groups in South Tarawa to promote income-generating activities (IGAs) which will ultimately result in formal recognition of MSMEs and creation of business opportunities in the domestic tuna value chain. Trainings and pilots are being conducted at the project's IGA facility and include small-scale tuna processing trials of tuna loins, jerky, sausages and samosas. Recipes are being tested using ingredients readily available on the island, thus reducing reliance on imports. Additional activities target roadside vendors, mainly women, involving them in the piloting and promotion of trolleys designed to meet food hygiene standards.

Support to fishery centres in the outer islands

Small-scale commercial fishery centres in the outer islands are a strategic priority for the Kiribati Ministry of Fisheries and Ocean Resources (MFOR). As in other Pacific countries, these fishery centres play an important role in the provision of services and socioeconomic benefits to island communities.

The islands of Makin and Nikunau in the Gilberts Islands were selected by MFOR for the SVC4SIDS project to support their disadvantaged reef island fishing communities. Adverse weather conditions

am For further details on the SVC4SIDS project, see: https://www.fao.org/in-action/kofap/projects/svc4sids/en

put these islands at risk of food shortages; this is not the case of the other Kiribati islands that can rely on the lagoon for food supplies during adverse weather.

The communities of Makin and Nikunau depend on fish for daily consumption, and this is supplied by a significant number of their fishers. Average annual per capita aquatic animal foods availability is estimated to exceed 100 kg. A particular challenge for these fishers is that they must stop fishing activities during peak season due to insufficient cold storage capacity and limited market opportunities.

Support to the fish centres on both islands will allow catches to be used to produce canned and other preserved products with a longer shelf-life, thus increasing supply, reducing imports, enhancing food security and enabling fishers to work throughout peak fishing seasons and obtain a steadier yearly income.

Support for business and operational planning
The SVC4SIDS project is collaborating with the state-owned enterprise, Central Pacific Producers Ltd (CPPL), and the two island councils who own the fisheries centres. It is planned that CPPL will take over the fisheries centres on behalf of the island council before the project comes to an end. The enterprise will support the centres' operations and be responsible for preserving and maintaining the buildings, in close collaboration with the two island councils.

Specialized fiscal literacy and business planning trainings were delivered during 2024 and 2025, and business plans together with simplified tools were developed for CPPL and the Coastal Fisheries Division. The project is continuously upgrading knowledge and technical capacity to improve implementation, upgrading and monitoring of business and operational plans with the view to achieve commercial sustainability.

Sustainability and increased catches in the small-scale artisanal tuna fishery
Ensuring the viability of the two fisheries centres relies on the enhancement of the domestic tuna catch of the small-scale fishery. The ten-year strategy advocates and emphasizes the importance of sustainable resource management and careful monitoring of fishing activities under the purview of MFOR. This required the installation and running of an improved data collection system for informed decision-making, as well as training, capacity development, technical assistance, and supervision.

Fostering efficient, inclusive and gender-sensitive aquatic value chains

Poverty and unemployment can be root causes of food insecurity, particularly in coastal and rural areas. Sustainable value chain development (SVCD) can support addressing these challenges by creating investment and economic opportunities in post-harvest and trade operations. However, SVCD interventions should be inclusive to support socioeconomic growth and involvement of artisanal and small-scale farmers/fishers, vendors and operators to access services, infrastructures and markets, thereby improving economic growth, enhancing livelihood security, and guaranteeing employment and a decent standard of living.

Upgrading the mahi-mahi value chain and social protection in the Dominican Republic

In the Dominican Republic, an estimated 22 000 artisanal fishers and more than 1 000 fish vendors and processors depend on fisheries for their livelihoods. One of their principal catches is mahi-mahi (*Coryphaena hippurus*, Figure 2.14), a highly appreciated aquatic food common to many of the world's warm and temperate seas. In the Dominican Republic, the mahi-mahi fishery faces various challenges, including substandard handling and processing practices that do not conform to food safety and quality standards and cause significant fish losses, as in Tumaco (Box 2.14), and lack of social protection for the men and women employed in the sector.

The Government of the Dominican Republic recognized the need to strengthen the mahi-mahi fishery to improve the livelihoods of its fisherfolks and preserve this precious fish resource for future generations. To achieve this goal, the fisheries authority teamed up with FISH4ACP, an OACPS initiative implemented by FAO with funding from the European Union and the BMZ, to modernize the mahi-mahi fishery and its value chain by making it more inclusive, resilient and sustainable, embedding the FAO

FIGURE 2.14 MAHI-MAHI (*CORYPHAENA HIPPURUS*)



© FAO/Ali Elly

voluntary guidance on social responsibility in fisheries and aquaculture value chains (Box 2.15).

Upgrading the mahi-mahi value chain

FISH4ACP conducted a mahi-mahi value chain analysis between 2021 and 2022 in collaboration with the Dominican Fisheries and Aquaculture Council (CODOPESCA), ISA University and other stakeholders. The study estimated mahi-mahi production in the Dominican Republic at 612 tonnes per year, valued at USD 6.6 million and supporting the livelihoods and food security of some 2 300 small-scale fisherfolk. The fish is in high demand and sells well on local markets and in the capital of Santo Domingo.

In collaboration with stakeholders, FISH4ACP developed and is implementing a ten-year strategy to upgrade the mahi-mahi value chain with the aim to enhance community well-being, bolster economic growth, and safeguard the environment. As part of the strategy, fishers, vendors and processors receive training and equipment to improve the handling and processing of mahi-mahi and its by-products.

Training sessions cover improved hygiene practices to ensure product safety and quality, and meal preparation techniques that promote healthier meals and reduce food waste by turning fish by-products into value-added products instead of discarding them.

To support these improvements, new tools and equipment – including fish cutting machines, vacuum sealers, food dehydrators, scales, stainless steel tables, and filleting knives – have been distributed to 12 mahi-mahi fishing organizations across five coastal provinces in the country.

The resulting mahi-mahi products are safer and better quality; they also fetch higher prices in markets, contributing to improved incomes and greater prosperity in coastal communities. Vendors have received additional support to strengthen their marketing skills and facilitate business connections with key buyers such as supermarkets, hotels and restaurants.

Social protection for empowerment and sustainability

The mahi-mahi fishery in the Dominican Republic is largely informal; consequently, workers are often absent from national labour statistics. Many of these fisherfolk are thus ineligible for national social security schemes, leaving them vulnerable in cases of illness, accidents at sea, or other external shocks.

To address this issue, FISH4ACP is working to expand social protection coverage for mahi-mahi stakeholders and their families by strengthening collaboration between CODOPESCA and the Unified Beneficiaries System (SIUBEN). This partnership has enabled the collection of essential socioeconomic and vulnerability data, necessary to support the inclusion of fisher households in public social protection programmes.

As part of this effort, 1 485 fishers from 1 190 households were surveyed, and their socioeconomic data were uploaded to SIUBEN in real time. The results showed that 13.9 percent of individuals live in conditions of extreme poverty and 46.8 percent live in moderate poverty, according to the national Quality of Life Index. At the household level, this corresponds to 16.1 percent and 50.6 percent, respectively.

On the basis of these data, 61 percent of the surveyed fishers and their families were considered for inclusion in the Dominican Social Security System, which offers social protection programmes that help vulnerable populations cope with crises, while ensuring access to food, health care and education, and support to the elderly.

BOX 2.14 CELEBRATING COLOMBIAN PACIFIC CUISINE IN TUMACO

In Tumaco, a vibrant town on Colombia's Pacific coast, the scent of the sea mingles with the rhythm of drums and the spirit of a community determined to shape its future. Home to the country's largest marine fishing population, Tumaco has long been a place where Afro-Colombian traditions, ocean livelihoods and culinary heritage converge.

For years, post-harvest losses plagued small-scale fisheries in the region with tonnes of fish lost and wasted due to poor infrastructure, inadequate cold chains, and limited knowledge of how to preserve fish and transform by-products. These losses impacted food security, reduced income opportunities, and diminished the value of artisanal fishing.

With support from FAO and national and international partners, Tumaco became a living laboratory for exploring Blue Transformation solutions to reduce fish losses. Participatory multistakeholder dialogue was conducted, local voices were heard, and shared solutions, grounded in tradition and community resilience, began to emerge.

Saboreando el Pacifico (Savouring the Pacific) played a key role. This gastronomic festival – a vibrant yearly celebration of local knowledge and sustainable aquatic food systems – allowed more than 35 small-scale fishery-based enterprises, many led by women and youth, to showcase an impressive array of tastes, products and practices. The festival gave them opportunities to expand market access and product visibility. This wasn't just a food fair; it was a statement of purpose promoting dignity, creativity and solutions enshrined in a circular economy.

What was once considered "waste" became an opportunity. The festival demonstrated the transformation of fish by-products into high-value goods such as protein-rich flours, cured snacks, natural cosmetics, organic fertilizers, and human-grade collagen-based gelatin made from fish scales. Each product told a story of environmental stewardship, cultural pride, and an opportunity for livelihoods.

The festival exemplified Colombia's commitment to the Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries (SSF Guidelines) and the country's vision for Blue Transformation. Through territorial innovation labs, multistakeholder dialogue and inclusive partnerships, Colombia is investing in aquatic food systems that are resilient, equitable and ecologically sound.

In Tumaco, fishing is no longer just a livelihood; it is a form of art, identity and collective progress. Saboreando el Pacifico is more than a name; it is an invitation to view the ocean not only as a resource, but as a source of heritage, health and hope – providing foods for nutrition and sources of livelihood.

Moreover, food loss and waste reduction is a central component of Colombia's National Plan of Action for Small-Scale Fisheries – the first officially approved National Plan of Action for Small-Scale Fisheries (NPOA-SSF) in Latin America. This landmark NPOA positions Colombia as a regional leader in the implementation of the SSF Guidelines and the building of equitable, resilient and dignified livelihoods in the small-scale fisheries sector. It highlights how local innovation, food culture, and evidence-based policymaking can work together to address global challenges while empowering communities.





Aquatic food products on display at the Savouring the Pacific festival in Tumaco, Colombia
© FAO/Heysel Calderón

BOX 2.15 FAO GUIDANCE ON SOCIAL RESPONSIBILITY IN FISHERIES AND AQUACULTURE VALUE CHAINS

Fisheries and aquaculture provide livelihoods for over 600 million people worldwide and play a crucial role in ensuring food and nutrition security. Yet social challenges persist. Many workers continue to face unsafe working conditions, informality, limited access to social protection, and inadequate recognition of labour rights. Migrant workers and small-scale fishers are particularly vulnerable, encountering greater risks and fewer safeguards. Addressing these realities is essential for building more sustainable, equitable and resilient aquatic food systems.

In response, FAO has been developing voluntary guidance on social responsibility in fisheries and aquaculture value chains (FAO voluntary guidance). This initiative, requested by FAO Members in 2017, is an integral part of the FAO Blue Transformation Roadmap and the FAO Strategic Framework 2022–2031.

The FAO voluntary guidance aims to consolidate in a single reference the wide range of existing international instruments on labour and human rights, including those developed by the International Labour Organization (ILO), the International Maritime Organization (IMO) and other United Nations entities. It is designed to complement existing frameworks, making them more accessible and easier to apply across the sector. It is voluntary, non-binding, and adaptable to diverse national contexts, with a particular focus on developing countries and small-scale fisheries.

Although primarily directed at the private sector, the guidance will have broader relevance. It will offer a standard reference for policymakers, regional fisheries management organizations, civil society, trade unions, and other stakeholders seeking to strengthen social responsibility in fisheries and aquaculture. Its scope extends across the entire value chain, from industrial and small-scale fishing and aquaculture production to processing, trade, distribution, wholesaling and retailing.

The development process of the FAO voluntary guidance has been inclusive and participatory. Since 2017, FAO has engaged governments, industry, workers' representatives, civil society, academia, and international organizations through regional and global consultations, open online platforms, and technical working groups. Key partners, including ILO, IMO, the Organisation for Economic Co-operation and Development, and the United Nations Conference on Trade and Development, have provided valuable expertise. FAO Members continuously engage in different opportunities to shape the guidance through comments and recommendations.

Promoting social responsibility yields benefits that extend beyond the workplace. It enhances responsible market access, strengthens the resilience of coastal and riparian communities, and enables the sector to contribute more fully to achieving the Sustainable Development Goals. The guidance will support progress on decent work and economic growth, poverty reduction, food security and nutrition, gender equality, reduced inequalities, stronger partnerships, and the sustainable use of the ocean and of aquatic resources.

By placing people's well-being at the centre of fisheries and aquaculture value chains, the FAO voluntary guidance can help foster healthier, fairer and more prosperous communities. It can ensure that sustainability in fisheries and aquaculture is not only about protecting aquatic resources and ecosystems, but also about valuing, respecting and empowering the people whose life and future depend on them.



Workers peel shrimp in the pre-processing unit in Anandapuram, India
© FAO/Harsha Vadlamani



Workers repair nets in Mindelo, Cabo Verde
© FAO/Luis Costa

Towards a more inclusive and resilient mahi-mahi fishery
By establishing a mechanism for long-term institutional collaboration and aligning fisheries value chain upgrading with social protection, this initiative contributes to a more inclusive and resilient fisheries sector. It also provides a model that can be replicated in other sectors seeking to extend social protection to informal or under-represented populations.

As active participants in their own ten-year upgrading strategy, the communities that depend on the Dominican Republic's small-scale mahi-mahi fishery are becoming more aware, knowledgeable, skilled and secure, thanks to improved fish processing capacity, better skills, and inclusion in social protection schemes. These developments support the shared mission of FAO, FISH4ACP and the Dominican Republic to sustainably strengthen the mahi-mahi fishery while improving the livelihoods of artisanal fisherfolk.

Developing value chains and improving access to international markets

Blue Transformation in South Sudan: from emergency aid to export commodity

South Sudan, the world's youngest nation, is endowed with vast inland waters, dominated by the Nile River and the Sudd wetland. In many remote and conflict-affected areas, fish are often the only source of animal protein, playing a critical role in food security and nutrition. Yet, for decades, the fisheries sector remained informal, underdeveloped and overlooked.

Amid years of conflict, displacement and humanitarian crisis, FAO's initial work in South Sudan's fisheries focused on emergency aid. Between 2012 and 2020, more than 400 000 households annually received basic fishing kits, contributing to the restoration of livelihoods and improved nutrition for millions. As stability gradually returned to parts of the country, the work of FAO and its partners evolved into broader development efforts, shifting the focus from crisis relief to the building of resilient, inclusive and sustainable fisheries.

From relief to recovery
Following independence in 2011, conflict and economic collapse left many families without access to food or income. FAO's large-scale distribution of fishing kits – basic gear enabling subsistence fishing – quickly became one of the most impactful livelihood interventions in the country. Fishing provided essential nutrition and income in areas where markets and agriculture had broken down.

However, deeper challenges emerged. Post-harvest losses exceeded 60 percent in many areas due to spoilage and inadequate processing and preservation methods. Women, who dominated fish processing and trade, lacked access to hygiene equipment and training. Poor infrastructure, insecurity, and weak institutions further constrained sector growth, requiring fisheries to shift strategy from a survival mechanism into a structured engine for development.

Investing in innovation and resilience
The FAO Fisher Community Resilience Enhancement Project (FICREP), funded by the Kingdom of the Netherlands and implemented in close collaboration with local authorities and partners, focused on reducing post-harvest losses and improving the quality of fish products.

The project introduced improved processing techniques – such as the FAO-Thiaroye technique for fish smoking – along with enhanced salting and sun-drying practices. These methods extended shelf-life, reduced food safety risks, and enabled access to better markets. Around the Sudd, traders reported reduced spoilage and higher prices; women processors enjoyed increased income and improved working conditions.

FAO also supported local canoe-building innovations using epoxy resin. This allowed the use of locally available softwoods to create longer-lasting boats, reducing reliance on costly imported fibre-reinforced plastic canoes, which pose environmental risks when abandoned. This approach increased equitable access to fishing grounds and built technical skills in communities. Together, these interventions laid out the groundwork for a surplus-producing, trade-oriented sector.

As fishers adopted better processing techniques, market opportunities expanded. FAO facilitated the formation of cooperatives and strengthened aggregation points in key areas such as Terekeka and Bor. Construction of the Juba-Borroad by the government facilitated further access conditions for trade.

Smoked and salted fish from Unity and Jonglei states reached markets in Uganda and the Democratic Republic of the Congo, where demand for dried fish remains high. Though much of the trade is still informal, estimates suggest annual values in the tens of millions of dollars. Notably, women-led cooperatives are now central to aggregation, processing, logistics and marketing.

Challenges that continue to hinder progress include limited cold storage facilities, poor roads, seasonal flooding, and border control constraints. Yet, the foundations of a functioning value chain are now in place.

Towards sustainability and governance

As production and trade expanded, sustainability became a priority. The canoe-building initiative reduced plastic waste and built local capacity. FAO also launched basic food safety training and initiated discussions with the South Sudan National Bureau of Standards to explore certification protocols. While laboratory testing remains limited, efforts to improve hygiene and traceability are underway.

In support of future resource management, FAO will pilot environmental DNA (eDNA) sampling – an innovative, non-invasive method to monitor aquatic biodiversity. This technology will help build baseline data essential for supporting co-management and conservation planning.

Impact and way forward

Nowadays, around 1.9 million people rely on the fisheries sector for income in South Sudan. In many communities, fisheries have become the most stable source of livelihood, particularly in flood-prone or conflict-affected areas.

Nutritionally, fish remains the most accessible and affordable source of animal protein. Safe and quality products are increasingly available in local markets and institutional food programmes. Environmentally, the adoption of fuel-efficient smoking techniques and the use of improved canoes have lowered emissions and reduced deforestation. The sector's transformation has also been inclusive: women now lead cooperatives, youth are trained as boatbuilders and traders, and traditional knowledge is integrated with improved practices to create a local model of sustainable fisheries development.

South Sudan's fisheries transformation demonstrates how tailored, context-sensitive interventions can reshape a sector – even in fragile settings. The progress made did not require massive investment or top-down reforms, but was the result of incremental, community-led actions aligned with the pillars of Blue Transformation: inclusive value chains, sustainable innovation, and governance. To consolidate the gains in South Sudan, future efforts should focus on:

- establishing a food safety system, comprising regulations, testing laboratories, inspection and certification processes;
- strengthening trade corridors and simplifying border constraints;
- expanding co-management and community-based governance systems; and
- mobilizing public and private investments, including those from international finance institutions, with a focus on sustainable or blue financing (Box 2.16).

South Sudan's fisheries sector now stands at a crossroads. It has demonstrated its potential – not just as a food source, but as a vehicle for peacebuilding, rural development and economic recovery. The road ahead will be challenging, but the foundations are strong.

Promoting fish consumption in school feeding programmes

To reverse the trend of malnutrition and rising rates of obesity, overweight and chronic diseases, health and nutrition authorities throughout the world sustain policies and campaigns to promote diversified and balanced diets and healthy lifestyles, stressing higher consumption of aquatic foods. Aquatic foods are widely recognized for their benefits to health, nutrition, digestion and the development of youth's cognitive capabilities. »

BOX 2.16 FINANCING BLUE TRANSFORMATION – THE CASE OF THAILAND

Achieving the goals of the 2030 Agenda for Sustainable Development requires the mobilization of significant investments to support projects and economic activities with both environmental benefits (green finance, including blue finance) and social benefits (social finance).

A shared and holistic understanding of the sustainability impact of economic activities is necessary – both to promote sustainable finance by enhancing investors' awareness and confidence in sustainable financial products and to address concerns about greenwashing. A unified classification system of sustainable finance, referred to as sustainable finance taxonomy, enables countries, development banks and financial institutions to share common principles, guidelines and best finance practices. These classifications define minimum social safeguards (MSS) and environmental technical screening criteria (TSC). The MSS and TSC are used to assess whether economic activities are eligible for sustainable finance, and to elaborate assessment and reporting procedures.[42] The TSC refer to one or more of six environmental objectives (EOs):

1. Climate change mitigation
2. Climate change adaptation and resilience
3. Sustainable use of water and marine resources
4. Resource efficiency and circular economy
5. Pollution prevention and control
6. Biodiversity and ecosystem protection

An economic activity meets sustainable finance requirements if it:

- makes a substantial contribution to at least one EO;
- does no significant harm to any of the other EOs;
- complies with relevant TSC; and
- complies with MSS.

Over a 15-month period during 2024–2025, the Government of Thailand worked with the World Bank to assess how a sovereign blue bond could be used to raise capital for its blue economy priority areas. The assessment reviewed Thailand's institutional and market readiness, developed the blue financing section of the Sustainable Financing Framework, mapped a pipeline of eligible projects, and designed a monitoring and reporting framework to support future issuance.[42]

The blue financing section spans 6 EOs, 4 priority sectors and 13 subsectors. It adopts a phased implementation approach and is benchmarked against key international and regional standards: International Finance Corporation Guidelines for Blue Finance; European Union taxonomy; International Platform on Sustainable Finance common ground taxonomy; and Association of Southeast Asian Nations (ASEAN) Taxonomy.

The proposed framework includes under the Sustainable Coastal and Marine Economy sector a dedicated subsector: Sustainable Fisheries, Aquaculture, and Seafood Value Chains. This subsector identifies eligible project activities with TSC aligned with the FAO Code of Conduct for Responsible Fisheries and its relevant guidelines.*

Three large-scale infrastructure projects were selected to address Thailand's most urgent threats: coastal erosion, sustainable tourism, and waste management. They form a pipeline of approximately USD 3 billion in proposed investments, positioning the issuance as potentially the largest sovereign blue bond in the ASEAN region.

An impact and reporting framework was developed to support transparent disclosure on use of proceeds and expected outcomes. National workshops were carried out to build the capacity of line ministries and implementing agencies for applying the framework effectively.

Blue bonds present a viable financing solution for countries such as Thailand, with an existing pipeline of coastal and marine infrastructure projects. Their effectiveness requires a robust finance taxonomy and clearly defined uses of proceeds, supported by strong monitoring and reporting systems that enhance transparency, build investor's confidence and ensure accountability for results.

NOTE: * The guidelines are available at: https://www.fao.org/3/v9878e/v9878e.pdf



Urak Lawoi compressor divers deploy their artisanal fish trap on the seafloor, Satun, Thailand
© FAO/Sirachai Arunrugstichai



Fish processing practices to reduce food loss and waste in Nong Bua Lam Phu Province, Thailand
© FAO/Alisa Suwanrumpha

» For years, FAO has been supporting initiatives to promote the use of aquatic products in school feeding programmes. In addition to the health and nutrition benefits, when ingredients are sourced and school dishes prepared locally, more opportunities are created for local actors and communities.

Strengthening value chain actors to supply aquatic foods to school feeding programmes in Malawi

School feeding programmes can boost both nutrition and local livelihoods. In Malawi, fisheries are important, providing 16.1 percent of animal proteins and employing over 220 000 people in 2023. School meal programmes have been promoted in the country for decades: they can improve educational outcomes (e.g. reduced absenteeism and increased enrolment); they increase food security and nutrition of learners; and they enhance livelihoods for local producers when foods are sourced locally. However, fish has been missing from school menus.

For several years, FAO has implemented initiatives to promote the use of fish products in school feeding programmes in different countries (Box 2.17), taking into account their acceptability, quality, affordability and convenience.[43–45] Building on these experiences, FAO and partners are strengthening the capacity of local small-scale fishworkers in Malawi to provide fish powder for school meals.[44, 45]

Usipa (*Engraulicypris sardella*), a small sardine from Lake Malawi, was made into fish powder using four different processing methods: (i) sun-drying; (ii) smoking; (iii) parboiling; and (iv) pan-roasting. The cost of production for each method was calculated and compared to school feeding programme budgets to assess affordability. The fish powders were then incorporated into school recipes in two districts; they were tested for acceptability – both through direct feedback from schoolchildren and catering staff, and by measuring the food left on plates at the end of the meal. The catering staff's feedback was important to ensure that the use of fish powder did not disrupt meal preparation.

Results showed that various school meals featuring fish powder incorporated into the original recipe (porridge made from maize and soy/groundnut flour) were highly accepted by schoolchildren. Pan-roasted usipa powder was the most liked, with approximately 90 percent of children consuming over 75 percent of porridges containing pan-roasted fish powder, regardless of whether the children were from a lake-shore or inland district. Catering staff found all the fish powders convenient to use, as they could easily incorporate them into porridge served every morning. On the other hand, while pan-roasting the fish before grinding it into fish powder was more accepted by students, this method increased both processing time and fuel costs; what is more, the use of additional fuelwood raised concerns over deforestation as well as economic sustainability (Figure 2.15).

Based on the calculation method of Ahern *et al.*,[45] the addition or substitution of fish powder represented about 2.5–10 percent of the weekly spending on food for school meals. Considering that 1 872 490 children receive meals from the school meals programme in Malawi, incorporating 2.5 g of fish powder per student into the meal three times per week would result in an additional cost of USD 18 725 per week, that is USD 675 000 for a 36-week school year. This represented about 4.8 percent of the total school meals budget, estimated at USD 13 964 063 in 2021.[46]

Most important are the nutritional benefits of including fish powder in school meals. The nutrient composition of a typical school meal recipe (maize and groundnut flour porridge) was calculated using published food composition data; the conventional recipe was then compared to a recipe substituting 5 g of fish powder for 5 g of groundnut flour. One meal of porridge containing fish powder had an increased nutritional content: protein (+6 percent), thiamin (+9 percent), riboflavin (+22 percent), vitamin B6 (+65 percent), niacin (+34 percent), vitamin B12 (from 0 mcg to 0.95 mcg), iron (+44 percent), zinc (+34 percent), calcium (+8 percent), phosphorus (+21 percent) and potassium (+27 percent). On the other hand, there was a reduction in the content of vitamin E (–16 percent) and folacin (–6 percent). Data were not available in the Malawi Food Composition Table for fatty acids, iodine and vitamin A.

BOX 2.17 SMALL-SCALE AQUACULTURE BOOSTS CHILD NUTRITION IN HONDURAS

A government school feeding programme, entitled Healthy Schools, has been implemented in Honduras since 1998 with the aim to boost school attendance, improve quality of life, decrease levels of malnutrition among schoolchildren, reduce poverty, and promote a healthy environment at both the physical and the mental levels. The food given to the children at school is mainly based on maize, rice, beans, oil and a pre-prepared mix of maize and soy flour. In 2019, FAO and partners investigated fish production and barriers to fish consumption in Honduras.

The studies showed that Honduras is one of the main exporters of fish in Central America, mainly of farmed tilapia. At the same time, fish consumption in the country is among the lowest in the world, with a per capita availability of aquatic animal foods of only 4 kg per year.[21] Poor quality, high prices, and the lack of a local tradition of eating fish are the main causes of the low consumption rate. Tilapia producers were identified as possible suppliers of affordable, locally produced fish for school feeding programmes. Supported by the Association of Fish Producers of Honduras – which provided small producers with access to financial resources and enabled the negotiation of the price of feed and other inputs – the number of tilapia farmers is growing, along with their contribution to the local economy and food security.

Different recipes including tilapia or bass were tested for acceptability among schoolchildren. A traditional dish was prepared using fillets, while the heads and bones were used to prepare a soup. By using the entire fish, more micronutrients were delivered and food losses and waste were reduced. The dishes were tested for acceptability in three schools in the municipality of Ilama in the department of Santa Bárbara, and in one school in Tela. Despite the low fish consumption in Honduras and the fact that the children are not used to consuming fish, the schools reported a 100 percent acceptance rate of the dishes.



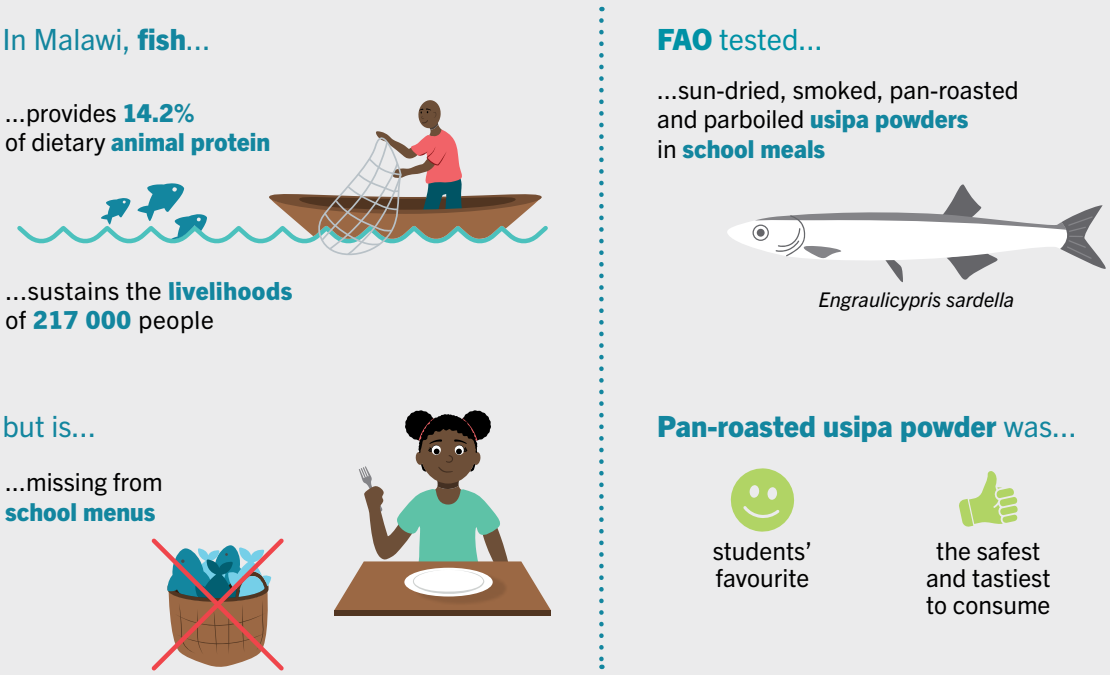
A child eating a fish-based school meal in Macholoa, Honduras
© FAO/Alcides Rodríguez



A cook preparing a fish dish in Santa Bárbara, Honduras
© FAO/Katya Erazo Ramos

However, it is expected that the content of these nutrients, particularly long-chain omega-3 polyunsaturated fatty acids – DHA and EPA – increased, as whole small fish are known to be rich in them. Bearing in mind that in Malawi, over 60 percent of pre-school and school-age children are zinc-deficient, almost 22 percent of pre-school and 5 percent of school-age children are iron-deficient, and more than 22 percent are anaemic,[47] the increased zinc and iron content of fish powder-enriched porridge represents a viable solution for improving the intake of these two micronutrients.

FIGURE 2.15 TRIALS ON USIPA (*ENGRAULICYPRIS SARDELLA*) FISH POWDERS FOR INCLUSION IN SCHOOL MEALS TO IMPROVE NUTRITION AND LIVELIHOODS, MALAWI



While fish powder was acceptable to children and convenient for kitchen staff to use, processing methods and practices must be further developed to increase efficiency and improve food safety. In addition, sustainability – both environmental and economic – must be considered when scaling up the use of fish powders in school meal programmes, taking into account both cost effectiveness and sustainable management of fish stocks. Ensuring acceptability of foods is vital for reducing loss and waste and maximizing the nutritional impact of school meals; indeed, higher acceptability of the porridge was associated with lower plate waste. FAO, the Government of Malawi and research partners are furthering this research and development to scale the use of fish powder in school meals through other pilot programmes in 2026. ■



GHANA
Fisher mending his nets.
© iStock.com/ Renate Wefers

PART 3 CONTEMPORARY ISSUES AND OUTLOOK

Fisheries and aquaculture play an important role in food security, nutrition, and poverty alleviation. However, the sector is increasingly shaped by a rapidly changing global context. The climate crisis, environmental degradation, economic shocks and shifting international political dynamics are influencing the sustainability and performance of aquatic food systems. Part 3 examines some of these interconnected issues and explores how they inform future projections of aquatic food production. It also highlights scientific advances in climate projections and adaptation strategies, and outlines FAO's efforts to mobilize its Members, partners and key stakeholders to translate this knowledge into action. Through targeted interventions, FAO aims to strengthen the resilience and sustainability of aquatic food systems in the face of ongoing and emerging pressures. ■

FROM COMMITMENTS TO ACTION

FAO's voluntary commitments to the 2025 United Nations Ocean Conference

Under the overarching theme of "Accelerating action and mobilizing all actors to conserve and sustainably use the ocean", the Governments of France and Costa Rica co-hosted the Third United Nations Conference to Support the Implementation of Sustainable Development Goal 14 (Ocean Conference). The event, held in Nice, France, from 5 to 9 June 2025, brought together more than 14 000 world leaders, country representatives, economic organizations and civil society organizations and other global stakeholders from 175 states, including 75 heads of state and government. More than 100 000 participants attended events in the area devoted to civil society, reaffirming the urgent need for transformative action to protect, conserve and sustainably use the ocean.

The Conference declaration – Our ocean, our future: united for urgent action[an] – reasserted the accelerating impacts of climate change, biodiversity loss and pollution on the health of the ocean and of all peoples. It emphasized the need to act urgently to conserve the ocean and its ecosystems, preserve and expand sustainable ocean-based economies, and accelerate action to achieve the targets of SDG 14.

The declaration also recognized that SDG 14 remains one of the least funded goals and invited the global community to provide appropriate financing and fulfil "existing commitments and obligations under relevant intergovernmental agreements". It highlighted the need to support technology transfer and capacity building for developing countries, especially Small Island Developing States and Least Developed Countries and vulnerable coastal communities.

an The full declaration is available at: https://documents.un.org/doc/undoc/gen/n25/146/52/pdf/n2514652.pdf

FAO's contribution and future role

FAO's role and actions were highly visible during the Conference and in its declaration; and pressing issues relevant to FAO's mandate and priorities were prominent at the Conference events. These included the achievement of sustainable aquatic food systems for food security and nutrition, the implementation of the Voluntary Guidelines for Securing Sustainable Small-scale Fisheries, the fight against overexploitation and illegal, unregulated and unreported fishing, and the curtailment of abandoned, lost or otherwise discarded fishing gear.

FAO's Blue Transformation – with its focus on sustainable aquatic food systems, equitable resource use, and ecosystem health – aligns with the declaration's call for urgent, science-based interventions. It serves as a guide for FAO to mobilize resources and strengthen partnerships to implement its priorities and commitments.

FAO's commitments and path to delivery

During the Ocean Conference, FAO made 12 specific commitments amounting to USD 275 million plus additional in-kind funding (Figure 3.1).

These commitments include pledges to strengthen implementation of the SSF Guidelines through national plans of action, capacity development to manage small-scale fisheries, and strengthening of fisher and fishworker organizations. The FAO–Norway Nansen Programme (Box 2.8) allocates resources to support actions that bridge science and policy for effective fisheries management, increase knowledge on marine ecosystems, and strengthen institutional capacities.

Access to data, information and statistics remains a key constraint for effective fisheries management. FAO therefore commits to enhance Members' capacities to collect, curate and analyse data, updating stock assessment methodologies, and leveraging technology to monitor and report on their fisheries. To tackle marine pollution, FAO supports the implementation of global guidelines to reduce abandoned fishing gear, particularly through partnerships that enable global knowledge and capacity sharing. In addition, FAO backs international initiatives that combat IUU fishing, furthering capacities to implement the FAO Agreement on Port State Measures and strengthening systems such as the Global Information Exchange System that facilitate global cooperation in the fight against IUU fishing (Box 2.11).

Recognizing the potential of the aquaculture sector to meet the rising global demand for aquatic foods, FAO pledges to advance its sustainable expansion and intensification (Box 3.1). This will require policy support, knowledge transfer, and innovation along the value chain.

Further commitments focus on strengthening the critical regional efforts required to support achieving the targets of SDG 14. This includes strengthening the FAO COFI Sub-Committee on Fisheries Management, and providing significant technical assistance to Members and regional fishery bodies to develop, implement and monitor fisheries management processes and systems that deliver social, economic and ecological benefits. Similarly, the Indian Ocean Tuna Commission (Box 2.9) and the General Fisheries Commission for the Mediterranean (Box 2.2) have committed significant resources to maximize the contribution of fisheries and aquaculture under their respective competence to food and nutrition security, livelihoods and healthy ecosystems.

To deliver on these commitments, FAO must mobilize pledged and significant additional resources, and foster strong partnerships with governments, donors, the private sector and civil society organizations. Capacity development adapted to developing countries' needs is critical to ensure that policies translate into action on the ground.

FAO's Blue Transformation objectives align with many of the outcomes of the Third United Nations Ocean Conference. Achieving them will require FAO leadership to strengthen international cooperation and foster partnerships that can turn commitments into measurable progress. ■

FIGURE 3.1 OVERVIEW OF FAO'S GLOBAL COMMITMENTS UNDER ITS BLUE TRANSFORMATION VISION LAUNCHED AT THE THIRD UNITED NATIONS OCEAN CONFERENCE

BLUE TRANSFORMATION

	COMMITMENT	FUNDS (USD)	DEADLINE
	Securing **sustainable SSF** for **food security** and **poverty eradication** through the **SSF Guidelines**	9 million	2027
	Advancing **sustainable aquaculture development** through the FAO **GSA**	3 million	2026
	Enhancing the role of **aquatic foods** in delivering **healthy diets** for those in **vulnerable settings**	0.5 million	2030
	Supporting the application of **EAF management** considering **climate** and **pollution impacts** (EAF-Nansen)	94 million	2028
	Advancing **climate change adaptation** and **mitigation** by facilitating access to **knowledge**, **tools** and **climate finance**	45 million	2024
	Reducing **marine litter** from **fisheries activities** and **maritime transport**, in particular **ALDFG**	7 million	2025
	Strengthening global efforts against **illegal**, **unreported** and **unregulated fishing** through **enhanced national capacities**	10 million	2028
	Improving **marine fishery stocks assessment**, **data accuracy** and **monitoring capacities**	3 million	2026
	Strengthening capacity for **sustainable fisheries** through enhanced **data collection**, **stock assessment** and **management**	20 million	2028
	Promoting **sustainable fisheries management** by supporting **Members** and **regional fishery bodies**	20 million	2029
	Improving **fisheries** and **aquaculture sustainability** in the **Mediterranean** and **Black Sea** (GFCM)	50 million	2030
	Supporting the **sustainable management** of **tuna** and **tuna-like species** in the **Indian Ocean** (IOTC)	13.5 million	2028
		TOTAL = USD 275 MILLION + IN KIND	

NOTE: SSF – small-scale fisheries; SSF Guidelines – Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries in the Context of Food Security and Poverty Eradication; GSA – Guidelines for Sustainable Aquaculture; EAF – ecosystem approach to fisheries; ALDFG – abandoned, lost, or otherwise discarded gear; GFCM – General Fisheries Commission for the Mediterranean; IOTC – Indian Ocean Tuna Commission.

SOURCE: Author's own elaboration.

BOX 3.1 FAO'S ACTIONS TO IMPLEMENT THE GUIDELINES FOR SUSTAINABLE AQUACULTURE

The Guidelines for Sustainable Aquaculture (GSA), adopted by FAO Members in 2024, mark a milestone as the first international instrument fully dedicated to the sector. Rooted in the Code of Conduct for Responsible Fisheries (CCRF) and the Blue Transformation Roadmap, the GSA provide a global framework to guide the sustainable growth of the sector.

To support their adoption and application in practice, FAO is actively raising awareness of the guidelines using a dedicated website that features case studies, publications and news, and showcases practical applications. Building on the Workshop on Communicating the Guidelines for Sustainable Aquaculture, FAO has convened regional workshops that engage governments, industry and civil society in identifying priority actions towards implementation. These workshops aim to mainstream the GSA throughout national and regional policies while targeting resource mobilization efforts.

Under the Food Systems Integrated Programme, funded by the Global Environment Facility, aquaculture projects are incorporating GSA principles into workplans and activities, with FAO support planned for spatial planning, integrated systems and sustainable feeds. Similarly, the Global Sustainable Aquaculture Advancement Partnership is addressing Members' requests by providing pooled expertise, ensuring technical capacity and resources are directed where most needed.

Regionally, strategies like the GFCM 2030 Strategy for sustainable fisheries and aquaculture in the Mediterranean and the Black Sea* and the white paper on aquaculture transformation in Asia and the Pacific** are being reviewed for alignment to the GSA. At the national level, FAO is supporting countries to contextualize the GSA into aquaculture development and investment strategies and plans. For example, in Malawi, the National Aquaculture Development Plan was aligned with the GSA in 2024, providing a concrete roadmap to supporting aquaculture growth.

Ownership is reinforced through monitoring and evaluation. FAO has revised the CCRF Questionnaire on Aquaculture to track GSA implementation and provide insights into regional and global aquaculture trends (Box 2.7). Upcoming normative work will further enhance action-oriented implementation, including guidance on monitoring and reporting tools.

By embedding the GSA into its programmatic work, FAO provides a consensus-based instrument to unite stakeholders, channel investments, and coordinate efforts in support of sustainable aquaculture development. This shared framework increases awareness, fosters alignment and builds ownership, ensuring that aquaculture achieves its full potential in contributing to better production, better nutrition, a better environment and a better life, leaving no one behind.



Yangcheng lake aquapark in Suzhou city, Jiangsu province, China
© FFRC/Haojun Zhu



Fish farming facilities in Orbetello, Italy
© FAO/Victor Sokolowicz

NOTES: * GFCM – General Fisheries Commission for the Mediterranean; for further details, see: https://doi.org/10.4060/cb7562en
** For further details, see: https://doi.org/10.4060/cc4962en

MULTILATERAL FISHERIES MANAGEMENT IN A CHANGING WORLD

The future role of regional fishery bodies in implementing international instruments

As global fisheries governance evolves, and demands for improved management and cooperation intensify, regional fishery bodies – comprising regional fisheries management organizations and regional fisheries advisory bodies – continue to stand at the forefront of ocean governance, promoting multijurisdictional cooperation and translating global instruments into actionable regional measures.

Regional fishery bodies provide scientific advice, implement management, compliance and monitoring actions, support capacity building, and facilitate cooperation across jurisdictions, placing them in a unique position to tackle future challenges such as overfishing, illegal, unreported and unregulated fishing, biodiversity loss, and climate change.

Supporting the effective implementation of international instruments

Regional fishery bodies are increasingly instrumental in the implementation of new and emerging international instruments, including the Agreement on the Conservation and Sustainable Use of Marine Biological Diversity of Areas beyond National Jurisdiction (BBNJ Agreement), the Kunming-Montreal Global Biodiversity Framework (GBF) under the Convention on Biological Diversity (CBD), and the World Trade Organization (WTO) Agreement on Fisheries Subsidies.

The BBNJ Agreement, which came into effect in January 2026, establishes a global framework for the conservation and sustainable use of marine biological diversity in areas beyond national jurisdiction. It addresses four key domains: marine genetic resources; area-based management tools; environmental impact assessments; and capacity building and technology transfer.[1]

The BBNJ Agreement must not undermine existing relevant instruments, frameworks and bodies, such as the RFMOs that oversee 95 percent of fishing in ABNJ. However, parties to the BBNJ Agreement are required to promote its objectives in other relevant bodies, and the BBNJ Agreement requires enhanced cooperation to achieve its objectives.

Regional fisheries management organizations will therefore be critical for the effective implementation of the BBNJ Agreement, including through capacity development, provision of science and data, and the development and implementation of monitoring frameworks.

The BBNJ Agreement also promotes cross-sectoral cooperation, offering new opportunities to strengthen ecosystem-based fisheries management (Box 3.2).

Adopted in 2022, the GBF is a non-binding instrument aiming to halt and reverse biodiversity loss by 2030.[2] It includes targets to conserve at least 30 percent of marine and coastal areas and restore degraded ecosystems while also promoting the sustainable management of fisheries and aquaculture. Regional fishery bodies can support its implementation by getting relevant spatial conservation measures recognized as other effective area-based conservation measures, advocating for bycatch reduction, habitat protection and ecosystem-based approaches to fisheries management.

In September 2025, the WTO Agreement on Fisheries Subsidies entered into force, marking a significant advancement in global trade governance by aligning subsidy regulations with sustainable fisheries management.[3] The agreement establishes binding rules that prohibit certain subsidies that contribute to IUU fishing, the overexploitation of fish stocks, and fishing in unregulated high seas areas (Box 3.3). Its implementation requires strengthened institutional frameworks and intergovernmental coordination, supported by targeted capacity development. The support of RFBs – in providing stock assessments and catch data, monitoring compliance, and maintaining vessel registries and IUU vessels lists – will be critical.

BOX 3.2 FAO'S SUPPORT TO THE CONSERVATION AND SUSTAINABLE USE OF BIODIVERSITY OF AREAS BEYOND NATIONAL JURISDICTION

The Agreement under the United Nations Convention on the Law of the Sea on the Conservation and Sustainable Use of Marine Biological Diversity of Areas beyond National Jurisdiction (BBNJ Agreement) sets up a global framework to conserve and sustainably use biodiversity in ocean areas beyond countries' exclusive economic zones. Adopted in 2023, the BBNJ Agreement came into effect in January 2026 and the first Conference of the Parties will meet in early 2027.

Marine biodiversity underpins sustainable fisheries and global food security. The importance of cross-sectoral collaboration and the critical role of conservation are well recognized: the BBNJ Agreement now presents a unique opportunity to enhance efforts and improve outcomes.

FAO is supporting its Members and regional fishery bodies in the implementation of the BBNJ Agreement through a variety of mechanisms. Although its operational modalities are still being developed, FAO's data systems, technical expertise and capacity-building activities will be important supporting mechanisms for its implementation.

FAO's supporting activities include:

- global systems for the collation and dissemination of fisheries data and statistics;
- technical expertise in fisheries science, management and governance, as well as genetic resources, and access and benefit-sharing;
- the FAO Committee on Fisheries and the Regional Fishery Body Secretariats' Network, both of which support coordination and dialogue between Member Nations and fishery bodies;
- the EAF-Nansen Programme, which collaborates with regional fisheries management organizations and regional fisheries advisory bodies through surveys with the *Dr. Fridtjof Nansen* research vessel, associated capacity development, and the provision of data and information on resources and ecosystems in little known areas beyond national jurisdiction (ABNJ) around Africa and in the Bay of Bengal; and
- the Global Environment Facility (GEF)-funded Common Oceans Programme, focused on efficient and sustainable fisheries management and biodiversity conservation in ABNJ.

In partnership with the United Nations Development Programme and the United Nations Environment Programme, FAO is implementing two interlinked, GEF-funded projects to support countries in the ratification and implementation of the BBNJ Agreement. These projects provide much needed resources and tools to strengthen national capacity, foster regional cooperation, and promote global collaboration and knowledge exchange.



Two purse seiners docked at Majuro Port, Marshall Islands
© FAO/Chewy E. Lin



Artisanal fishers unloading boxes of pota or giant squid at the port of Pucusana, Peru
© FAO/Jordi Vaque

BOX 3.3 THE GLOBAL IMPACT OF THE TRADE-RELATED AGREEMENT ON FISHERIES SUBSIDIES

The World Trade Organization (WTO) Agreement on Fisheries Subsidies (hereafter "the Agreement"), adopted at the Twelfth Ministerial Conference in 2022, is the first in WTO history to focus specifically on sustainability. Entering into force in 2025, it commits Members to eliminate harmful subsidies that undermine aquatic marine resources and dependent livelihoods.

The Agreement establishes binding rules that prohibit subsidies: (i) contributing to illegal, unreported and unregulated (IUU) fishing; (ii) regarding overfished stocks based on the best available scientific evidence; and (iii) for fishing or fishing-related activities in unregulated high seas. The aim is to decrease incentives for overexploitation, support recovery vital for food security and nutrition, and make the global aquatic trade sustainable.

Effective implementation presents many challenges beyond subsidy reform. It requires sound fisheries science, transparent data, and strong institutions – areas within the mandate of FAO. Countries must improve control, monitoring and surveillance (MCS), rebuild overfished stocks, and enhance reporting. Through its technical expertise and global tools, FAO assists Members in strengthening their scientific and institutional capacities, developing evidence-based policies, and fulfilling associated obligations.

The Code of Conduct for Responsible Fisheries, the Port State Measures Agreement and the voluntary guidelines on catch documentation schemes and transshipment offer key guidance in this regard. They cover principles for sustainable fishing practices, as well as guidance for MCS to deter illegal activities and improve transparency and traceability; the normative instruments of FAO are thus indispensable for sustainability.

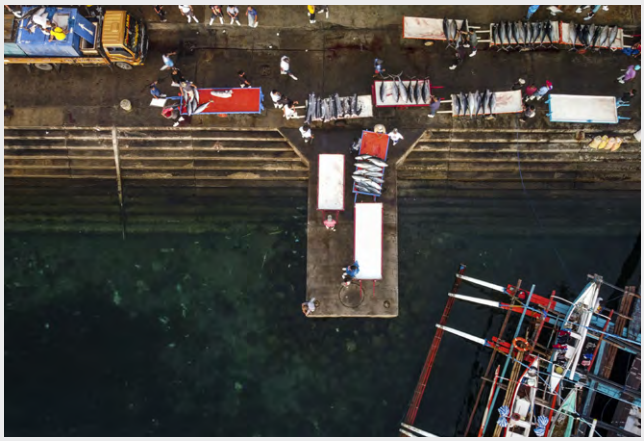
Regional fisheries management organizations (RFMOs) and arrangements play a crucial role in combating IUU fishing, evaluating overfished stocks, and setting and enforcing sustainable catch levels within specific jurisdictions. With 80 percent of WTO members belonging to at least one RFMO, and nearly half belonging to more than one, these organizations are essential for international cooperative fisheries governance.

FAO promotes enhancing scientific capacity, upgrading data systems, and supporting dialogue. Tools such as FishStatJ, the Fishery Resources Monitoring System (FIRMS), the Global Record of Fishing Vessels and the State of Stocks Index support countries and RFMOs in gathering, sharing and analysing data for better decision-making.

As a technical partner to the WTO Committee on Fisheries Subsidies, FAO ensures scientific evidence guides implementation, as well as future negotiations. FAO also assists the WTO Fisheries Funding Mechanism ("Fish Fund") by providing counsel on and evaluating applications, technical requirements, and capacity development needs, taking into account the circumstances of developing and least developed Members.

The Agreement's influence goes beyond fisheries. Removing incentives for overfished stocks and IUU fishing helps strengthen marine ecosystems, boosts resilience in coastal communities, and supports a fairer global fisheries economy. Implementation advances the Sustainable Development Goals (SDGs), particularly SDG 14 (Life below Water), while also contributing to poverty reduction, food security and decent work.

The Agreement demonstrates how trade policy, science and sustainability can be integrated to support global public goods. With its normative frameworks, technical expertise, and capacity-development efforts, FAO is uniquely positioned to help Members fulfil their commitments and turn them into lasting benefits. Aligning subsidy reform with responsible fisheries is a crucial step towards maintaining the ocean as a source of food, livelihoods and biodiversity for future generations.



Local fishing boats docked at the General Santos fish port complex during peak morning trading in General Santos City, Philippines
© FAO/Veejay Villafranca



Tuna fishing vessels approach a cargo ship to unload the day's catch, Maldives
© FAO/Giulio Napolitano

Strengthening governance and capacity to tackle current and emerging challenges

Regional fishery bodies provide institutional platforms and mechanisms for cooperation, enabling collective responses to transboundary issues, and ensuring management measures are science-based and regionally adaptable.

Climate change is a most pressing challenge requiring the integration of climate considerations into regional fisheries management to sustain productivity, protect ecosystems, safeguard livelihoods, and plan adaptation in order to respond to the changes adequately (see **Climate projections for informing adaptation strategies**). Changes in ocean temperature may be associated with shifts in the productivity, spatial distribution and abundance of marine species. Under high emissions scenarios, exploitable fish biomass is projected to decline by over 10 percent by mid-century in several regions.[4] These changes risk undermining management frameworks, particularly where stocks cross jurisdictional boundaries or enter unregulated areas. Regional fishery bodies can help understand and manage these risks through joint research, data sharing, climate-informed modelling, and adaptive, precautionary approaches that enhance fisheries resilience.[5]

Robust and harmonized data are foundational to effective regional governance. In practice, the quality and reliability of data collection systems vary across countries, and regional databases often suffer from incomplete reporting, inconsistent time series, and insufficient spatial or taxonomic resolutions. These limitations hinder stock assessments and ecosystem-based management and weaken the foundation for coordinated regional action. Regional fishery bodies are instrumental in addressing these gaps by promoting standardized data collection frameworks, building common protocols, supporting collaborative assessments and facilitating data sharing. Continued investment in institutional coordination, interoperable data systems, and capacity development is essential to strengthen regional science and adaptive decision-making.

Despite the broad reach of RFBs, some gaps remain in geographical coverage, species-related mandates, and institutional coordination. The catch of non-tuna species in several high seas areas – such as the Southwest Atlantic and parts of the Indian and Pacific Oceans – falls outside the mandates of existing RFMOs, and RFB management advice for associated and non-target species is often under-resourced, particularly for small tunas, elasmobranchs, and other ecologically or economically significant species.[ao] Expanding cooperative monitoring and management frameworks, supported by stronger national and regional capacities, will be essential for closing these gaps.

To meet these and future challenges, RFBs require strengthened mandates, enhanced coordination, and more inclusive governance that actively engages key sectors and stakeholders. Building adaptability into decision-making processes is essential as RFBs confront emerging issues such as shifting species distribution, technological innovation, and the need for greater coherence across fisheries, biodiversity and climate agendas. Investment in science, technology and digital monitoring will improve compliance and transparency, while sustained capacity development will enable broader participation, particularly among developing states. Through collaboration, innovation and shared stewardship, RFBs will remain essential pillars of twenty-first century ocean governance – safeguarding sustainable fisheries, marine biodiversity and the livelihoods that depend on them. ■

CLIMATE PROJECTIONS FOR INFORMING ADAPTATION STRATEGIES

Long-term projections of climate change risks to aquatic food systems

Climate change impacts on the aquatic food sector are increasingly documented around the world. Studies on the relevance and potential success of adaptation measures[6–8] have supported their practical application on the ground. As a result, there is a growing awareness among decision-makers, who are increasingly integrating

ao For further details, see: https://openknowledge.fao.org/handle/20.500.14283/cd8075en

climate change considerations in fisheries and aquaculture planning and management.

A key challenge posed by climate adaptive management of aquatic food systems is the uncertainty of climate risks in the short, medium and long term. This is particularly critical for countries that rely heavily on fisheries and aquaculture for their economy or food security. The Central/Southwest Pacific provides an outstanding example in this respect.

Several Pacific Island countries are highly dependent on tuna resources, with access fees contributing an average of 37 percent and up to 84 percent of government revenue across ten tuna-dependent Pacific SIDS.[9] These countries are experiencing a shift of the resources away from traditional fishing grounds, leading fisheries managers to make decisions based on cutting-edge science and model projections for tuna species at different time horizons.[10] The models used are refined as science progresses; for example, correction of the forcing earth system models, based on the latest oceanic projections on temperature and productivity, helps reduce uncertainties and improves the accuracy of management responses (Box 3.4). Models are thus critical for planning: they can inform decision-making, and their accuracy improves as new science becomes available.

Projecting future biomass, productivity and species distribution

Modelling marine ecosystems has received substantial attention, compared to freshwater ecosystems. However, despite considerable efforts, the task of ecosystem modellers in providing projections of climate change impacts on marine ecosystems and fisheries to inform decision-makers remains immense, and useful data are not always available to cover all regions of the world. Current models represent complex processes and interactions (e.g. predator–prey relationships), but are based on assumptions on forcing variables and have different computing capabilities, leading to different results despite being built on solid science. To address this, the Fisheries and Marine Ecosystem Model Intercomparison Project (FishMIP) ensemble integrates multiple ecosystem and species distribution models. FishMIP provides long-term projections of fish biomass and ecosystem indicators under different greenhouse gas emissions pathways, ranging from the low emissions Shared Socioeconomic Pathways 1–2.6 (SSP1–2.6) to the high emissions SSP5–8.5 (now considered highly unlikely). This multi-model approach captures both the mean response and the uncertainty across models and regions, providing a robust picture of potential futures for marine fisheries. The results have direct relevance for designing adaptation programmes and management frameworks aimed at ensuring climate-resilient fisheries in the future.

The latest comprehensive synthesis of FishMIP projections of marine fish biomass[4] indicates that under a low emissions scenario, marine fish biomass is expected to either be stable or decrease by less than 10 percent, whereas under a high emissions scenario, it could decline by approximately 30–40 percent by 2100 relative to the period 1950–2014. The magnitude of change varies regionally (Figure 3.2), with the strongest declines expected in tropical and subtropical waters, particularly in the Equatorial Pacific, Western Indian Ocean, and parts of the Atlantic. In contrast, biomass in high-latitude systems such as the Arctic and subpolar North Atlantic is projected to slightly increase, reflecting poleward range expansions of fish species, which is one of the most robust patterns emerging from FishMIP. Species historically concentrated in tropical waters are projected to migrate towards higher latitudes following their thermal niches. This results in increasing biomass and biodiversity in subpolar regions such as the North Atlantic and the Southern Ocean margins, while tropical exclusive economic zones, especially those of Small Island Developing States, face persistent losses.

An example of regional illustration of this process is available in the North Atlantic and the Barents Sea,[11] where non-tuna fish species show increasing biomass and richness as warm-water taxa expand northwards. However, this gain is offset by declines in cold-adapted species such as polar cod and capelin, leading to substantial ecological reorganization. Such evidence supports the FishMIP conclusion that climate change will not only reduce overall biomass in many areas, but also transform community composition, requiring adaptive shifts in fisheries operations and management.

BOX 3.4 MODELLING CLIMATE CHANGE IMPACTS ON THE DISTRIBUTION AND PRODUCTIVITY OF TUNA FISHERIES

As climate change alters marine ecosystems, understanding and anticipating its impacts on tuna populations are critical for sustainable fisheries management. The Spatial Ecosystem and Population Dynamics Model (SEAPODYM) is a state-of-the-art tool that simulates tuna population dynamics in response to environmental variability and fishing pressure. By integrating oceanographic data, tuna biology and fisheries information, SEAPODYM provides spatially explicit estimates of tuna abundance, movement and catchability.[9]

Under the Common Oceans Tuna project (2022–2027), funded by the Global Environment Facility (GEF) and implemented by FAO, SEAPODYM is being enhanced and applied across the Pacific, Atlantic and Indian Oceans. This work is carried out in collaboration with tuna regional fisheries management organizations (RFMOs), national and regional research institutes and international experts to ensure the model reflects the unique ecological and fisheries contexts of each region.

Adapting Pacific Island economies to climate change-driven changes in tuna distribution

In the Pacific, SEAPODYM projections suggest that climate change will shift tuna distributions eastwards, with significant implications for Pacific Island economies (see figure). Over the next 25 years, the combined biomass of skipjack tuna (*Katsuwonus pelamis*), yellowfin tuna (*Thunnus albacares*) and bigeye tuna (*T. obesus*) is projected to decline by up to 37 percent in Papua New Guinea, 26 percent in the Federated States of Micronesia, and 15 percent in the Marshall Islands. Conversely, increases of 18 and 15 percent are expected in the Cook Islands and Kiribati.

These shifts are expected to reduce government revenues from tuna fishing licences in some Western Pacific nations, while increasing them in Eastern Pacific ones. For example, the share of licence-derived government revenue is projected to decline from 47.2 to 39.9 percent in the Federated States of Micronesia, while increasing in Kiribati from 54.4 to 57.9 percent. Additionally, a growing share of tuna catches is projected to occur in high seas areas, reducing further the ability of coastal states to benefit from access fees.[15]

Applying SEAPODYM to the Indian and Atlantic Oceans

To support adaptive management, region-specific SEAPODYM configurations for the Atlantic and Indian Oceans are being developed. These include the integration of local tagging data, fisheries statistics, and environmental parameters to generate detailed insights into tuna stock dynamics under climate change.

Capacity building is a core component of this work. Scientists and fisheries managers are being trained to use and interpret SEAPODYM outputs, fostering regional ownership and long-term sustainability of the modelling tools.

Looking ahead, SEAPODYM will be used to project climate-driven changes in skipjack, albacore (*T. alalunga*), yellowfin and bigeye tuna distribution and biomass across all three ocean basins. These studies will inform the development of climate-adaptive, ecosystem-based fisheries management strategies for tuna RFMOs and their Members.

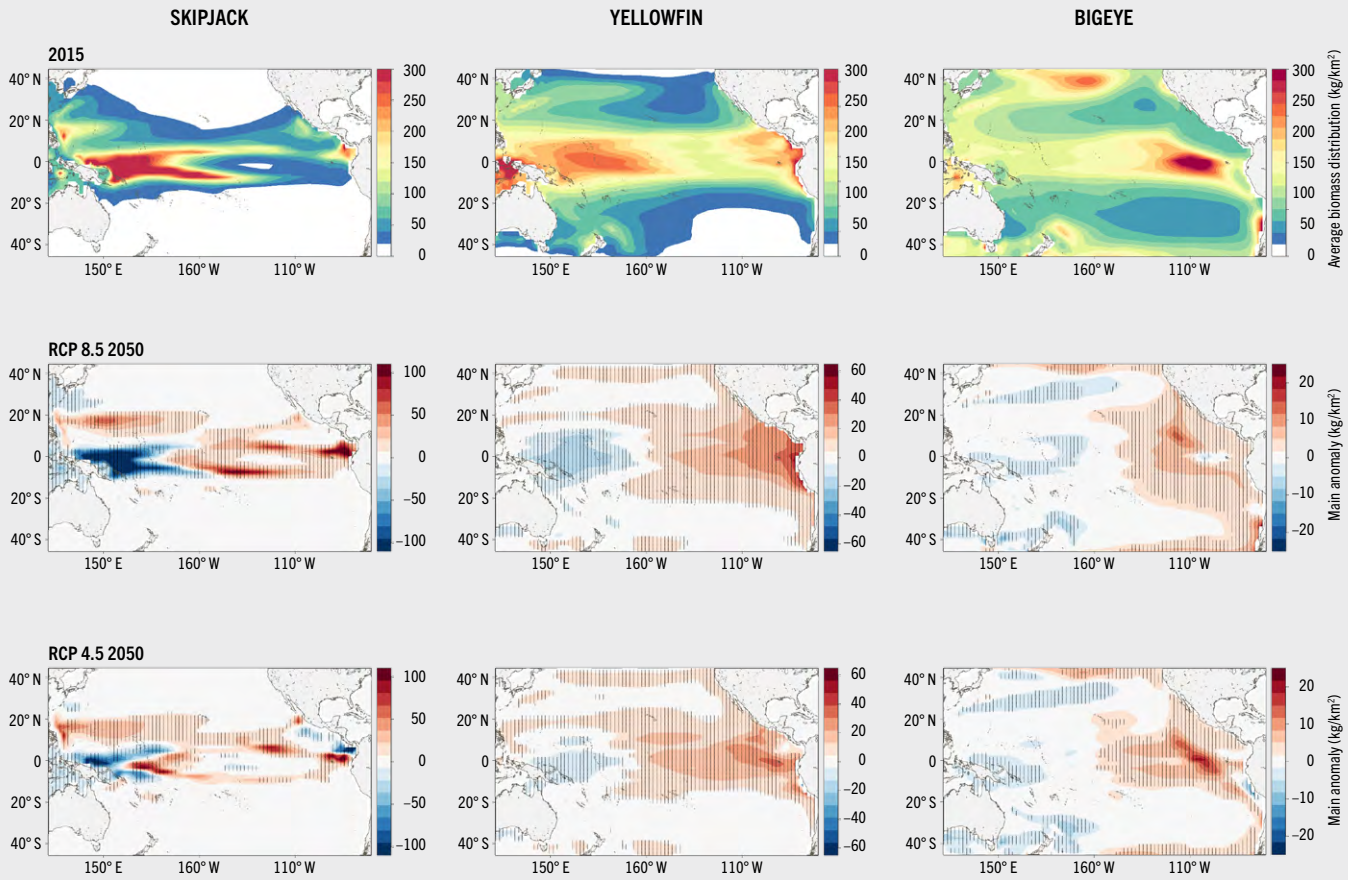
Adapting fisheries management

The redistribution of biomass towards higher latitudes implies a redistribution of fishing opportunities: countries in temperate areas may gain access to new or expanding stocks, while tropical countries risk losing access to historically important species. This potential shift in fisheries productivity between regions could create global inequalities in aquatic food supply and trade, and pose governance challenges for transboundary and migratory stocks.

The sustainability of fisheries in the future will be the result of a combination of changes in productivity and management actions setting adequate exploitation levels that take into account

BOX 3.4 (Continued)

PROJECTED EFFECTS OF CLIMATE CHANGE ON THE DISTRIBUTIONS OF THE THREE TUNA SPECIES CAUGHT BY PURSE-SEINE FISHING IN THE PACIFIC OCEAN



Refer to the disclaimer on the copyright page for the names and boundaries used in these maps.

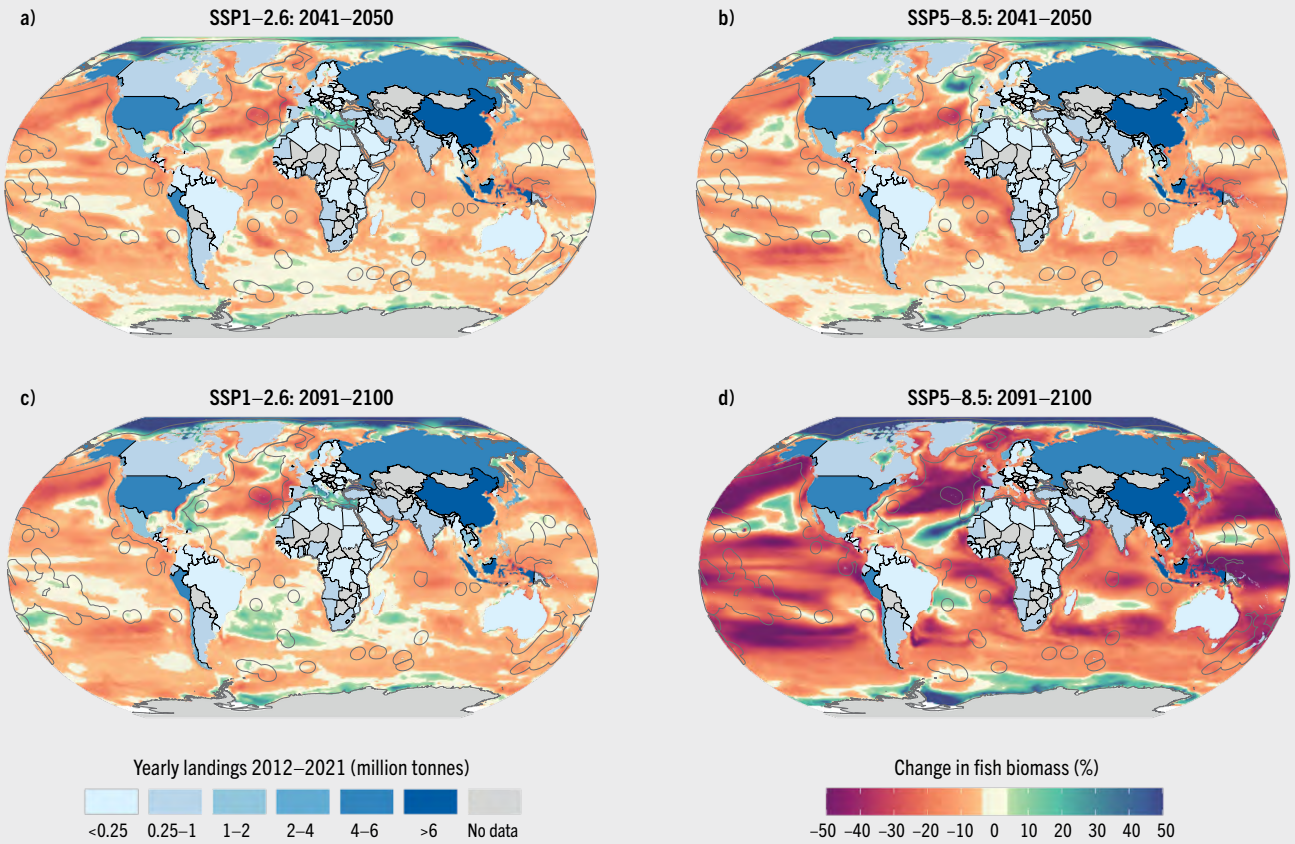
NOTES: Average biomass distributions (kg/km²) of skipjack, yellowfin and bigeye tuna in the Pacific Ocean basin for 2015 (2011–2020) (top row) and mean anomalies (kg/km²) from the average 2015 biomass distribution of each tuna species projected to occur by 2050 (2044–2053) under two emissions scenarios, Representative Concentration Pathway (RCP) 8.5 (middle row) and RCP 4.5 (bottom row). Shading indicates areas where projections agree in the sign of change, excluding near-zero changes (white zones).

SOURCE: Adapted from Bell, J.D., Senina, I., Adams, T., Aumont, O., Calmettes, B., Clark, S., Dessert, M. *et al.* 2021 Pathways to sustaining tuna-dependent Pacific Island economies during climate change. *Nature Sustainability*, 4: 900–910. https://doi.org/10.1038/s41893-021-00745-z

these changes.[12, 13] Global models show that if fishing pressure is reduced and stocks are allowed to rebuild, biomass losses under warming scenarios can be partially offset, particularly under low emissions pathways.[14] These findings underscore that adequate planning and adaptive management responses based on available projections can help fish stock recovery, as well as enhance resilience to climate stress.

Long-term projections such as those produced by FishMIP serve as decision-support tools for

FIGURE 3.2 PERCENTAGE CHANGE IN EXPLOITABLE FISH BIOMASS



Refer to the disclaimer on the copyright page for the names and boundaries used in these maps. Dotted line represents approximately the Line of Control in Jammu and Kashmir agreed upon by India and Pakistan. The final status of Jammu and Kashmir has not yet been agreed upon by the parties. Final boundary between the Republic of Sudan and the Republic of South Sudan has not yet been determined. Final status of the Abyei area is not yet determined.

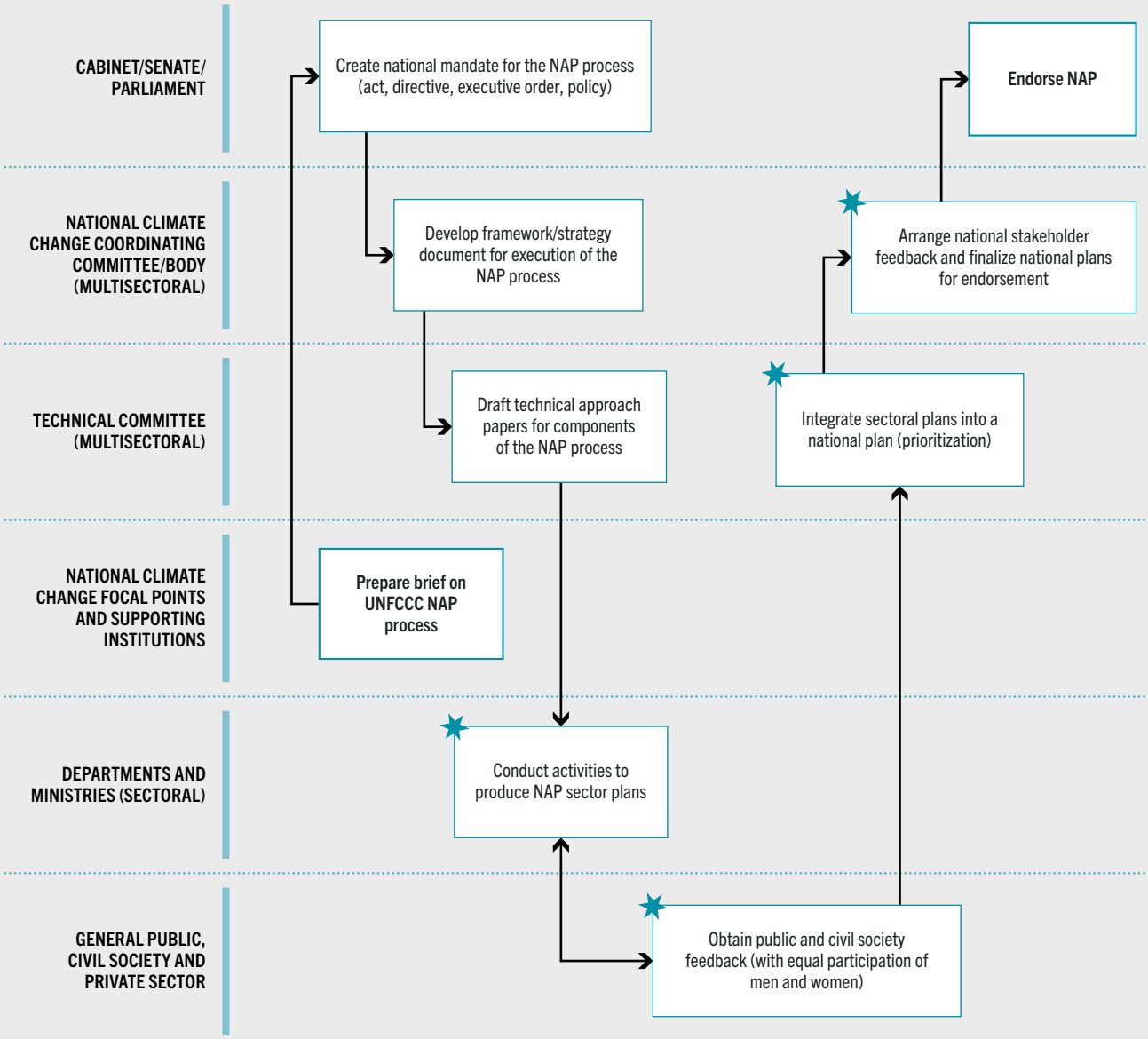
NOTES: In the ocean, model ensemble projects the change (percentage) in exploitable fish biomass between 2005–2014 and 2041–2050 (a, b) or 2091–2100 (c, d) under low emissions (a, c) and high emissions (b, d) scenarios. Projections capture ecosystems under climate change but in an unfished state. On land, mean annual fisheries catches over the period 2012–2021 are shown by country.

SOURCES: Adapted from Blanchard, J.L. & Novaglio, C., eds. 2024. *Climate change risks to marine ecosystems and fisheries – Projections to 2100 from the Fisheries and Marine Ecosystem Model Intercomparison Project*. FAO Fisheries and Aquaculture Technical Paper, No. 707. Rome, FAO. https://doi.org/10.4060/cd1379en

adaptation and policy design. The identification of vulnerable systems and hotspots helps translate these scientific insights into actionable adaptation responses. Projections can guide the timing of adaptive measures such as livelihood diversification for local communities; they are crucial to adjust management boundaries and quotas or fishing rights, as well as to design adequate investments in the sector. Moreover, they are a useful tool to prioritize research and capacity building. For example, national adaptation plans can use projection results to estimate future catch potential and assess how infrastructure, fleets and market systems can align with expected changes (Figure 3.3).

Insights on redistribution of biomass across jurisdictions can support the design of effective, cooperative and adaptive management frameworks necessary to minimize disputes »

FIGURE 3.3 KEY ENTRY POINTS FOR INTEGRATING FISHERIES AND AQUACULTURE CLIMATE CHANGE PROJECTIONS INTO THE NATIONAL ADAPTATION PROCESS



NOTES: NAP – National Adaptation Plan; UNFCCC – United Nations Framework Convention on Climate Change. White boxes represent key steps in the NAP formulation process; stars indicate key entry points where fisheries and aquaculture climate projections can be integrated.

SOURCES: Adapted from UNFCCC. 2012. *The national adaptation plan process: A brief overview.* UNFCCC Secretariat, Bonn, Germany. https://unfccc.int/files/adaptation/application/pdf/nap_overview.pdf and Brugere, C. & De Young, C. 2020. *Addressing fisheries and aquaculture in National Adaptation Plans*. Supplement to the UNFCCC NAP Technical Guidelines. Rome, FAO. https://doi.org/10.4060/ca2215en

BOX 3.5 SUPPORTING CLIMATE CHANGE ADAPTATION IN AQUACULTURE

Aquaculture holds significant growth potential and is a vital contributor to global food security. However, it is vulnerable to climate change impacts such as increasing temperatures, ocean acidification, and extreme weather events. Integrating climate adaptation into aquaculture policies and practices will be critical for promoting sustainable aquaculture expansion and intensification.

The Guidelines for Sustainable Aquaculture provide a policy and governance framework to guide such action.[16] Section 5.6 of the guidelines outlines strategies for integrating aquaculture into climate policies, improving risk and vulnerability assessments, supporting adaptation in aquaculture-dependent communities, and promoting climate-resilient farming systems.

The operationalization of these strategies is supported by the FAO Adaptation Toolbox for fisheries and aquaculture, which presents nearly 90 adaptation options – half of which are specific to aquaculture – across institutional, livelihoods, and risk reduction and management domains.[8] These include early warning systems, insurance schemes, infrastructure upgrades, and genetic improvement programmes.

To help countries and communities select and implement adaptation options, FAO developed the Aquaculture Adaptation Framework for Climate Change (Aqua-Adapt).[17] It provides a structured and stepwise process guiding countries through defining the adaptation unit, evaluating climate projections and pathways, performing risk and vulnerability assessments, designing and implementing an adaptation plan, and continuous monitoring and evaluation (see figure).

Moreover, integration into national climate strategies is essential for mobilizing resources and ensuring policy coherence. The NDC-Fish Guidelines provide entry points for embedding aquaculture into nationally determined contributions (NDCs) and other climate plans.[18] Recommended actions include adopting adaptive technologies, improving feed efficiency, transitioning to renewable energy, and promoting integrated, low-input or no-fed systems.

FAO is actively supporting countries in implementing these frameworks, tools and solutions. In Thailand, FAO collaborates with national authorities to promote low-carbon shrimp farming and carbon footprint certification. In Timor-Leste, the IkanAdapt project aims to strengthen resilience of fisheries and aquaculture-dependent livelihoods, focusing on seaweed farming as a nature-based solution for food security and climate adaptation. In the Gambia, a Green Climate Fund project supports climate-resilient aquaculture through mangrove restoration, rice–fish systems and hatchery development.

In Latin America and the Caribbean, FAO organized a training course* to strengthen extension services and build capacity of authorities and stakeholders in addressing climate change and biosecurity challenges. In the Mediterranean and Black Sea, the General Fisheries Commission for the Mediterranean supports climate-resilient aquaculture through its Technical Advisory Groups, using tools such as climate-sensitive spatial planning, a proposed Aquaculture Climate Change Observatory, and a new Aquaculture Demonstration Centre in La Ràpita, Spain, showcasing restorative aquaculture as a scalable response to climate risks.

NOTE: * For more information see: https://www.fao.org/americas/news/news-detail/innovacion-pesca-acuicultura/es

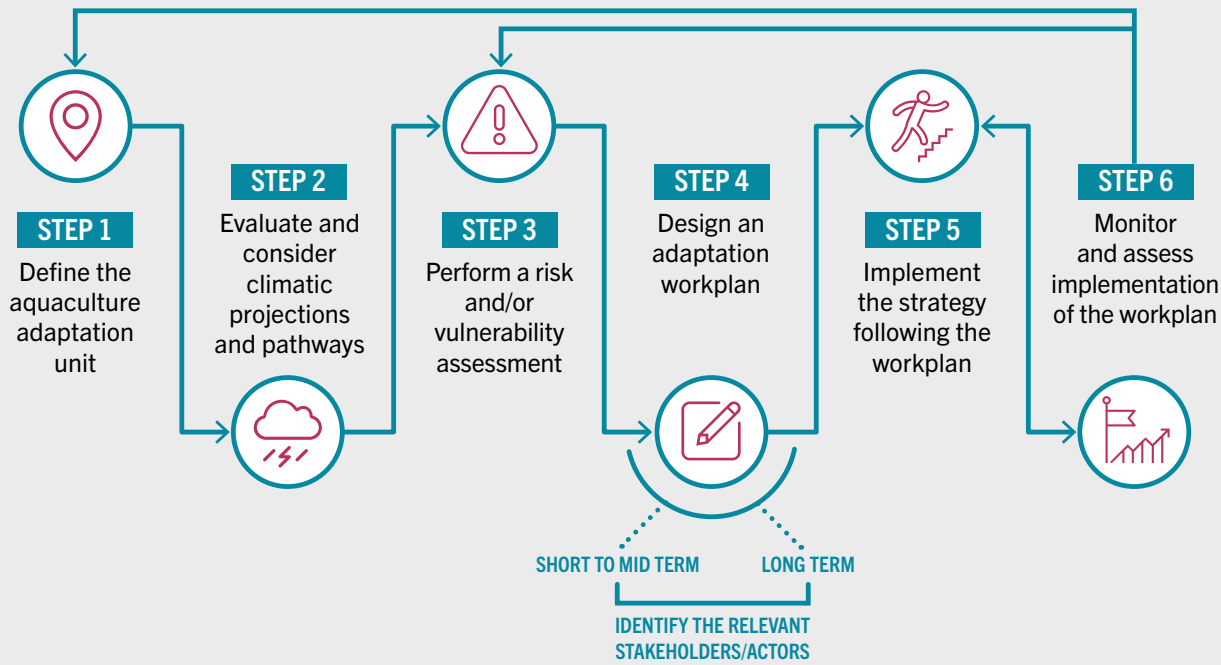
» over shifting resources. Adaptive quota systems, dynamic allocation of fishing rights, flexible licensing, and transboundary agreements are examples of responses being compiled with the support of the United States National Oceanic and Atmospheric Administration, with the aim of developing good practices intended for marine RFBs.

Way forward

While model accuracy for climate risks to marine fisheries has substantially improved in data-rich areas, some regions still require better data systems to further improve their models. For inland fisheries, important climate projection gaps persist. Because of the confined and highly interdependent nature of inland aquatic systems, climate impacts on inland fisheries are compounded by non-climatic stressors, including habitat degradation, altered hydrological regimes, competition for water resources, deforestation, stressors linked to an increasing human population and, in some contexts, poorly planned or managed aquaculture development. These interconnected stressors and the highly context-specific impacts of climate change make the development of projections of inland fisheries resources a complex endeavour. Sound

BOX 3.5 (Continued)

AQUACULTURE ADAPTATION FRAMEWORK FOR CLIMATE CHANGE (AQUA-ADAPT)



SOURCE: Adapted from Soto, D. & Garcia Sampaio, F., eds. 2025. *Aquaculture Adaptation Framework for Climate Change (Aqua-Adapt) – A tool to support the development and implementation of strategies to improve aquaculture's resilience to climate change*. FAO Fisheries and Aquaculture Technical Paper, No. 739. Rome, FAO. https://doi.org/10.4060/cd6476en

projections require improved data collection and monitoring systems that integrate fisheries, climate and hydrological information and explicitly incorporate local ecological knowledge. This requires building on global initiatives such as integrated water resources management, which seeks to combine basin-level spatial assessments with *in situ* data collection and stakeholder surveys to evaluate the effects of various stressors including climate impacts on inland fisheries.

Filling the gaps on inland fisheries projections for different climate scenarios is essential, because of their critical role in food security, sustainable livelihoods and poverty reduction, particularly in developing countries. In the case of aquaculture, adaptation solutions and guidance have been developed (Box 3.5), and these provide insight on responses at farm and policy levels. Given the ongoing alterations to the productivity of marine and freshwater systems, the growth potential of aquaculture under different greenhouse gas emissions pathways requires further analysis – especially as it relates to the dynamics between terrestrial and aquatic environments that might affect critical aquaculture inputs such as clean water and feed production. These interconnections require further work by scientists, modellers and policymakers to guide future global fisheries and aquaculture policies and planning.

Long-term climate projections are crucial for anticipating ecological transformations, economic disruptions, and governance challenges. By linking robust long-term ecological forecasts with flexible, participatory management frameworks and suitable investments, policymakers can design adaptation programmes that move beyond crisis response towards true climate resilience of aquatic ecosystems and the food production they sustain, for the benefit of millions of people who depend on them for their livelihoods and food security. ■

A MEDIUM-TERM OUTLOOK FOR THE FISHERIES AND AQUACULTURE SECTOR

This section presents the medium-term outlook for global fisheries and aquaculture over the period 2024–2034, drawing on ad hoc projections generated using the FAO fish model.[19] Since 2010, the FAO fish model has been elaborated to explore plausible developments in fisheries and aquaculture production, utilization, trade and prices under certain macroeconomic, demographic and sector-specific assumptions. While the fish model is conceptually linked to the AglinkCosimo framework employed jointly by the Organisation for Economic Co-operation and Development and FAO to produce the annual OECD–FAO Agricultural Outlook,[ap] it remains a stand-alone analytical tool tailored to the characteristics of global fisheries and aquaculture.

The projections herein are the result of an FAO analysis designed to illustrate how fisheries and aquaculture could evolve over the next decade if current macroeconomic conditions, demographic trends, technological progress and policy settings broadly maintain their recent trajectories. As such, they should not be interpreted as forecasts. Rather, they represent scenarios that help identify expected trends and key factors likely to shape future production, consumption, trade, and market and price dynamics for aquatic products.

The macroeconomic assumptions cover population growth, income fluctuations, exchange rates and selected commodity prices, complemented by fisheries and aquaculture parameters such as those regarding the evolution of fisheries management, biological productivity, technology, aquaculture production systems, feed use, post-harvest utilization, and consumer demand for aquatic foods.

The baseline assumptions underpinning the projections include continued progress, albeit uneven across regions, in the implementation of fisheries management measures to ensure biological sustainability, including harvest controls and effort regulation. The outlook assumes no major disruption from extreme or systemic shocks such as large-scale natural disasters, pandemics, and severe trade or market crises. Climate variability is implicitly reflected through recent trends but is not explicitly modelled through acute or extreme events. Technological developments are assumed to continue incrementally, supporting gradual efficiency gains across fisheries, aquaculture and post-harvest segments.

Given the leading role of China in global fisheries and aquaculture production, particular attention is paid to the continuation of the national policy introduced in the mid-2010s to promote resource conservation, environmental protection and improved efficiency. Population growth, urbanization and rising incomes, particularly in low- and middle-income countries, are expected to continue shaping demand for animal source foods, including aquatic foods, alongside evolving dietary preferences and growing awareness of nutrition and health considerations.

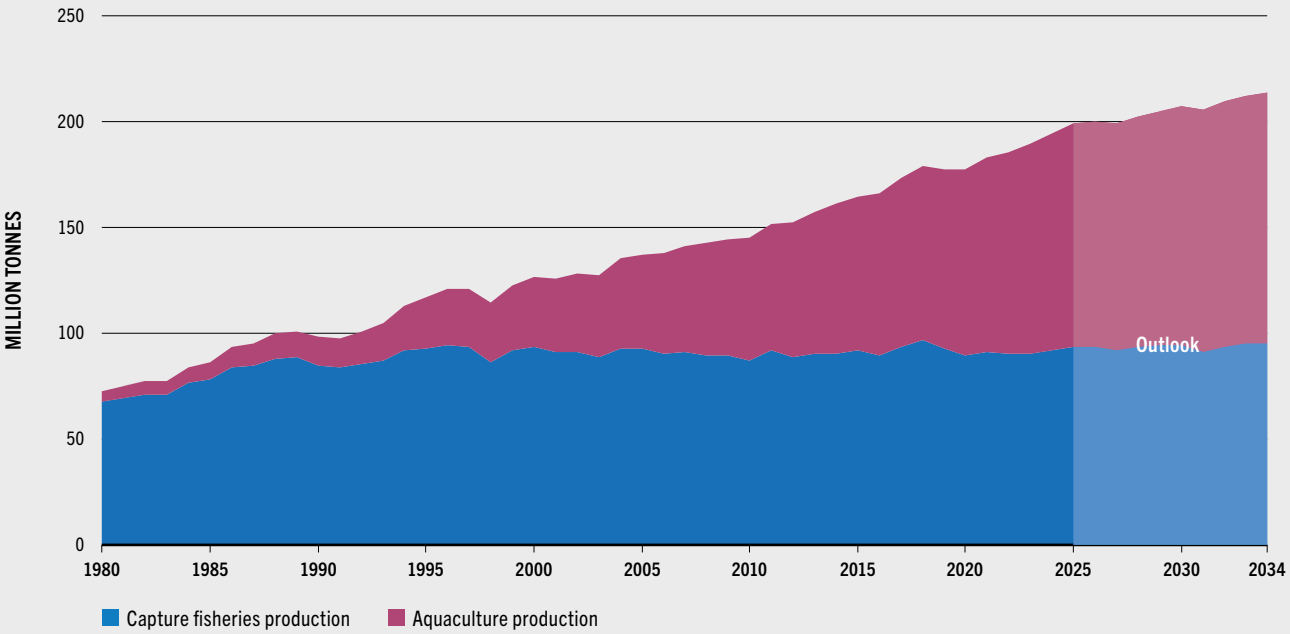
Production

Under the assumptions described above, total global production of aquatic animals is projected to continue increasing through to 2034, although at a slower pace than in earlier decades. It is expected to reach 214 million tonnes (live weight equivalent) in 2034, an additional 19 million tonnes or 10 percent increase relative to 2024 (Figure 3.4 and Table 3.1). The overall expansion reflects continuous growth in aquaculture output, small to moderate increases in fisheries production in selected regions, and improvements in utilization, particularly through reduced pre-harvest losses and discards.

Despite the expected increase in total output, both the annual growth rate and the absolute volume of additional production are projected to be lower than those observed during 2014–2024, when production increased by 34 million tonnes, or 21 percent. This reduced growth reflects a convergence of structural factors affecting both sectors, including biological limits in capture fisheries, tighter environmental and

ap For more information about the OECD–FAO Agricultural Outlook and the work on the models see: https://www.agri-outlook.org

FIGURE 3.4 **WORLD FISHERIES AND AQUACULTURE PRODUCTION OF AQUATIC ANIMALS, 1980–2034**



NOTES: Aquatic animals exclude aquatic mammals, crocodiles, alligators, caimans, aquatic products (corals, pearls, shells and sponges) and algae. Data are expressed in live weight equivalent.

SOURCE: FAO estimates.

spatial constraints on aquaculture expansion, and a moderation of productivity gains as technologies mature.

Aquaculture is expected to account for most of the additional global supply over the outlook period, while the projected contribution of capture fisheries to overall growth remains positive but limited, consistent with longstanding production trends observed since the late 1980s.

Global aquaculture production of aquatic animals is projected to expand steadily over the period 2024–2034, reaching 119 million tonnes in 2034 (compared to 103 million tonnes in 2024) and corresponding to an overall growth of 16 percent. Aquaculture output will continue to increase in absolute terms, with a further deceleration in the average annual growth rate relative to the previous decade for several reasons.

Environmental regulations are expected to be more widely enforced, limiting expansion in ecologically sensitive areas. Competition for land and water resources, and concerns over water quality, are likely to restrict the availability of suitable sites for new aquaculture operations. The increasing incidence and economic impact of aquatic animal diseases, particularly in intensive systems, are expected to continue weighing on productivity and profitability. At the same time, efficiency gains from genetic improvement, feed formulation and farm management are likely to persist, albeit at diminishing marginal rates.

China is projected to remain the world's largest aquaculture producer of aquatic animals throughout the projection period, accounting for 56 percent of total aquaculture production in 2034, reaching over 66 million tonnes. China is expected to continue implementing policies introduced since 2016[aq] to reduce environmental pressure,

aq Thirteenth (2016–2020), Fourteenth (2021–2025) and Fifteenth (2026–2030) Five-Year Plans.

TABLE 3.1 PROJECTED FISHERIES AND AQUACULTURE PRODUCTION OF AQUATIC ANIMALS TO 2034

	Production			Of which aquaculture		
	(thousand tonnes, live weight equivalent)		(%)	(thousand tonnes, live weight equivalent)		(%)
	2024	2034	Growth of 2034 vs 2024	2024	2034	Growth of 2034 vs 2024
Africa	**13 151**	**14 907**	**13.3**	**2 422**	**3 315**	**36.9**
Egypt	2 026	2 492	23.0	1 600	2 028	26.7
Nigeria	1 114	1 198	7.6	258	330	27.7
South Africa	477	466	–2.3	5	6	10.1
Americas	**23 107**	**24 998**	**8.2**	**5 065**	**6 295**	**24.3**
Latin America and the Caribbean	**17 820**	**19 308**	**8.3**	**4 438**	**5 599**	**26.2**
Argentina	892	892	0.0	12	12	0.1
Brazil	1 546	1 810	17.1	882	1 053	19.4
Chile	3 508	3 962	13.0	1 408	1 806	28.3
Mexico	2 193	2 304	5.1	274	342	24.8
Peru	5 860	6 102	4.1	118	123	4.3
Northern America	5 287	5 690	7.6	627	696	10.9
Canada	798	876	9.7	161	183	13.8
United States of America	4 220	4 556	8.0	467	513	9.8
Asia	**139 774**	**153 878**	**10.1**	**91 506**	**105 166**	**14.9**
China	70 501	79 075	12.2	57 557	66 072	14.8
India	18 370	20 607	12.2	12 088	14 075	16.4
Indonesia	13 640	14 945	9.6	5 892	6 892	17.0
Japan	3 334	3 088	–7.4	527	576	9.2
Philippines	2 389	2 501	4.7	766	849	10.8
Republic of Korea	1 827	1 895	3.7	561	571	1.9
Thailand	2 541	2 543	0.1	999	1 000	0.1
Viet Nam	9 069	10 213	12.6	5 635	6 716	19.2
Europe	**16 543**	**17 669**	**6.8**	**3 450**	**3 906**	**13.2**
European Union*	4 463	4 491	0.6	1 013	1 060	4.6
Norway	3 823	4 256	11.3	1 667	2 008	20.4
Russian Federation	5 327	5 581	4.8	322	386	20.0
Oceania	**1 964**	**2 467**	**25.6**	**220**	**310**	**40.8**
Australia	294	385	30.8	118	194	65.1
New Zealand	423	442	4.6	99	112	13.6
World**	**194 587**	**213 918**	**9.9**	**102 664**	**118 992**	**15.9**

NOTES: Aquatic animals exclude aquatic mammals, crocodiles, alligators, caimans, aquatic products (corals, pearls, shells and sponges) and algae.
* Cyprus is included in Asia as well as in the European Union but not in Europe. ** For 2024, the aggregate includes also 47 859 tonnes of not identified countries, data not included in any other aggregates.

SOURCE: FAO estimates.

https://doi.org/10.4060/cd8357en-table3.1

improve biosecurity and promote sustainable production practices. These policies include limits on the physical expansion of aquaculture areas, stricter enforcement of environmental standards, reduced reliance on antibiotics, and increased emphasis on technological upgrading and responsible intensification. While these measures may contribute to a moderate production growth in the short term, they are likely to support greater efficiency and resilience in the longer term.

Aquaculture production is projected to increase across all continents, although growth rates and species composition will vary considerably across countries and regions. Strong relative growth is expected in regions where aquaculture is developing from a low base and where domestic demand for aquatic foods continues to expand rapidly. Between 2024 and 2034, aquaculture production of aquatic animals is projected to increase by 41 percent in Oceania (+90 000 tonnes), 37 percent in Africa (+0.9 million tonnes), 26 percent in Latin America and the Caribbean (+1.2 million tonnes), 15 percent in Asia (+13.7 million tonnes), 13 percent in Europe (+0.5 million tonnes) and 11 percent in Northern America (+69 000 tonnes).

Asian countries will continue dominating aquaculture production in 2034, producing about 88 percent of the total and accounting for around 84 percent of the total increase over the projection period. Outside Asia, growth is expected to be driven by a diversified range of species and production systems, often oriented towards export or high-value domestic markets. In Africa, growth is supported by recent investments, national policies and rising demand, although total production volumes will remain modest, slightly over 3.3 million tonnes in 2034. Egypt will continue to dominate African aquaculture, producing about 2.0 million tonnes in 2034 and accounting for most of the region's output.

The share of aquaculture in total global fisheries and aquaculture production of aquatic animals is projected to increase from 53 percent in 2024 to 56 percent in 2034 (Figure 3.5).

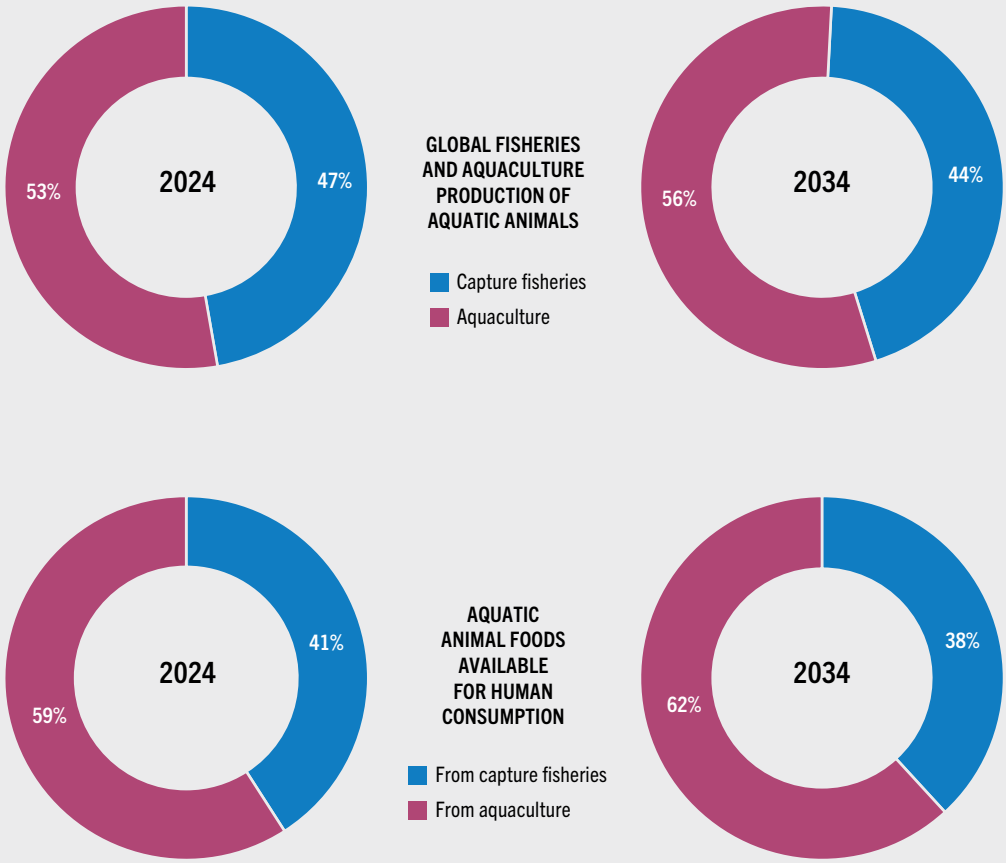
Excluding China, the corresponding share is projected to increase from 36 percent to 39 percent. The role of aquaculture in total fisheries and aquaculture production is projected to increase in all regions except Northern America, where it will remain stable at around 12 percent, the lowest share among the major regions in 2034. By 2034, aquaculture is expected to account for 13 percent of total production in Oceania (up from 11 percent in 2024), 22 percent in Africa (up from 18 percent), 22 percent in Europe (up from 21 percent), 29 percent in Latin America and the Caribbean (up from 25 percent) and 68 percent in Asia (up from 65 percent). Excluding China, the share of aquaculture in Asia is projected to increase from 49 percent in 2024 to 52 percent in 2034. The share of aquaculture in Chinese fisheries and aquaculture production will slightly increase from 82 percent to 84 percent (Figure 3.6).

The species composition of aquaculture production is projected to evolve gradually. Species with lower feed requirements or greater flexibility in feed formulation are expected to expand more rapidly than those heavily dependent on fishmeal and fish oil, whose prices are projected to remain relatively high. As a result, the relative importance of herbivorous and omnivorous species is expected to increase, while growth in some carnivorous finfish and crustacean sectors will lessen. Carps should remain the main group of farmed species in 2034, albeit with a declining share of total aquaculture production.

World capture fisheries production of aquatic animals is projected to increase by a modest 3 percent over the outlook period, rising from about 92 million tonnes in 2024 to around 95 million tonnes in 2034.[ar] This growth is broadly consistent with trends observed over the past several decades and reflects a combination of stock rebuilding in areas where effective

ar The projections assume normal weather and production conditions, with the exception of the impact of the El Niño phenomenon set for selected Latin American countries to occur more strongly every five years, based on more recent trends. The years in which it occurs might not be exact, but the trends provide an indication as to the possible overall effects on both capture fisheries and aquaculture production. This climatic phenomenon reduces production of fishmeal and fish oil obtained from anchoveta and other small pelagic species in the affected region, with an impact on prices and input costs for aquaculture. It is important to note that a reduction in growth rate does not indicate a decrease in production. Expressed in percentage terms, growth rates are usually higher when the calculation starts from a low base, and these rates decline as the size of the base grows.

FIGURE 3.5 INCREASING ROLE OF AQUACULTURE



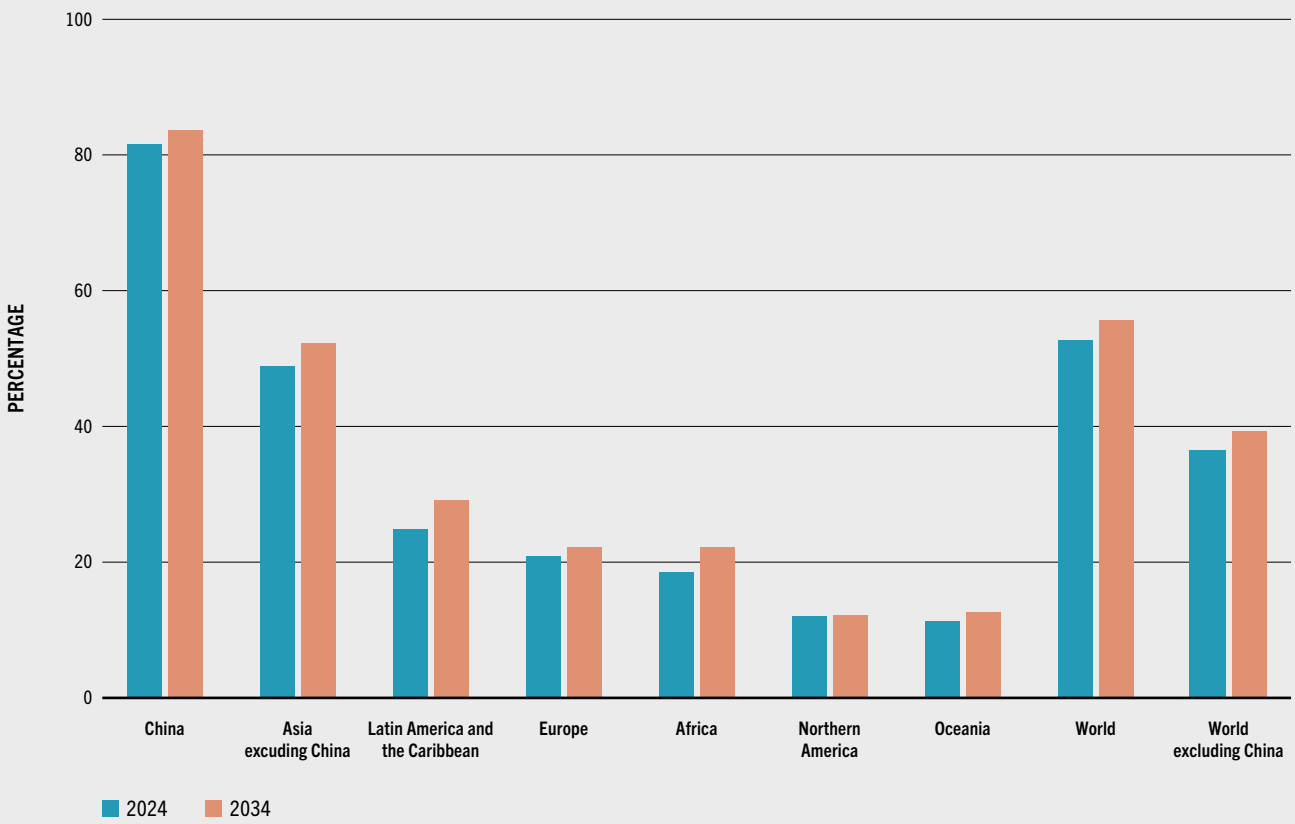
NOTE: Aquatic animals exclude aquatic mammals, crocodiles, alligators, caimans, aquatic products (corals, pearls, shells and sponges) and algae.
SOURCE: FAO estimates.

management measures are in place, improved utilization of catches, and limited expansion in regions with underexploited resources.

Short-term fluctuations in capture fisheries output are expected during the projection period, particularly in regions affected by climatic variability such as periodic El Niño events. These fluctuations are most pronounced in South America, where environmentally driven changes in key small pelagic stocks can cause marked year-to-year variability in landings. At the global level, however, these effects tend to level off over time.

With about 13 million tonnes in 2034, China is expected to remain the largest fisheries producer of aquatic animals, accounting for about 14 percent of global output. Domestic catches are projected to decline gradually as environmental and management policies continue to limit fishing capacity and effort. Measures include reduction in vessel numbers, enforcement of stricter licensing systems, seasonal closures, and continued efforts to combat IUU fishing. Reductions in domestic catches will be partly compensated by output from China's distant water fleet, which is assumed to remain active under strengthened regulatory oversight.

FIGURE 3.6 SHARE OF AQUACULTURE IN TOTAL FISHERIES AND AQUACULTURE PRODUCTION OF AQUATIC ANIMALS BY REGION AND VOLUME, 2024 VS 2034



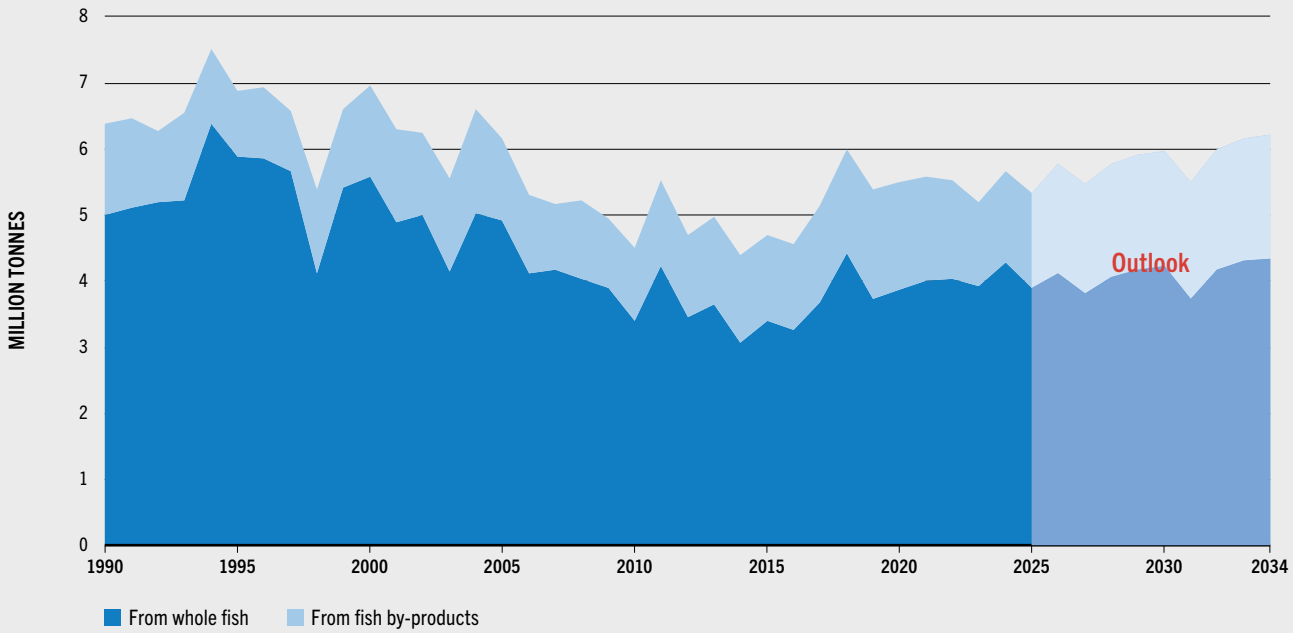
NOTE: Aquatic animals exclude aquatic mammals, crocodiles, alligators, caimans, aquatic products (corals, pearls, shells and sponges) and algae.
SOURCE: FAO estimates.

In other regions, moderate increases in fisheries production are projected where improved governance and stock recovery permit higher sustainable yields, particularly for selected demersal and pelagic species. Improvements in post-harvest and processing, combined with reduced discards and losses, also contribute positively to maintain supply.

Production of fishmeal and fish oil is expected to increase gradually by about 13 percent and 9 percent, respectively, between 2024 and 2034 (Figure 3.7). This reflects both moderate growth in capture fisheries output and an increasing reliance on by-products from fish processing. The share of total capture fisheries production reduced to fishmeal and fish oil is projected to remain broadly stable at around 19–20 percent, while the proportion derived from by-products should continue to increase.

This trend reflects further improvements in the collection and processing of trimmings from both fisheries and aquaculture, supported by technological advances and sustained demand from aquaculture. Between 2024 and 2034, the proportion of total fishmeal obtained from fish by-products is expected to increase from 25 percent to 30 percent, while the proportion of total fish oil derived from by-products is projected to rise from 51 percent to about 54 percent.

FIGURE 3.7 WORLD FISHMEAL PRODUCTION, 1990–2034



NOTE: Data are expressed in product weight.
SOURCE: FAO estimates.

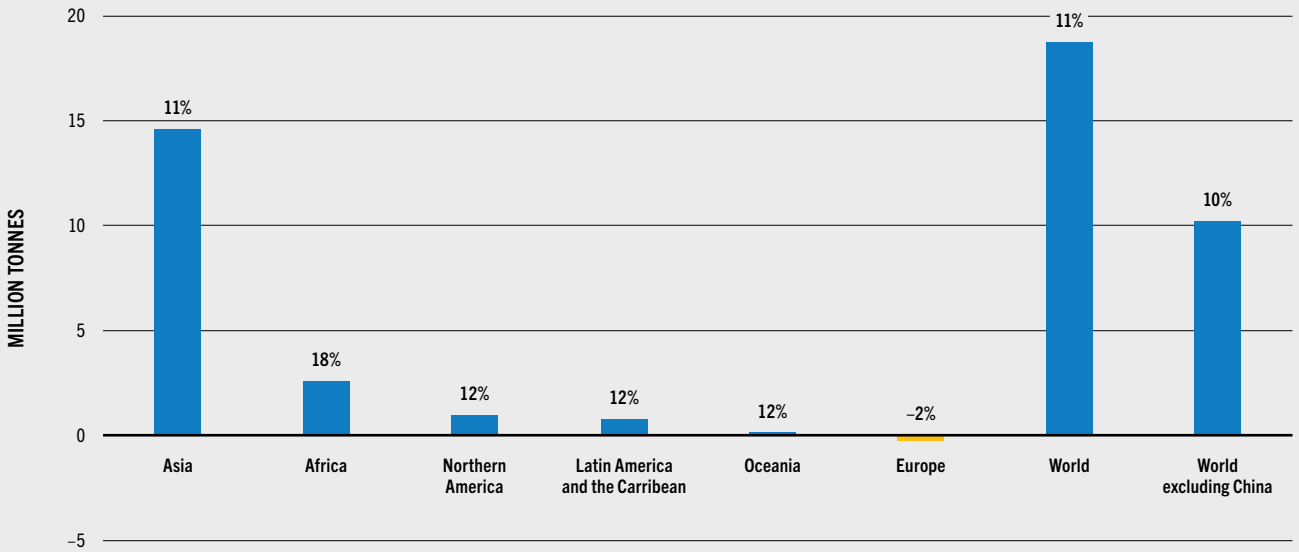
Peru and Chile are projected to continue dominating the global supply of fishmeal and fish oil, although production will remain subject to interannual variability linked to environmental conditions. Demand for fishmeal and fish oil will continue to be driven primarily by aquaculture, particularly for high-value carnivorous species, with China remaining the largest importer of fishmeal and a major consumer of fish oil.

Availability of aquatic animal foods

The vast majority of fisheries and aquaculture production will continue to be destined for direct human consumption, and this share is projected to increase slightly from 89 percent in 2024 to 90 percent in 2034. Total availability of aquatic animal foods for human consumption is expected to expand steadily by about 19 million tonnes compared to 2024, reaching 193 million tonnes by 2034. This represents an overall increase of about 11 percent, compared to 21 percent (or 30 million tonnes) over the period 2014–2024, reflecting a slower pace of expansion than in the previous decade. This moderation is driven by slower production growth, rising prices in nominal terms, a deceleration in population growth, and increasingly saturated demand in some countries, particularly high-income countries, where aquatic food consumption is projected to show limited growth.

The increase in availability of aquatic animal foods is expected to remain uneven across regions, shaped by differences in population growth, income dynamics, urbanization patterns, dietary habits and cultural preferences. Overall demand will continue to be driven by rising incomes and urbanization in low- and middle-income countries, alongside growing recognition of the role of aquatic foods in nutrition. Improvements in cold chains,

FIGURE 3.8 **INCREASE IN AVAILABILITY OF AQUATIC ANIMAL FOODS BY REGION, 2034 COMPARED TO 2024**



NOTES: Aquatic animals exclude aquatic mammals, crocodiles, alligators, caimans, aquatic products (corals, pearls, shells and sponges) and algae. Percentages represent percentage change. Data are expressed in live weight equivalent.

SOURCE: FAO estimates.

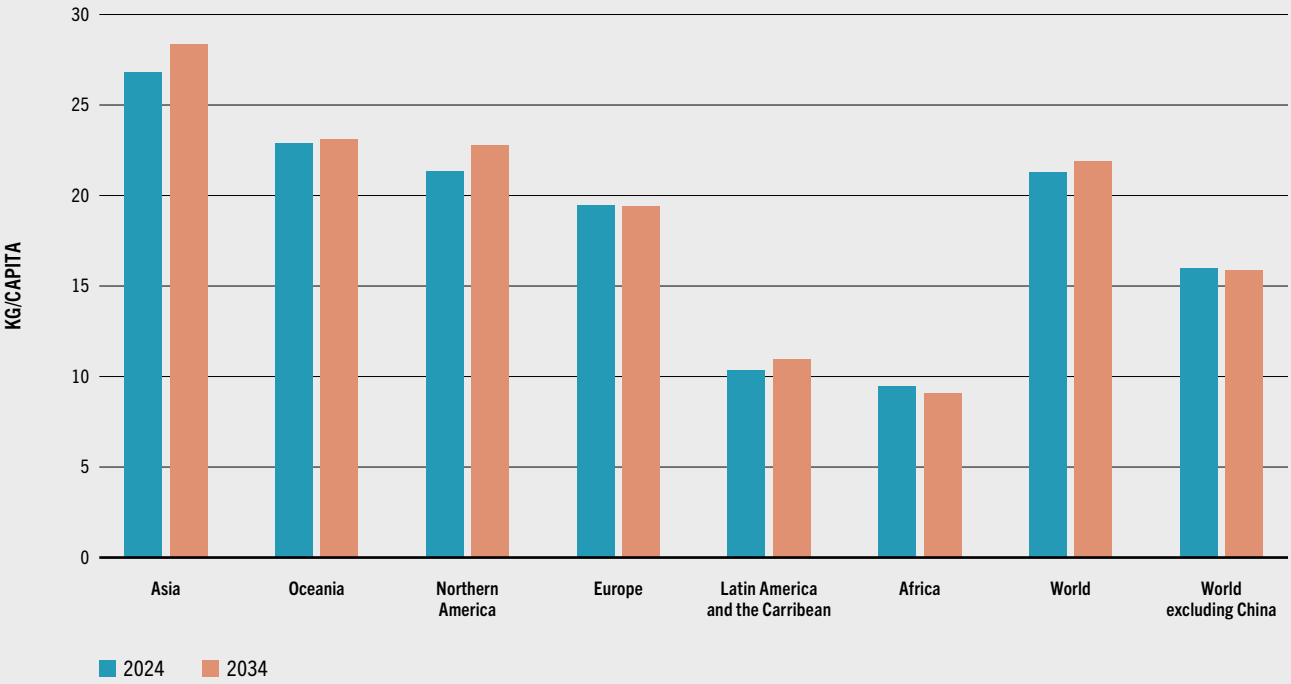
processing and distribution will also expand access to a wider variety of aquatic products, including in inland and remote areas.

Asia is projected to account for the bulk of the additional global availability of aquatic animal foods over the projection period, absorbing about 78 percent of the global increase by 2034 and accounting for approximately 74 percent of total availability. Between 2024 and 2034, total availability of aquatic animal foods is expected to increase in all regions except Europe (–2 percent). The highest growth rates are projected in Africa (18 percent), followed by 12 percent each in Northern America, Latin America and the Caribbean, and Oceania, while Asia will increase by 11 percent (Figure 3.8). Despite these regional trends, patterns in both the quantity and the variety of aquatic foods consumed are expected to vary considerably across and within countries.

While total availability increases in most regions, per capita trends diverge markedly. Global per capita availability of aquatic animal foods is projected to increase modestly, from 21.3 kg in 2024 to 21.9 kg in 2034. Per capita availability is expected to increase in all regions except Africa, which presents a more challenging outlook.

Despite increases in total availability from domestic production and imports, rapid population growth in Africa is expected to limit gains in per capita availability, which is projected to decline by about 4 percent by 2034 (Figure 3.9). The largest declines are expected in sub-Saharan Africa, raising concerns regarding food security and nutrition, given the high prevalence of undernourishment in the region and the importance of aquatic foods as a source of animal proteins in many countries. In contrast, Northern Africa is projected to experience increasing per capita availability, driven in part by the continued expansion of aquaculture in Egypt.

FIGURE 3.9 PER CAPITA AVAILABILITY OF AQUATIC ANIMAL FOODS BY REGION, 2034 VS 2024



NOTES: Aquatic animals exclude aquatic mammals, crocodiles, alligators, caimans, aquatic products (corals, pearls, shells and sponges) and algae. Data are expressed in live weight equivalent.

SOURCE: FAO estimates.

By 2034, aquaculture is expected to supply a growing share of aquatic animal foods for human consumption, increasing from 59 percent to 62 percent globally (Figure 3.5), reinforcing its central role in aquatic food systems across most regions (see Box 3.6). However, availability data are expressed in live weight equivalent and, given the relatively high shares of crustaceans and bivalves in aquaculture production, the corresponding share in edible weight is lower. Capture fisheries nevertheless will remain particularly important for food security and livelihoods in many coastal and inland communities.

Trade

International trade in aquatic products plays a critical role in balancing supply and demand across regions, supporting food security and economic development, while also providing access to aquatic foods in countries with limited domestic production capacity. Between 2024 and 2034, globally traded aquatic animal products are expected to continue expanding in volume, but at a slower rate than previously observed.

Deceleration in trade growth reflects slower production expansion, rising domestic consumption in major producing countries, and higher prices that temper demand. As a result, the share of global fisheries and aquaculture production of aquatic animals entering international markets is expected to decline gradually over the outlook period from 36 percent

BOX 3.6 THE ROLE OF AQUACULTURE IN MEETING THE CHALLENGE OF RISING POPULATION

By 2050, global availability of aquatic animal foods needs to increase by 33 million tonnes (+19 percent) to maintain per capita availability at the 2023 level. This growth is modest compared to past decades when it expanded by approximately 81 million tonnes from 1996 to 2023.

The increase from 1996 to 2023 was driven almost entirely by aquaculture, the fastest-growing food production sector, which accounted for about 72 million tonnes of additional availability. During the same period, capture fisheries remained broadly stable, constrained by the ecological limits of marine ecosystems. As a result, aquaculture's share of global aquatic animal food availability rose steadily to 58 percent in 2023, up from just 8 percent in the 1970s (see figure).

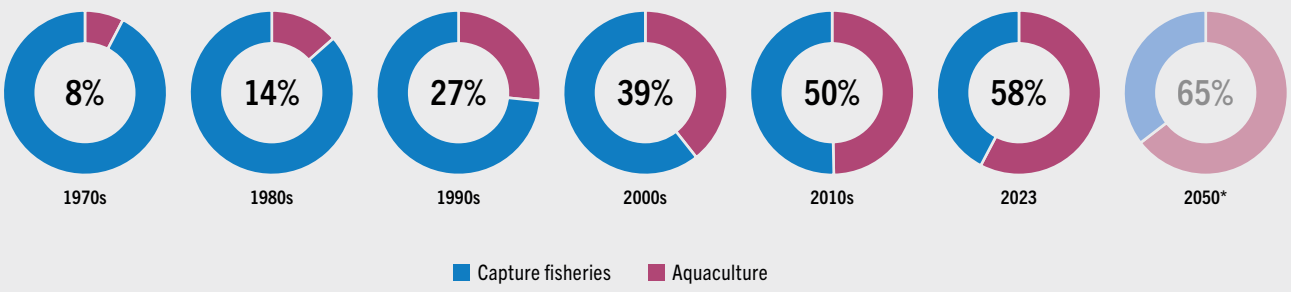
Future growth of total aquatic animal food availability will continue to depend primarily on aquaculture, expectedly under tighter environmental and regulatory conditions to ensure its sustainable expansion and intensification. In addition, capture fisheries may still offer scope for increases through improved management in marine ecosystems and the untapped potential of inland fisheries. If aquaculture were to provide all the additional aquatic animal food needed to maintain per capita availability at its 2023 level while keeping pace with population growth, its share of total aquatic animal food availability would rise to 65 percent by 2050.

This scenario is consistent with the objectives of FAO's Blue Transformation to sustainably expand aquaculture into areas with significant yet unexploited potential and increase output through efficiency gains, improved species, better practices and biosecurity. For example, despite significant natural aquatic resources, Africa contributed less than 2 percent of global aquaculture in 2024. Adequate policies and structural reforms to integrate marine and inland aquaculture into broader development objectives are necessary to mobilize investment and create enabling environments to tap the aquaculture potential of Africa.

Trade should also play a critical role in meeting future demand. Some regions, particularly sub-Saharan Africa, where population growth is projected to be high, are likely to continue depending on imports to meet domestic demand growth. Efficient, transparent and predictable international and regional trade regimes, supported by improved infrastructure and logistics, are necessary to balance supply and ensure wider access to aquatic foods.

This analysis does not predict the future; it provides an indication of the requirements under a possible scenario in which per capita availability of aquatic animal foods is maintained at 2023 levels through to 2050. Global availability would need to increase further for per capita availability to surpass its 2023 level.

INCREASING SHARE OF AQUACULTURE IN GLOBAL AVAILABILITY OF AQUATIC ANIMAL FOODS



NOTES: Aquatic animals exclude aquatic mammals, crocodiles, alligators, caimans, aquatic products (corals, pearls, shells and sponges) and algae.
* Estimated share if all growth in food availability comes from aquaculture.

SOURCE: FAO estimates.

in 2024 to 35 percent in 2034 (30 percent, excluding intra-European Union trade).

Asia will remain the principal exporting region, accounting for 49 percent of global exports of aquatic animal foods, slightly declining from 50 percent in 2024. China will continue to be the largest exporter by volume, though export growth is expected to decrease moderately as domestic demand absorbs a larger share of production. Viet Nam and Norway are projected to remain key exporters, specializing in distinct product segments and destinations.

High-income regions, particularly the European Union, the United States of America and Japan, together with China, are expected to remain heavily dependent on imports to satisfy consumer demand, together absorbing 50 percent of total imports of aquatic animal foods in 2034, compared to 52 percent in 2024.

Trade in fishmeal and fish oil is projected to expand more slowly than in previous decades. Major trade patterns will remain broadly unchanged, with South America supplying much of the global fishmeal and fish oil market and demand concentrated in aquaculture-producing regions.

Prices

Nominal prices for fisheries and aquaculture products are projected to increase moderately over the period to 2034, driven by sustained demand growth, higher input costs and constrained supply expansion. Aquaculture prices are expected to rise slightly faster than capture fisheries prices, reflecting higher feed, energy and compliance costs.

Prices of fishmeal and fish oil are expected to remain relatively high throughout the projection period, supported by strong demand from aquaculture and limited scope for rapid supply expansion. While real prices are projected to decline gradually, they are expected to remain above historical averages.

The growing share of aquaculture in total supply should increase the influence of farm-level costs and productivity on price formation at both national and international levels. Price volatility is expected to persist for specific species and products, reflecting variability in biological production, environmental conditions and market dynamics.

In real terms, prices across most product categories are projected to decline slightly, with a more pronounced decline expected for fish oil prices and traded aquatic food products.

Summary of main outcomes from the projections

The analysis highlights a number of key trends expected to characterize global fisheries and aquaculture over the period to 2034:

- Global fisheries and aquaculture production, availability of aquatic animal foods and trade are all expected to continue increasing, although at slower growth rates compared to previous decades.
- Overall production of aquatic animals is projected to increase by 10 percent, reaching 214 million tonnes by 2034.
- Aquaculture will continue to drive production growth, filling most of the supply–demand gap, increasing by 16 percent to reach 119 million tonnes by 2034.
- Trends in capture fisheries production will remain similar to those of the past few decades, with production growing modestly (3 percent), supported by improved management and utilization, mainly in traditionally well-managed areas.
- Total availability of aquatic animal foods for human consumption is projected to increase in all regions, except Europe, while per capita availability is expected to decline in Africa, particularly in sub-Saharan Africa, raising concerns about food security.
- Trade of aquatic animal products is projected to continue to expand, albeit at a slower pace, with a gradual decline in the share of production exported.
- Prices across most product categories are expected to increase in nominal terms, while remaining elevated but declining in real terms.

Main uncertainties

The projections presented in this section depend on a set of assumptions regarding economic conditions, policy frameworks, resource availability and environmental stability. Deviations from these assumptions could lead to markedly different outcomes.

Key sources of uncertainty include geopolitical developments, changes in trade policies, macroeconomic volatility, and shifts in consumer behaviour. In addition, climate change and variability pose growing risks to fisheries and aquaculture, with impacts that are likely to be unevenly distributed across regions and production systems.

Governance effectiveness remains a critical determinant of future outcomes. Weak management, habitat degradation, illegal fishing, and disease outbreaks could undermine sustainability and productivity. Conversely, continued improvements in governance, technology and innovation – aligned with FAO's Blue Transformation objectives – will support more resilient, inclusive and sustainable aquatic food systems over the long term. ■

GLOSSARY

Abandoned, lost or otherwise discarded fishing gear (ALDFG). A collective term referring to any fishing gear that is: abandoned (deliberately left at sea with no intention of fishers to retrieve it, for whatever reason); lost (accidentally lost at sea); or otherwise discarded (deliberately thrown overboard without any intention of further control or recovery).[1]

Algae. A highly diverse group of mainly aquatic, autotrophic, photosynthesizing organisms ranging from microscopic single-cell forms to multicellular forms, distinguished from vascular plants by the absence of structures such as true roots, stems, leaves and flowers.[as, 2]

Aquaculture zoning. Bringing together the criteria for locating aquaculture and other activities in order to define broad zones suitable for different activities or mixes of activities. Zoning is a process that countries can use to sustainably and responsibly identify and allocate areas that are biophysically and socioeconomically suitable for aquaculture. In broad terms, zoning can be used to identify potential areas for growth where aquaculture is new, and can help regulate the development of aquaculture where it is already established. In turn, effective zoning can facilitate investment, infrastructure planning and the strengthening of aquaculture value chains.[3]

Aquatic animals. Animals grown in, or harvested from, water, whether marine or inland. In this publication, the term "aquatic animals" includes all types of fish, crustaceans, molluscs and other aquatic animals, with the exception of aquatic mammals, reptiles and other aquatic products (corals, shells, pearls and sponges). Trade statistics on aquatic animals also exclude data on amphibians and turtles.[4]

Aquatic animal foods. Foods for human consumption originating from animals grown in, or harvested from, water. They include foods from all types of aquatic animals, with the exception of aquatic mammals and reptiles.[5]

Aquatic food systems. Food systems encompassing the entire range of actors and their interlinked value-adding activities involved in the production, processing, distribution, consumption and disposal of aquatic food products that originate from fisheries and aquaculture as well as the broader economic, societal and natural aquatic environments in which they are embedded.[6]

Aquatic foods. All foods for human consumption grown in, or harvested from, water. They include foods from all types of algae and aquatic animals (fish, crustaceans, molluscs and other aquatic animals, with the exception of aquatic mammals and reptiles).[5]

Aquatic products. The outputs of fisheries and aquaculture production presented whole or in parts, processed or unprocessed, in various product forms, regardless of their final utilization. They include all aquatic animals (fish, crustaceans, molluscs and other aquatic animals), algae (macroalgae, microalgae and cyanobacteria) and other aquatic products (e.g. corals and sponges).[at, 5]

Biologically sustainable stock. A fish stock of which abundance is at or greater than the threshold level that can produce the maximum sustainable yield, which therefore includes both maximally sustainably fished and underfished stocks.[5]

Biologically unsustainable stock. A fish stock of which biomass is significantly below the threshold level that can produce the maximum sustainable yield in the long-term – analogous to the definition of an overfished stock.[5]

Biomass at maximum sustainable yield (B_{MSY}). The expected long-term average biomass of a fish stock that can produce the maximum sustainable yield (MSY) under prevailing environmental conditions when exploited at the fishing mortality rate corresponding to MSY (F_{MSY}).[5]

as Algae include multicellular macroalgae (e.g. *Eucheuma* spp.), unicellular microalgae (e.g. *Chlorella* spp.) and cyanobacteria, not true algae but informally known as "blue-green algae" (e.g. Spirulina).

at Aquatic mammals and reptiles are excluded from reported figures and statistical analysis, as data are only available in numbers of individuals (not in weight). Moreover, analysis is carried out separately for aquatic animals and algae, and other aquatic products.

Biosecurity. The management of all biological and environmental risks associated with food and agriculture, including forestry and fisheries and aquaculture.[5]

Blue Transformation. The targeted process by which FAO and its Members and partners use existing and emerging knowledge, instruments, tools and practices to sustainably expand the contribution of aquatic food systems to food security, resilient aquatic ecosystems and healthy diets for all, leaving no one behind.[5]

Bycatch. The part of the catch that is unintentionally captured during a fishing operation in addition to the target species. It may refer to the catch of other commercial species that are landed, commercial species that cannot be landed (e.g. undersized, damaged individuals) or non-commercial species, as well as to the incidental catch of endangered, vulnerable or rare species (e.g. sea turtles, sharks, marine mammals).[7]

Capture fisheries production. The nominal landings, converted into a live weight basis, of aquatic organisms killed, caught, trapped or collected for all commercial, industrial, recreational and subsistence purposes or other uses, by all types and classes of fishing units (e.g. fishers, vessels and gear) operating in inland (both fresh and brackish water) areas, as well as in inshore, offshore and high seas marine fishing areas.[4]

Certification. Procedure by which a third party gives written or equivalent assurance that a product, process or service conforms to specified requirements. Certification may be, as appropriate, based on a range of inspection activities that may include continuous inspection in the production chain.[8]

Community fish refuge (CFR). A natural or artificial water body that retains water year round, serving as a dry-season refuge for aquatic life. Local communities, with support from fisheries authorities, protect these refuges to ensure that fish survive the dry season and reproduce when rains return, thereby enhancing fisheries productivity in associated rice fields during the flood season.[9]

Community fisheries. A fishing activity exerted in public or communal waters generally designed to meet community needs. It may involve different levels of community involvement and participation.

Critical aquatic habitats. Aquatic areas of marine, brackish or freshwater environments that provide physical, biological or ecological features essential to the functioning of aquatic ecosystems and to the life cycles, productivity, resilience and sustainability of aquatic species and fisheries, and which may therefore require special management or protection measures within ecosystem-based fisheries and aquaculture management frameworks.

Drifting fish aggregating device (dFAD). Device that is neither anchored nor otherwise attached to the seabed; it is let adrift and used for attracting and concentrating fish for the purpose of capture by fishing gear.[10]

Ecosystem approach to fisheries (EAF). An approach that strives to balance diverse societal objectives by taking into account the knowledge and uncertainties about biotic, abiotic and human components of ecosystems and their interactions, and applying an integrated approach to fisheries within ecologically meaningful boundaries.[11]

FAO Major Fishing Areas for statistical purposes. Arbitrary areas, the boundaries of which have been determined in consultation with international fishery agencies since the 1950s. The rationale is that each area should coincide, where possible, with the areas of competence of fishery commissions (when existing). There are currently 26 FAO Major Fishing Areas; seven are for inland waters. For statistical purposes, capture fisheries and aquaculture production are assigned to the areas where the catch/harvest took place according to this classification.[12]

Fisheries and aquaculture value chain. The full range of activities from capture/production to utilization and their coordinated value-adding activities that transform raw materials into aquatic products.[13]

GLOSSARY

Fish silage. Liquid produced from the whole fish or parts of it, to which acids, enzymes or lactic acid-producing bacteria are added, with the liquefaction of the mass provoked by the action of enzymes from the fish.[14]

Food availability. The amount of food available for human consumption. Food availability differs from effective food consumption, which is the actual quantity of food eaten and can be measured through household or individual food consumption surveys.

Food availability per capita. The estimate of the total food availability divided by the total population.

Gender mainstreaming. The process of assessing the implications for men and women of any planned action – including legislation, policies and programmes – in any area and at all levels. It makes the concerns and experiences of women and men an integral part of the design, implementation, monitoring and evaluation of policies and programmes in all political, economic and societal spheres so that they benefit equally and inequality is not perpetuated.[15]

Illegal, unreported and unregulated fishing. A broad term that describes a wide variety of unacceptable fishing activities that can be found in all types and dimensions of fisheries. It occurs both on the high seas and in areas within national jurisdiction. It concerns all aspects and stages of the capture and utilization of fish, and it may sometimes be associated with organized crime.[au, 16]

Integrated water resource management. A process that promotes the coordinated development and management of water, land and related resources to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems.[17]

Market access. The conditions imposed by countries that determine whether and how specific products may access their markets, including tariff and non-tariff measures.[18]

Maximum sustainable yield (MSY). The maximum long-term average yield that can be obtained from a harvested stock under prevailing environmental conditions. Under variable stock dynamics, MSY is the average yield associated with biomass fluctuating around the biomass level (B_{MSY}) capable of producing MSY in the long term.[19]

Maximally sustainably fished. Status of a harvested stock for which biomass is at, near or fluctuating around the biomass level (B_{MSY}) capable of producing maximum sustainable yield in the long term.

Overfished. Status of a harvested stock for which biomass is below a threshold biomass level capable of producing the maximum sustainable yield in the long term.[20]

Rice–fish culture. An agrifood production system in which rice paddies are deliberately managed to support the cultivation of rice together with naturally occurring and/or introduced aquatic animals (e.g. finfish, shrimp, crabs), cultured either concurrently or in rotation within the rice field environment.[21]

Stock assessment. The process of collecting and analysing biological and statistical information to determine the changes in the abundance of fish stocks in response to fishing, environmental, anthropogenic and other factors, and, to the extent possible, to predict future trends of stock abundance.[20]

Sustainable aquaculture. The practice of producing safe aquatic foods and associated products in a manner that is environmentally and socially responsible, economically viable, and able to meet the needs of present and future generations.[22]

Traceability. The ability to systematically identify, follow and verify the history, location, movement and relevant attributes of a product through specified stages of the supply chain, from capture

au For full details, please refer to paragraphs 3.1–3.3 in the International Plan of Action to prevent, deter and eliminate illegal, unreported and unregulated fishing available at: https://openknowledge.fao.org/items/dda4ea4e-5603-4984-b22b-ae6cacbf2d1c

or harvest through processing and distribution, by means of recorded information.

Transshipment. The direct transfer of any quantity of fish onboard from one vessel to another vessel regardless of the location of the event, without the fish being recorded as landed.[23]

Underfished. Status of a harvested stock for which biomass is above a threshold biomass level capable of producing the maximum sustainable yield in the long term.[20]

Vulnerable marine ecosystems. Assemblages of marine benthic organisms or habitats which are susceptible to anthropogenic disturbance, especially that arising from the impact of fishing gear used in bottom fishing.[5]

Water basin. The area of land drained by a particular river system, reservoir or other body of water; a drainage basin. Also referred to as catchment basin.[5]

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PART 1

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