Food and Agriculture Organization of the United Nations

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BOBP

Report of the Regional Workshop on

Strengthening Sustainable Aquatic Food Value Chains for Enhanced Food Security and Nutrition in Asia

02-04 December 2025

Fortune Beach Resort, Chennai, India

Food and Agriculture Organization of the United Nations

DEPARTMENT OF FISHERIES

Report on Regional Workshop on Strengthening Sustainable Aquatic Food Value Chains for Enhanced Food Security and Nutrition in Asia

Fortune Beach Resort, Chennai,

02 – 04 December 2025

Bay of Bengal Programme Inter-Governmental Organisation (BOBP-IGO)

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About the organizers

Food and Agricultural Organization of the United Nations (FAO)

FAO is a specialized UN agency founded in 1945 to combat global hunger and promote sustainable agricultural development. Headquartered in Rome, FAO works with governments and international organizations to improve food security, nutrition, and rural livelihoods. It plays a key role in fisheries and aquaculture governance, developing international agreements

Department of Fisheries (DoF)

It is a governmental body responsible for the development, management, and regulation of fisheries and aquaculture in India. It plays a crucial role in formulating policies, implementing schemes, and promoting sustainable fisheries practices to enhance productivity, livelihoods, and food security. The DoF oversees the conservation and management of marine and inland fisheries resources, enforces regulatory frameworks. It also supports capacity-building initiatives, research, and technological advancements to strengthen India's fisheries sector.

Bay of Bengal Inter Governmental Organisation (BOBP-IGO)

The BOBP-IGO is a regional fisheries advisory body with Bangladesh, India, Maldives and Sri Lanka as its contracting parties. It is mandated to enhance cooperation amongst its member countries and other countries (especially, Indonesia, Malaysia, Myanmar and Thailand) for sustainable fisheries management in the Bay of Bengal region. The BOBP-IGO Secretariat is located at Chennai. The Department of Fisheries, Government of India is the nodal agency from India and the hosting agency.

Preparation of Report

This report of the "Regional Workshop on Strengthening Sustainable Aquatic Food Value Chains for Enhanced Food Security and Nutrition in Asia" has been prepared by the Bay of Bengal Programme Inter-Governmental Organisation (BOBP-IGO). The workshop was held at the Fortune Beach Resort, Chennai, from 2-4 December 2025, and was organised in collaboration with FAP-RAP.

The designations employed and the presentation of material in this report do not imply the expression of any opinion whatsoever on the part of BOBP-IGO concerning the legal status of any country, territory, city, or area, or of its authorities, or concerning the delimitation of its frontiers or boundaries.

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Executive Summary

Asia is the global epicentre of fisheries and aquaculture, contributing over 60 percent of world aquatic food production and supporting the food security, nutrition and livelihoods of hundreds of millions of people. Despite this dominance, the region's aquatic food value chains remain constrained by high levels of fish loss and waste (FLW), weak cold-chain and post-harvest infrastructure, underutilisation of nutrient-rich small fish species, persistent gender inequalities, and uneven compliance with food safety, quality and traceability standards. These systemic weaknesses limit the sector's ability to deliver affordable, nutritious aquatic foods while equitably distributing economic benefits.

To address these challenges, FAO and BOBP-IGO convened a Regional Workshop on Strengthening Sustainable Aquatic Food Value Chains for Enhanced Food Security and Nutrition in Asia (Chennai, India; 2–4 December 2025), bringing together national governments, regional organisations, research institutions, development partners, small-scale fisheries representatives and women entrepreneurs from South and Southeast Asia. The workshop reviewed and validated national country profiles on food security and nutrition, shared country experiences, and identified priority actions to strengthen sustainability, nutrition sensitivity, inclusiveness and resilience across aquatic food systems.

Key Abbreviations

BOBP IGO	Bay of Bengal Programme Inter-Governmental Organisation
EEZ	Exclusive Economic Zone
FAO	Food and Agriculture Organisation
FLW	Fish Loss and Waste
FSN	Food Security and Nutrition
GDP	Gross Domestic Product
HDI	Human Development Index
SEAFDEC	Southeast Asian Fisheries Development Center

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1. Background

Asia accounts for the largest share of global fisheries and aquaculture production and consumption, underpinning food security, nutrition, and livelihoods for hundreds of millions of people. The region contributes over 60 percent of global aquatic food production, with China, India, Indonesia, and other countries playing leading roles. Yet, inefficiencies along aquatic food value chains, including high levels of fish loss and waste, weak compliance, underutilization of nutrient-rich small fish species, and gender inequalities, continue to limit the sector's capacity to deliver on its potential.

The nutritional importance of aquatic foods is well established: small pelagic and indigenous species provide affordable sources of protein, essential fatty acids, and micronutrients critical for maternal and child health. However, poor post-harvest handling, lack of cold chain, limited infrastructure, and inefficient processing methods often result in significant losses, reduced nutritional quality, and diminished market value. In addition, barriers to trade, traceability gaps, and gender-based constraints further undermine equitable access to markets and associated benefits.

To address these challenges, FAO and BOBP-IGO organised a Regional Workshop on Strengthening Sustainable Aquatic Food Value Chains for Enhanced Food Security and Nutrition in Asia from 2nd to 4th December 2025 at Chennai, India. The following is the detailed proceedings of the workshop.

2. Inaugural Session

2.1. Context and Background

Dr. P. Krishnan, Director, BOBP IGO

An overview of aquatic regional value-chains was presented by **Dr. P. Krishnan** who noted that Asia feeds the world with aquatic foods but faces weak value chains that result in loss of nutrition, income and equity. He explained that the workshop provides a foundation for regional solutions.

Asia is the centre of global aquatic food systems, accounting for 72% of global aquatic animal production, 88.8% of world aquaculture, and 71% of global consumption, with inland waters and small fish being critical for nutrition. Dr. Krishnan outlined core challenges including high fish loss and waste, poor cold chain and handling, unequal value distribution, gender gaps across the chain, weak compliance and traceability, and persistent undernutrition - recognizing that shared problems require shared solutions. He explained the importance of value chains by stating that stronger aquatic food value chains improve availability and affordability, enhance nutrition from small fish, reduce waste and strengthen food safety, support small-scale fisheries and women's livelihoods, and build climate and market resilience. He emphasized that regional collaboration is essential due to transboundary species, shared markets, similar post-harvest constraints, parallel challenges in fish loss and waste, the necessity of harmonized standards, and accelerated regional learning, noting that no country can resolve these issues independently.

Dr. Krishnan described the workshop's purpose as reviewing and validating national reports and regional synthesis for accuracy, relevance and policy uptake, understanding methods to strengthen value chains, sharing experiences and best practices across Asia, and fostering cooperation among countries and stakeholders to address shared challenges and advance sustainable trade and nutrition. He concluded with the view that Asia's aquatic food systems can nourish billions in a sustainable and equitable manner, and that this workshop would mark the first step toward that collective vision, acknowledged by FAO, BOBP-IGO and participating member countries.

Highlights:

- Asia dominates global aquatic food production but suffers from weak value chains and high Fish Loss and Waste (FLW).
- Stronger value chains improve nutrition, income, equity, and climate/market resilience.
- Regional collaboration is essential for shared challenges, harmonised standards and effective solutions.

2.2. Opening Remarks

Ms. Angela Lentisco, Fishery and Aquaculture Officer, FAO/RAP, Bangkok, Thailand

Ms. Angela Lentisco said that Asia remains the driving force of global aquatic food production, supplying more than 60 percent of the world's fish and providing essential nutrition and livelihoods for millions. Although major producers like China, India and Indonesia are central to this success, the region still faces significant value chain inefficiencies, ranging from fish loss and waste to gender imbalances and limited use of nutrient-rich small fish. She stressed that small pelagic and indigenous fish play a unique role in maternal and child nutrition due to their high content of protein, essential fatty acids and critical micronutrients. However, inadequate post-harvest practices, fragmented infrastructure and insufficient cold-chain management continue to erode product quality, reduce nutritional benefits and weaken market outcomes. These technical limitations are compounded by trade restrictions, traceability challenges and unequal access to markets, particularly for women and small-scale actors.

She added that FAO and BOBP-IGO are working alongside national governments to strengthen sustainable aquatic food value chains, and that this workshop is a foundational step toward producing coordinated regional and country-specific analyses for Bangladesh, Cambodia, China, India, Indonesia, Malaysia, Maldives, the Philippines, Sri Lanka, Thailand and Vietnam. Fish must be regarded not only as a traded commodity but as a strategic nutritional resource capable of addressing malnutrition and micronutrient deficiencies. She linked this perspective to the SDGs, urging countries to advance gender equity, improve compliance and governance, and share knowledge across borders. In closing, she highlighted that the workshop represents an important opportunity for collective action to ensure that aquatic foods more effectively support economic development and strengthen public health and nutrition throughout the region.

Highlights:

- Asia supplies over 60% of global fish but faces FLW, nutrient loss, gender gaps and weak cold chains.

- Small fish are critical for maternal/child nutrition but are underutilised due to poor handling and infrastructure.

- The workshop aims to strengthen evidence-based, nutrition-sensitive and gender-responsive value chain reforms.

2.3. Keynote Address: Aquatic Value Chain Analysis – An Overview

Ms. Meeta Punjabi Mehta, Senior Food Systems Officer, FAO/RAP, Bangkok, Thailand

A talk on aquatic value chain analysis was given by **Ms. Meeta Punjabi**, explaining why value chain development is needed, defining core concepts, and linking value chains to circular economy and sustainable food systems. She described value chains as product, financial and information flows across production, aggregation and transport, processing, retail and consumption, distinguishing core chains (production, aggregation, processing, retail) from extended chains (research, extension, finance and other services) and emphasizing efficiency, coordination and shared benefits. She spoke about "supply-push" chains, where actors focus narrowly on their own roles and face traditional practices, poor access to inputs and services, post-harvest losses, limited market information and weak linkages, and food safety and quality issues. She went on to contrast existing "supply-push" chains with "demand-pull" upgraded chains that respond to target markets through better practices, diversified and climate-resilient production, improved services, stronger post-harvest systems, value addition, robust market linkages and price information, and empowerment of fishers, women and youth through collectives.

Outcomes of aquatic value chain development were noted and used to outline a stepwise approach of value chain selection, analysis, strategy development, design and implementation, and monitoring and evaluation, with analysis based on mapping actors and flows. She stressed on the fact that value chain development starts with understanding current and potential end markets, buyers, demand, standards and opportunities, and then working backward to ensure demand is met competitively, sustainably and inclusively.

Key challenges and strategies were presented for production, aggregation and transport, processing and retail/consumption. High post-harvest losses, poor handling and hygiene, weak cold chains, fragmented actors, quality and safety issues, weak linkages and volatile prices were highlighted. Correspondingly, value addition at source, climate-resilient practices, stronger cold chains, traceability, certification, support to women and youth and inclusive sustainable practices were proposed. The speaker referred to FAO tools, questionnaires and e-learning on sustainable food value chains, recent work on food loss and waste, circular economy and sustainable agrifood systems and clarified FLW boundaries for SDG 12.3. She linked sustainable agrifood systems transformation to at least 12 SDGs.

Highlights:

- Value chain concepts, contrasting weak supply-push chains with upgraded demand-driven chains.

- Gaps including post-harvest losses, poor linkages, limited information, weak cold chain and safety issues.

- Tools, SDG links, and stepwise approaches for value chain selection, analysis and upgrading.

2.4. Address by the Guest of Honour

Dr. Omar Peñarubia, Fishery Officer, FAO, Rome

Aquatic food systems are expected to deliver more while future growth must be sustainable, impactful and equitable under the vision of Blue Transformation, said **Dr Omar Peñarubia**. He described Blue Transformation as a framework for transforming aquatic food systems toward better production, nutrition, environment and life, with an equitable and resilient future built on innovation, efficiency and practical solutions. He outlined detailed objectives for aquaculture, fisheries and value chains including sustainable aquaculture intensification, effective fisheries management and modernised value chains that are socially, economically and environmentally viable. He noted that aquatic food value chains are inherently complex across geographic, economic and institutional dimensions, and showed how sustainable aquaculture and sustainable fisheries are connected through policy, infrastructure, private sector engagement, institutional capacity and markets to support sustainable value chains and healthy diets. These were illustrated by a global map of value chain development projects.

Dr. Omar went on to highlight common challenges revealed by value chain analysis such as information gaps, stringent market requirements, B2B linkage needs, inequitable benefit sharing, food safety concerns, climate change impacts, organizational and language barriers, difficulties in scaling technologies, access to finance constraints, inadequate infrastructure for landings and distribution and the need to place women at the centre of improvements. He referred to value chain upgrading tools related to Article 11 of the CCRF on post-harvest practices and trade, summarised regional implementation progress based on FAO questionnaire responses, and presented results on HACCP systems, FLW assessments, reduction efforts, and use of WTO trade concerns and agreement clauses as market access tools. He pointed to FAO Globefish for trade and market access, Codex and FAO/WHO resources for food safety and processing, nutrition work on minerals, vitamins and essential fatty acids including a school-feeding toolkit, bioeconomy opportunities from by-product use such as tuna fishbone nutrients, and a multidimensional FLW solution framework spanning policy, technology, skills, services, infrastructure, regulation, social and gender equity and markets.

The speaker underlined that small-scale fisheries provide about 90% of the global catch and that women constitute roughly 40% of the workers in aquatic value chains and 40% of the capture fisheries workforce. He showcased the Blue Ports Initiative to transform marine and coastal

areas particularly fishing ports into sustainable hubs for value creation and social benefits, alongside the Guidelines for Sustainable Aquaculture. He concluded by pointing out that Blue Transformation depends on collaboration and participation of all actors and that meaningful change is achievable through the right approach and collective action.

Highlights:

- Blue Transformation calls for sustainable aquaculture, effective fisheries management and modern value chains.

- Challenges include information gaps, compliance burdens, food safety and gender inequities.

- FAO tools, FLW frameworks, Globefish resources and women-centered interventions are available.

2.5. Address by the Chief Guest

Mr. D. V. Swamy, IAS

Stressing on the importance of regional collaboration, the need for institutions capable of protecting and strengthening aquatic value chains, and Chennai's role as a strategic East Coast hub from which farming extends north and south, **Mr D.V. Swamy** shared reflections on exports and domestic value chains, nutrition and women's roles. He noted that India exports around USD 7.5 billion of marine products, mainly shrimp, supported by MPEDA and its initiative, which covers about 200,000 hectares, works with 1.2 million small and marginal farmers, and interfaces with about 1,300 exporters and 658 e-workers supplying highly demanding markets such as New York, with stringent hygiene and quality standards.

Drawing on his experience, the speaker underscored differences between domestic and export value chains, observing that domestic fish chains remain largely informal with institutional frameworks, norms and behaviours shaping access to credit and resources, unlike rice and wheat sectors that benefit from minimum support prices and strong infrastructure. He noted gaps such as limited access to high-quality shrimp in cities like Delhi despite India's export strength. He explained how export markets have created a quality ecosystem that can lift domestic standards, and highlighted RGCA's role in aquaculture development, including hatchery rehabilitation in Andhra Pradesh and Odisha that enabled the vannamei shrimp revolution - a twenty-year Andaman project that domesticated diseased Indian tiger shrimp stocks to produce pathogen-free seed - collaborations on seabass and other species, and support for crab hatcheries where private investment is limited.

Turning to nutrition, Mr. D. V. Swamy said that education and knowledge are central, pointing to low awareness of differences between fish and legume protein, essential amino acids, and protein quality. He also described contested norms around vegetarian and non-vegetarian foods, debates on eggs and fish in midday meals, varied non-vegetarian consumption patterns, preferences between inland and marine fish, and medical advice on allergies - all of which shape attitudes and can blunt efforts by agencies like FAO. He commented on Indian preferences for

“fresh” food and the stigma attached to frozen products, pointing out that factory-processed frozen fish or shrimp can be more hygienic than products stored for days in markets, and that perceptions of freshness and nutrition need to be re-examined. He linked this to circular economy opportunities by noting his visits to waste-treatment units that convert fish scales and shrimp waste into gelatin and collagen hydrolysates for pharmaceutical and nutraceutical use.

On women in the sector, Mr. D. V. Swamy observed that unlike women in agriculture whose participation is more visible, women in fisheries are concentrated in factories and inland aquaculture. He added that commercial shrimp farming tends to favour large landholders, and that poorer women often lease common-property ponds and practice basic aquaculture with technical and profitability constraints. He described agriculture livelihood projects that have enabled large collectives to export mangoes and horticultural products, and contrasted these with slower progress in aquaculture. But on the positive side, he also cited promising examples such as the environment resilience project in Andhra Pradesh and Odisha focused on mud crabs, where most beneficiaries and climate champions are women. Odisha in particular has begun exporting mud crabs by air cargo. Mr. D. V. Swamy concluded by reaffirming that MPEDA will continue to collaborate with BOBP and FAO, recalling current joint work in Andhra Pradesh and committing to support value chain strengthening.

Highlights:

- India’s export chains are highly organized, but domestic chains remain informal and fragmented.
- Perceptions of “freshness,” nutrition awareness, and women's limited access hinder value chain upgrading.
- Innovations (RSW, waste-to-nutraceuticals) and women-focused resilience programmes

3. Session 1: Presentation of Technical Report and Discussion

Chair: Ms. Angela Lentisco

3.1. Aquatic Food Value Chain: Findings from the Regional Study (South and Southeast Asia)

Mr. Rajdeep Mukherjee presented preliminary findings from a regional study on aquatic food value chains in South and Southeast Asia, noting Asia’s emergence as the global fisheries leader with over 70% of production, first driven by marine capture growth from the 1950s–1990s and later by rapid expansion of culture fisheries since the 1990s which now dominate aquatic food output. He highlighted that per capita fish supply in Asia increased 2.5-fold between 1961–2019, improving domestic availability and positioning the region as a major hub for both imports and exports, contributing to a more equitable global fish distribution, and then cited malnutrition statistics to show persistent nutrition gaps.

Mr. Mukherjee described data limitations on fresh versus locally processed consumption, unreported small indigenous species and hidden harvests, causes of waste and by-product use,

underscoring the need for systematic surveys. Key structural changes were reported, including declining marine capture in China (down 15–20% from its 2015 peak), Sri Lanka (sharp fall since 2014) and Malaysia (steady decline since 2016), and rapid aquaculture growth in Viet Nam (up 52% since 2016), India (inland culture rising from 1.5 to about 4.0 million tonnes between 2014–2023) and the Philippines (aquaculture about 56% of production in 2023), with China remaining the global leader in both capture and aquaculture. He noted aquaculture concentration in carps and high-value crustaceans, with capture shifting to pelagics, and country specializations such as seaweed in the Philippines, striped catfish, rohu and tilapia in Bangladesh, and pangasius and shrimp in Viet Nam.

Labour trends showed a shift from capture to aquaculture: capture employment in China fell by about 25% while aquaculture employment remained stable, India's aquaculture employment rose from 17% in 1995 to around 40% in 2020, and women accounted for 86–95% of workers in marketing, curing, processing and peeling in India, 52% of processors and traders in the Philippines and about 60% of post-harvest workers in Bangladesh and Indonesia, often in informal, low-paid and unrecognised roles. He described fishing gear patterns dominated by trawlers, with China operating 468,312 vessels in 2019 and the Maldives relying mainly on pole-and-line, and summarised regional trade patterns showing strong export orientation except in China and Thailand, with India dominated by frozen shrimp exports (83–85%), the Philippines exporting tuna and seaweed/carrageenan, Viet Nam earning over USD 9 billion in exports from shrimp, pangasius and marine products, Maldives dependent on frozen skipjack tuna, and China, Thailand and the Philippines also acting as significant importers of premium species and raw material.

The speaker presented consumption and nutrition data showing very high per capita fish intake in Maldives (80.1 kg/year) and Cambodia (63 kg), substantial dependence on fish as a primary animal protein source in Maldives, Cambodia, Bangladesh and Indonesia, and the nutritional importance of SIS for Ca, Fe, Zn and vitamins in Bangladesh, India and Cambodia, while also pointing to India's triple burden of malnutrition, declining fish consumption in the Philippines (from 36 to 14.32 kg/year) and rising obesity with micronutrient deficiencies in Thailand. He identified FLW as a major constraint to value capture, nutrition and livelihoods, citing loss levels of 40–60% in Sri Lanka, 25–35% in Indonesia (USD 7.28 billion), 25–40% in the Philippines and Cambodia, 20–45% in Bangladesh (USD 151 million) and rising marine losses in India from 2.78% to 10.52% (with dry fish losses at 36.97%), and described key loss points at landing, transport and processing linked to weak cold chains, poor handling, traditional low-efficiency methods and logistical challenges in archipelagic settings. Mitigation options presented included decentralised cold-chain hubs, solar cold storage, upgraded landing centres, insulated boxes, flake ice and chilled seawater systems, scaling FAO-Thiaroye technology, hygiene and handling training, quality assurance and stronger policy integration, noting that FLW reduction is already a national priority in India, Indonesia and the Philippines. He concluded with recommendations for an integrated cold-chain and quality backbone, gender-responsive chain upgrading, stronger traceability and food-safety readiness, ecosystem-based low-impact production systems, and explicit nutrition and climate resilience integration in national fisheries policies.

Highlights:

- Asia leads global fisheries; aquaculture growing rapidly despite marine declines in some countries.

- Women dominate post-harvest roles but remain informal and poorly paid.

- FLW is widespread (20–60%), driven by weak cold chains, poor handling and fragmented logistics.

3.2. Aquatic Food Value Chain: Overview of the Status and Concerns for SEAFDEC Countries

Ms. Jariya Sornkliang, SEAFDEC

Providing an overview of the status and concerns of aquatic food value chains in SEAFDEC member countries, framed by SEAFDEC's Resolution and Plan of Action 2030 which emphasizes food security, livelihoods, sustainable resource use and SSF support through ecosystem-based and participatory approaches, **Ms Jariya Sornkliang** explained the distinction between supply chains, which focus on physical product flows and logistics, and value chains, which focus on value addition, competitiveness and consumer satisfaction, and described efforts to strengthen fisheries officers' understanding of SSF supply and value chains.

Country examples showed common reliance on SSF and persistent structural constraints: in Indonesia, SSF underpin food security and exports such as swimming crab, with efforts like KUSUKA to formalize fishers, but concerns over a 60% decline in swimming crab, financial barriers, dependence on middlemen, gender inequality, ageing fishers, weak infrastructure and inconsistent support; in Lao PDR, inland systems using cement tanks, cages and rice, fish culture face outdated techniques, limited knowledge, feed import dependence, climate risks and weak chain integration; in Malaysia, Zone A SSF and community enterprises are vital but constrained by overfishing, middlemen, weak cooperatives, inadequate cold chains and gender inclusion, with needs for improved packaging, labelling and processing.

In the Philippines, municipal SSF (SSF fishing in municipal waters), women and indigenous groups depend heavily on fisheries but encounter high post-harvest losses, insufficient cold chains, weak technical capacity, outdated aquaculture technologies, middlemen dominance, unclear chain mapping and frequent quality deterioration, while in Thailand family-based SSF and short chains are challenged by low bargaining power, fuel costs, seasonal variability, resource decline and limited market access. She noted that in Viet Nam, coastal and inland SSF operate in a context of strong aquaculture and over 90% middlemen involvement, but still face weak chain linkages, low bargaining power, overfishing, traceability issues that hinder EU exports of *Acetes*, inadequate cold storage and climate vulnerability.

She summarized cross-cutting regional issues as heavy reliance on middlemen, weak post-harvest and cold-chain systems, limited financial access, inadequate market information, gender inequality, climate and environmental risks, traceability gaps and an ageing workforce.

Case studies of good practice included Thailand's "Fisherman Shop" for direct sales with quality and certification, the "Pla Organic Social Enterprise" with organic certification, value-added processing and fair trade, and Indonesia's Smart Fisheries Village in Mariana focusing on community processing, packaging and digital marketing.

Ms Sornkliang highlighted successful approaches such as improved quality and certification, value-added processing, better market access via digital platforms and cooperative retail, inclusion of women and community enterprises, and stronger governance and infrastructure for cold chains and processing. She concluded with recommendations to reinforce SSF supply and value chains by strengthening cooperatives and community enterprises, upgrading post-harvest and cold-chain systems, promoting certification, traceability and branding, supporting value addition, expanding digital and direct market channels, improving financial access, ensuring gender-responsive approaches and scaling successful models across SEAFDEC countries.

Highlights:

- SSF are central across countries but constrained by middlemen, weak cold chains, aging workforce and gender gaps.
- Country-specific issues include overfishing, outdated aquaculture methods, and limited market access.
- Good practices include certified direct-sale models, digital platforms and community processing hubs.

4. Session 2: Country Presentations

Chairs: Ms Quennie Rizaldo and Ms. Jariya Sornkliang

4.1. Bangladesh

Bangladesh reported that total fish production in 2023 - 24 was 5.02 million MT, with fisheries contributing 2.53% to national GDP and 22.26% to agricultural GDP, per capita fish consumption of 67.8 g/day, fish providing 60% of animal protein, employment for about 20 million full-time and part-time workers including 1.40 million women, and an average sectoral growth rate of 2.74% over five years. Bangladesh was noted as ranking third in Asia and fourth in the world in tilapia production, and as a leader in self-sufficiency and hilsa production, with a sevenfold rise in total production and 87.47% of output coming from inland fisheries.

However, marine growth has declined by 7.47%, illustrated by tiger shrimp and hilsa value chain diagrams. Post-harvest loss was estimated at 20–30% overall due to inadequate handling, transport and cold-chain gaps, around USD 150 million/year in marine fisheries and 15.6% in farmed fish. Mitigation is via training, better drying racks, insulated ice boxes, crates, ice-based transport and policy integration, and evidence shows that insulated boxes reduce spoilage and extend shelf life. The nutrition section highlighted fish as essential to national and household nutrition, providing high-quality protein, essential fatty acids and micronutrients for child and maternal health and dietary diversity.

The team described promotion of Small Indigenous Species such as mola through demonstration farms, awareness-raising, and homestead production, with fisheries linked to wider nutrition initiatives through government, NGO and partner support. Gender and inclusion noted women's important roles in PL/fry nursing, homestead aquaculture, post-harvest processing and marketing, and youth engagement in hatcheries, digital marketing, cold-chain innovation and entrepreneurship. But they also highlighted barriers such as limited access to credit, assets, technology, training and capital, cultural constraints, and lack of mentorship, and referenced the gender equity provisions in the draft National Fisheries Policy 2025.

The export overview for 2024–25 listed shipments of 77,407.94 MT worth USD 405.71 million to over fifty countries. Compliance and control measures managed by DoF were described as establishment approvals based on HACCP, testing under a National Residue Control Plan and corrective actions supported by the Fish and Fish Products (Inspection & Quality Control) Act 2020 and draft Rules 2023 aligned with EU, US FDA, China GACC, Codex, WTO SPS and ISO/IEC 17025:2017. Key challenges included limited integration of SSF actors, women and youth, climate impacts affecting supply chains, high post-harvest losses, compliance and traceability gaps limiting exports and environmental pressures such as disease and pollution. A proposed way forward focused on accreditation of inspection bodies, e-certification and e-traceability, disease surveillance systems, expanded laboratories and FIQC stations, updated farm registration, NRCP automation and stronger official controls.

Highlights:

- Bangladesh is a major global fisheries producer, generating 5.02 million MT in 2023–24, contributing significantly to GDP and nutrition (60% of national animal protein), with strong inland aquaculture growth ranking among the world's leaders in hilsa and tilapia and supporting 20 million workers, including 1.4 million women.

- Key constraints include high post-harvest losses (20–30%), inadequate cold-chain and handling systems, declining marine production, climate and environmental pressures, and persistent gender and youth barriers despite evidence that improved storage, insulated boxes and better transport can substantially reduce losses.

- National priorities focus on modernising quality, safety and traceability systems, strengthening HACCP-based compliance, expanding labs and surveillance, adopting e-certification and e-traceability, promoting nutrition-sensitive fisheries (e.g., Small Indigenous Species), empowering women and youth, and improving integration of small-scale fishers to meet global market and sustainability standards

4.2. Cambodia

Cambodia has a total population of about 17.9 million and fish production was 926,934 tonnes in 2024, composed of 467,344 tonnes inland (~50%), 139,310 tonnes marine (~16%) and 320,280 tonnes aquaculture (~34%). The team emphasised that aquaculture makes a substantial contribution to production, food security, socioeconomic development and employment. It was noted that fish provide around 75% of total animal protein intake, supplied through ponds, cages,

pens and rice–fish culture, but that producers face rising feed costs, poor fingerling quality, limited technical knowledge, climate and water constraints, weak research on breeding, feed and disease management, data gaps on production and environmental impacts, and financial and infrastructure limitations.

Strategies for sustainable development include technical capacity-building, farm management planning, promotion of rice–fish co-culture, smart aquaculture systems, farmer clustering, GAqP and strengthened regulation under national policy and sub-decrees. Value chain mapping identified actors across production, processing and marketing, with most of the 926,934 tonnes consumed domestically and only 3,833 tonnes exported (FiA, 2024). Post-harvest handling still relies on both traditional and modern methods (drying, smoking, fermenting) with improved hygiene where potable water, ice and facilities exist, but insufficient sanitation at landing sites and inadequate preservation lead to roughly 25% loss due to limited chilling, storage, ice supply and cold-chain capacity.

Fish utilization was reported for 76% of household protein intake, with per capita consumption of 52.3 kg/year, and value addition examples included converting residuals to bio-fertilizer, fish bones to powder and fish skin to crackers, alongside efforts to promote CQS and HACCP certification. Trade, compliance and traceability are supported by schemes such as CQS, GAqP and CamTrace, although important trade challenges remain in the form of technical and processing constraints, market and infrastructure gaps, regulatory hurdles and sustainability concerns.

Highlights:

- Strong national dependence on fish for nutrition and livelihoods. Cambodia produced ~927,000 tonnes of fish in 2024, with fish supplying ~75% of total animal protein and 52.3 kg/capita/year consumption, reflecting a critical role in household food security and rural employment.
- Aquaculture is growing but constrained by systemic challenges. Aquaculture contributes ~34% of national production, yet faces high feed costs, low-quality seed, weak technical capacity, climate and water constraints, limited research, and financial and infrastructure gaps, affecting sustainability and productivity.
- Post-harvest losses and weak compliance limit value addition and trade. About 25% of fish is lost post-harvest due to poor chilling, sanitation and cold-chain limits. While schemes like GAqP, CQS and CamTrace support safety and traceability, Cambodia exports only 3,833 tonnes, constrained by processing capacity, market access, regulatory hurdles and sustainability concerns.

4.3. China

China considers its aquatic food system as central to addressing hidden hunger because aquatic foods are nutrient-dense, affordable and rich in polyunsaturated fatty acids, and are the primary dietary source of EPA and DHA, aligning with the Chinese Dietary Guidelines which encourage aquatic product consumption. It highlighted China as the world's largest producer and consumer

of aquatic foods, accounting for about one-third of global output, with China's aquaculture alone providing 56% of global aquaculture production and contributing significantly to food security, employment, wealth creation and rural revitalisation.

The "Big Food Approach" promoted by national leadership was introduced as a call to diversify food sources, while long-term data from 2000–2020 showed gradual declines in capture fisheries and a situation in which aquaculture supplied over 82% of China's aquatic products in 2024. The sector was characterised as highly diverse, involving more than 600 aquatic animal and plant species, and structured along upstream raw materials, capture and aquaculture production, downstream processing and distribution, and services including recreational fisheries and research.

The policy framework for green agriculture and specific directives for healthy aquaculture, rural revitalization, modern facilities, offshore aquaculture, demonstration zones and green circular pilots were presented, along with five priority actions on ecological and healthy culture models, full-coverage wastewater treatment in demonstration bases, a targeted 7% reduction in aquatic veterinary drug use, 77% substitution of trash fish with compound feed, and promotion of 96 new aquatic varieties. Spatial planning under the Fisheries Law was described with designated aquaculture, restricted and prohibited zones and multi-level plans (36 provincial, 351 regional, 1,572 county-level), and the expansion of aquaculture into large inland water bodies, saline–alkali lands and deep and offshore areas.

Healthy aquaculture measures include demonstration zones for ecological "healthy" culture, legally sourced seedlings, certified medicines and feed, licensed veterinarians and disease control systems. Seed industry revitalisation has produced 306 new varieties, 105 national-level seed farms and identification of 857 germplasm resources (558 indigenous, 209 selected and 90 introduced). Capture fisheries transformation under recent Five-Year Plans features declining production, strict control of marine effort, summer and high seas moratoriums, reduced motorised vessel numbers, regulation of distant-water fishing, a 10-year Yangtze River ban, pond rewilding and protected areas for germplasm and water sources, with domestic marine capture capped at 10 million tonnes in 2025.

Highlights:

- Aquatic foods are central to China's nutrition and food security strategy. China positions aquatic foods as a core solution to hidden hunger due to their affordability and density of micronutrients, EPA and DHA. National dietary guidelines explicitly promote aquatic food consumption, and China is both the world's largest producer and consumer, accounting for one-third of global output.

- Aquaculture dominates and is rapidly modernising under strong policy direction. Aquaculture now supplies over 82% of national aquatic products (2024), representing 56% of global aquaculture production. A comprehensive policy framework covering green agriculture, healthy aquaculture, spatial planning, offshore expansion, and seed industry revitalisation drives sustainability through wastewater treatment, reduced drug use, feed substitution and development of 300+ improved varieties.

- Capture fisheries are tightly regulated to restore ecosystems and rebuild stocks. Long-term decline in capture output has led to major governance reforms: marine effort controls, summer and high-seas moratoria, the 10-year Yangtze River ban, reduced motorized vessels, distant-water regulation, pond rewilding and new protected areas. Domestic marine capture is capped at 10 million tonnes by 2025, signalling a strategic shift toward ecological conservation.

4.4. India

India outlined a rapidly expanding fisheries sector contributing 6.72 percent to the agriculture economy and 1.1 percent to the national economy, with FY 2023 to 2024 production reaching 4.49 million tons from marine waters and 13.91 million tons from inland systems and supporting more than twenty-eight million fishers and fish farmers. Key national policy frameworks such as the PMMSY, the National Policy on Marine Fisheries, 2017, Coastal Regulation Zone norms, aquaculture guidelines and state level MFR Acts guide sustainable growth across the sector.

India exported seafood worth 7.45 billion USD to more than one hundred and thirty countries with shrimp dominating both value and volume and key markets including the United States, China, Japan, Vietnam and Thailand. Aquaculture produced 38% of export volume but 62% of export value driven mainly by whiteleg shrimp and black tiger shrimp while capture fisheries supplied the remaining volume and value.

Detailed mapping of shrimp and tuna value chains showed the complexity of input supply, hatcheries, broodstock management, feed, farm preparation, grow out systems, primary and secondary processing, packaging, cold chain logistics and domestic and international marketing. Capture fisheries value chains for shrimp and tuna included vessel operations, gear, fuel, ice, labour, major landing centres, auction systems, on-board handling, sorting, grading and processing for products ranging from whole fish to fillets, loins, ready to eat items and canned tuna.

India's priority actions focus on science-based resource management, restoration of coastal and inland habitats, climate resilient fisheries, upgrading hatcheries, strengthening biosecurity, expanding cold chain infrastructure, modernizing harbours, promoting value addition, ensuring traceability and certification, enhancing fisher welfare and skills, improving access to finance and strengthening data systems and research through public and private partnerships.

The presentation highlighted post-harvest fish loss due to quality deterioration and market forces and emphasized the need for improved on-board facilities, insulated storage, slurry ice, refrigerated seawater systems and harbour infrastructure to reduce losses and support higher value utilization. Nutrition related evidence underscored the rising contribution of fish to national protein intake and its importance as a source of key micronutrients including calcium, iron, zinc, iodine and omega fatty acids with small fish species playing a vital role in diets of low-income groups.

The presentation also emphasized gender dimensions noting that women make up forty percent of India's small-scale fisheries workforce with major roles in processing, trading and marketing

including very high participation in curing, peeling and fish marketing. Trade and compliance sections described the roles of MPEDA, FSSAI, the Export Inspection Council, the Coastal Aquaculture Authority and state departments in regulating safety, certification and export quality. India's new national digital traceability framework aims to establish end to end, real time tracking of seafood from catch to consumer supported by modern digital technologies, critical tracking events and unique identifiers under a phased rollout. Overall, the presentation highlighted India's commitment to sustainable, traceable, value driven aquatic food systems that enhance economic opportunity, nutritional security and fisher livelihoods.

Highlights:

- Rapidly expanding, contributing significantly to the national and agricultural economy, driven by strong marine and inland production, major export earnings; guided by comprehensive national policies.

- Complex and evolving value chains for shrimp and tuna, along with major investments in science-based management, climate resilience, biosecurity, cold chain, harbour modernization and digital traceability, are central to boosting efficiency, reducing losses and enhancing global competitiveness.

- Fisher welfare, nutrition, gender inclusion and compliance are core priorities, recognizing the vital roles of women, the nutritional importance of fish for low-income groups, and the need for strong regulatory oversight to support sustainable, value-driven, traceable aquatic food systems.

4.5. Indonesia

Indonesia was described as one of the world's leading producers of fish and aquaculture products, with marine and fisheries output (fish and seaweed) stabilizing at about 20–25 million tonnes annually between 2020–2024, including average capture production of 7.39 million tonnes, aquaculture production of 5.66 million tonnes and seaweed production of 9.70 million tonnes. It underscored the sector's contribution to food security, nutrition, employment and income for millions in coastal and rural areas, as more than half of animal protein intake derives from aquatic sources and that small pelagic and local species enhance dietary diversity. Persistent challenges such as high post-harvest waste, limited cold storage and transport infrastructure, fragmented traceability and compliance systems and gender inequality were also acknowledged.

Trade data for 2018–2023 showed significant export and import flows with relatively low global market shares for major commodities such as shrimp and tuna skipjack mackerel, indicating untapped growth potential. The Blue Economy Policy was introduced as a pillar for sustainable development, alongside Indonesia's role as the world's largest tuna producer, which requires robust traceability mechanisms such as STELINA, a GDST-compliant national system, and shrimp value chains that prioritise disease control, biosecurity and compliance with international standards. Key constraints were identified as climate change, post-harvest losses of up to 33%, stringent quality assurance requirements, IUU fishing, gender disparities and

limited capacity among small-scale actors. Priority solutions were presented including investment in cold-chain and processing infrastructure, strengthened community-based resource management, expansion of digital traceability, support for climate-resilient fisheries and aquaculture, and stronger regional cooperation.

The Nusantara Blue Swimming Crab Fishermen Group in Jepara Regency was showcased as an example of community engagement, and the presentation concluded with policy recommendations to better connect actors along the value chain, invest in innovation and research, and reinforce data systems and capacity building.

Highlights:

- Indonesia remains one of the world's largest aquatic food producers, with stable annual output of 20–25 million tonnes (capture, aquaculture and seaweed combined), playing a crucial role in national food security, nutrition and livelihoods, while facing persistent constraints such as post-harvest losses, weak cold chain, fragmented traceability and gender inequality.

- Trade performance reveals strong volumes but low global market share for major exports like shrimp and tuna/skipjack, indicating significant untapped growth potential, driving national priorities around Blue Economy development, disease control, biosecurity, GDST-aligned traceability systems (e.g., STELINA) and stronger compliance with international standards.

- Priority solutions emphasise sustainability, resilience and inclusive participation, including cold-chain investments, digital traceability expansion, climate-resilient fisheries, community-based resource management, stronger regional cooperation, improved data systems and capacity building highlighted through examples such as the Nusantara Blue Swimming Crab Group.

4.6. Malaysia

Malaysia reported total production of 1.91 million MT worth MYR 16.95 billion, comprising aquaculture output of 511,860 MT worth MYR 4.5 billion with 16,873 culturists, capture fisheries production of 1,392,130 MT worth MYR 11.8 billion with 105,287 fishers, and inland fisheries production of 9,652 MT worth MYR 190.7 million with 12,596 fishers for 2024. Per capita fish consumption had risen to 48.1 kg in 2024, with capture landings dominated by sardines, mackerel, lizardfish, Indian mackerel and threadfin bream, aquaculture by seaweed, seabass, catfish, white shrimp and tilapia, and inland catches by bagrid catfish, river carp, giant freshwater prawn, black tilapia and Javanese carp.

The National Agrofood Policy 2.0 goals include a fisheries production target of 2.55 million MT, self-sufficiency of 97.8%, a 60:40 capture-to-aquaculture ratio, a 30:70 deep-sea to coastal fishing ratio, 10% of national waters designated as MPAs, phasing out trawlers from Zone B, average fisher incomes of MYR 5,500 and safe, traceable and sustainable resource utilization, supported by mapped aquatic food value chains across the food system. Key challenges

discussed were stock depletion, IUU fishing losses, ecosystem damage from destructive gears, reliance on foreign crews, input constraints and rising costs in aquaculture (including electricity and water abstraction charges), productivity issues and disease risks.

Main priorities for capture and aquaculture fisheries were detailed, along with a Climate Change Action Plan (2024–2030) covering adaptation, mitigation, sustainability, green technologies and collaboration, addressing impacts across marine, aquaculture and inland sectors through data hubs, GHG accounting, coral restoration, climate-resilient systems and water-saving measures aligned with SDG 13 and national reporting. Post-harvest handling and FLW were estimated at 15–20%, largely due to handling, infrastructure and processing limitations, with governance anchored in the Fisheries Act 1985, Food Act 1983 and associated regulations, and implementation supported by capacity-building, training and attention to gender and social inclusion.

Highlights:

- Malaysia's fisheries and aquaculture sector is substantial and diversified, producing 1.91 million MT worth MYR 16.95 billion in 2024, with rising per-capita fish consumption (48.1 kg) and strong contributions across marine, aquaculture and inland fisheries, guided by ambitious National Agrofood Policy 2.0 targets for production, self-sufficiency and sustainability.

- The sector faces significant structural and environmental challenges including stock depletion, IUU fishing, destructive gears, foreign crew dependence, rising aquaculture input costs, productivity and disease risks, and 15–20% post-harvest losses, underscoring the need for stronger resource management, better governance and improved infrastructure.

- Malaysia's priorities centre on sustainability, climate resilience and inclusive development, with actions such as phasing out trawlers, expanding MPAs, climate change adaptation/mitigation (2024–2030 plan), data hubs, green technologies, and gender-sensitive capacity building, all aimed at ensuring safe, traceable and resilient aquatic food systems.

4.7. Maldives

Maldives positioned the country as a small-island nation whose economy, food systems and rural livelihoods depend heavily on fisheries, producing around 120,000 metric tonnes annually, mainly skipjack and yellowfin tuna along with reef fish. Fisheries contribute 7% to GDP and sustain employment across dispersed islands, with over 90% of exports comprising tuna products supplied to EU and Asian markets. The national governance framework, built on the Maldives Fisheries Act, Tuna and Aquaculture Regulations, consists of species-specific management plans and sustainability-focused policies, and prioritises precautionary management and climate resilience in the face of sea-level rise.

Aquaculture is expanding through a combination of government facilities such as the K. Maniyafushi Research & Training Facility and the Aquatic Animal Health Facility, and private ventures including hatcheries, seaweed farms and mariculture enterprises farming brown-marbled groupers, sea cucumbers, *Kappaphycus* seaweed, clownfish and black-winged pearl oysters. The tuna value chain, grounded in pole-and-line fishing, connects dhoni crews with collector vessels, processors, exporters, domestic wholesalers, resorts and consumers, supported by cold-chain operators, harbour authorities, MSC certification bodies and cooperatives. Operations span live-bait supply, on-board icing and bleeding, landing and grading, processing (freezing, canning), storage, logistics and export distribution, driven by sustainability credentials, traceability and engagement with regional tuna governance through IOTC.

A parallel value chain for brown-marbled groupers is advancing through hatchery-based seed, cage culture, cold-chain transport and processing, supplying domestic markets and export destinations such as China, Hong Kong and the Netherlands. The sector faces structural challenges including post-harvest and trade bottlenecks, regulatory gaps, limited aquaculture technology and skilled personnel, and climate-related pressures on marine resources, alongside the need for stronger biosecurity and aquatic-animal-health systems as aquaculture grows. Priority actions emphasised enhancing governance and licensing systems, building local seed production and hatchery capacity, embedding sustainable practices, and developing robust biosecurity frameworks. Innovation initiatives showcased included solar-powered ice plants installed on selected islands to reduce diesel dependency, the rollout of refrigerated seawater systems to 43 vessels to improve catch preservation, and deployment of Fish Aggregation Devices supporting pole-and-line and sports fisheries across numerous atolls.

The presentation further highlighted gender and inclusiveness, noting women's key roles in post-harvest processing and value addition, and youth participation in aquaculture start-ups, seaweed farming and fisheries training. National policies support gender equity, livelihood diversification and community empowerment, while inclusive initiatives such as the World Bank's Grouper Mariculture Pilot, the TRANSFORM Youth Internship, certified mariculture training programmes, and the Floating Acres seaweed farm illustrate practical pathways for participation. The presentation concluded by describing the need to strengthen data systems, expand climate-adaptive innovations, reduce post-harvest losses, broaden aquaculture capacity and reinforce gender-responsive, community-based approaches to ensure resilient and sustainable aquatic food value chains in the Maldives.

Highlights:

- Fisheries are the backbone of the Maldivian economy and food system, contributing 7% to GDP, driving exports (over 90% tuna products) and sustaining dispersed island livelihoods through sustainable pole-and-line fishing, strong governance under the Fisheries Act, species-specific management plans and a growing emphasis on climate resilience.

- Aquaculture and diversified value chains are expanding, including tuna, brown-marbled grouper, sea cucumber, seaweed and ornamental species, supported by public R&D

facilities, private hatcheries, cold-chain investments (e.g., solar ice plants, RSW systems), FAD deployment and traceability/MSC certification though gaps remain in technology, skills, aquaculture health, post-harvest systems and regulations.

- Strengthening resilience, inclusiveness and innovation is a national priority, with actions focused on governance and licensing, domestic seed production, biosecurity frameworks, climate-adaptive technologies, reduced post-harvest losses, improved data systems and greater participation of women and youth through targeted programmes and community-based initiatives.

4.8. The Philippines

Philippines has vast and diverse fisheries resources, spanning a 2.2 million square km area with one of the world's longest coastlines, extensive coral reefs, swamplands, fishponds and inland waters, alongside the 24-million-hectare Philippine Rise comprising EEZ and extended continental shelf areas. In 2023, the Philippines ranked as the 11th top fish producer globally with 4.12 million MT, 11th in aquaculture production, and 4th in aquatic plant production, reflecting the sector's considerable contribution to food supply and livelihoods.

A strong regulatory foundation guides fisheries management. It includes the Philippine Fisheries Code (RA 8550), the Food Safety Act, the Magna Carta of Women, veterinary drug residue controls, bans on chloramphenicol and nitrofurans, and traceability measures under BFAR Administrative Circular 251. It is complemented by the Comprehensive National Fisheries Industry Development Plan (2021–2025) and species-specific national roadmaps for shrimp, tilapia, milkfish and seaweed. The structure and value chain of the milkfish industry were highlighted, alongside economic assessments showing significant financial losses in capture fisheries and aquaculture.

Ongoing improvements focus on implementing regional hygiene and cold-chain guidelines, strengthening major and municipal fish ports, and enhancing compliance with food safety standards. Current priorities include expanding post-harvest facilities, improving technologies for processing waste and by-products, upgrading BFAR laboratory capacity, and addressing climate-related vulnerabilities through climate-risk assessments and AMR management in aquaculture. Gender inclusiveness remains central, with national profiles documenting women's contributions across fisheries and post-harvest activities. BFAR's trade, compliance and traceability programs encompass HACCP certification, inspections, vessel monitoring and electronic reporting, SPS-related permissions, disease surveillance and national residue control - together reinforcing a safer, more transparent and resilient fisheries sector.

Highlights:

- The Philippines is a major global aquatic food producer, ranking 11th in total fish output and aquaculture, and 4th in aquatic plants, with 4.12 million MT produced in 2023 supported by vast marine and inland resources that are central to national food supply and livelihoods.

- A robust regulatory and planning framework underpins fisheries management, anchored in the Fisheries Code, Food Safety Act, gender legislation, strict residue and traceability controls, BFAR's national plans and species-specific roadmaps while major challenges persist in post-harvest handling, economic losses, climate risks, AMR pressures and infrastructure gaps.

- National priorities focus on strengthening safety, traceability, resilience and inclusiveness, through improved hygiene and cold-chain systems, upgraded ports and laboratories, expanded post-harvest and by-product processing, climate-risk and AMR management, and active support for women's roles across fisheries and value chains.

4.9. Sri Lanka

Sri Lanka is referred to as the "Pearl of the Indian Ocean," highlighting its narrow continental shelf, a territorial sea of 21,500 km^2 and a vast EEZ of 517,000 km^2, eight times larger than its land area, underscoring the strategic advantage of being an island with rich marine resources. With a population of 22 million, the fisheries sector contributes about 1.2% of GDP, producing 397,230 MT of fish annually, of which the marine sector accounts for the majority. The country's marine economy is driven by coastal and deep-sea fisheries supported by 1,700 fishing boats, 75 exporters, 32 EU-approved processors and strong tuna exports, especially yellowfin and bigeye to the USA, EU and Japan, alongside lobsters, crabs, squid, cuttlefish, shark fin, *beche-de-mer* and fish maws.

Value chain mapping for shortfin scad and tuna illustrated the structure of harvesting, post-harvest handling, processing and export. However, the sector continues to face persistent challenges such as 20–30% post-harvest losses due to weak cold-chain systems, fragmented coordination, unreliable supply, gaps in traceability and compliance, market access barriers, low value addition, limited preservation technology, and climate-driven threats including species shifts, storms, coastal erosion and disease outbreaks. Priority national actions emphasised upgrading infrastructure through strengthened cold chains, landing sites and smart, climate-adaptive vessels, improving traceability via QR-based records and e-logbooks, expanding value-added processing and branding, enhancing certification and logistics, promoting ecosystem-based management and biosecurity, and investing in training, women's cooperatives and local advisory centres to uplift small-scale actors. Regional collaboration opportunities were highlighted in joint harbour upgrades, shared research and development for climate-smart fisheries technologies and coordinated training for sustainable practices.

The gender section detailed women's substantial but often undervalued role in post-harvest activities - sorting, gutting, drying, processing and marketing - as well as gleaning and near-shore gathering, while noting entrenched challenges such as limited mobility, patriarchal norms, restricted access to credit and equipment, absence from leadership roles, and heightened vulnerability to climate impacts due to low-capital livelihoods. The presentation closed with a call to strengthen value chains, empower women, and advance collective regional action to secure nutritious aquatic food for present and future generations.

Highlights:

- Sri Lanka's strategic island geography and rich marine resources underpin a vital fisheries sector, producing ~397,000 MT annually and contributing 1.2% of GDP, with strong export-oriented value chains for tuna (yellowfin, bigeye) and high-value species such as lobsters, crabs, squid and beche-de-mer.

- The sector faces major structural and climate-related challenges, including 20–30% post-harvest losses, weak cold-chain and processing systems, gaps in traceability and compliance, low value addition, market-access constraints, and climate threats like species shifts and coastal erosion all limiting competitiveness and resilience.

- National priorities focus on modernization, inclusiveness and regional cooperation, through cold-chain upgrades, climate-smart vessels, digital traceability, value-added processing, certification, ecosystem-based management, women's economic empowerment, and joint regional initiatives to strengthen research, harbours and sustainable practices.

4.10. Thailand

Thailand has rich aquatic resources that include extensive inland waters such as sixty-six rivers, more than ten thousand lakes, and hundreds of reservoirs along with productive coastal aquaculture zones in the Gulf of Thailand and the Andaman Sea. These combined systems support a diverse fisheries sector composed of inland capture freshwater culture and coastal culture activities. The Department of Fisheries under the Ministry of Agriculture and Cooperatives leads national research monitoring regulation and sectoral development guided by strategies that enhance aquaculture production improve quality strengthen sustainable resource management advance fisheries technology and support human resource development. Policies focus on improving raw material quality ensuring products are free from chemical or environmental contaminants strengthening preventive inspection systems meeting export requirements and certifying approved processors.

Thailand's aquatic food value chains span major species and processing categories supported by a well-developed marine processing industry and rigorous certification mechanisms. The sector faces challenges including effluent discharge reduced land availability for aquaculture gaps in cold chain and traceability infrastructure climate impacts rising production costs lower market prices for aquatic animals and regulatory or trade related constraints. Priority areas include sustainable fisheries and IUU compliance climate resilient aquaculture food safety and export competitiveness circular economy approaches ecosystem restoration support for small scale fishers and wider digital transformation. The country continues to expand value added seafood products innovate diverse product lines utilise waste materials and explore opportunities in non-food sectors. Thailand maintains strong export markets with the United States Japan and China purchasing large volumes of canned tuna canned pet food and frozen shrimp while imports include tuna chilled or frozen fish and squid from countries such as China Norway and India.

Certification systems ensure the quality safety and traceability of products through approved establishments inspection services laboratory analysis monitoring programs and traceability tools including the Thai flagged catch certification and Port State Measures linked processing statement systems. Production data highlight key species such as Pacific white shrimp Nile tilapia Asian seabass cockles' oysters' mussels and sea crabs which collectively support significant export volumes. The presentation concluded by emphasizing the importance of aquatic foods in Thai diets as an accessible nutrient rich and culturally significant source of animal protein that supports livelihoods contributes to national food security and promotes sustainable and climate resilient nutrition.

Highlights:

- Thailand's diverse inland and coastal aquatic resources support a major fisheries and aquaculture sector, guided by strong government regulation, research and quality-control systems aimed at improving production, ensuring contaminant-free products, and maintaining export readiness.

- Despite a well-developed processing industry and strong export markets (notably the US, Japan and China), the sector faces persistent challenges including effluent discharge, land constraints, cold-chain and traceability gaps, climate impacts, rising costs, price pressures and regulatory/trade hurdles.

- National priorities focus on sustainability, competitiveness and resilience, through IUU compliance, climate-resilient aquaculture, food safety, circular economy approaches, digital transformation, ecosystem restoration and support for small-scale fishers, while expanding value-added products and maintaining high standards of certification and traceability to secure global market access.

4.11. Vietnam

Vietnam has a rapidly growing fisheries sector with 2024 production reaching 9.5 million tons and export earnings of 10 billion USD, placing the country among the world's leading producers and exporters of shrimp, Pangasius, marine fish and molluscs. The sector continues to expand at almost five percent per year and supports large rural communities through inland coastal and marine farming systems.

National strategies and development plans guide long term progress by promoting reduced fishing effort, increased aquaculture, organic and certified production, low carbon technologies, environmental protection, waste reduction and modern value chain development. These include the national fisheries development strategy, the shrimp development plan, environmental protection schemes, sustainable capture fisheries programs, aquaculture development plans and seafood processing initiatives which all support Vietnam's goal of shifting the industry from volume-based growth to growth based on value, quality, efficiency and sustainability.

Mapping of major value chains illustrated how skipjack tuna in Khanh Hoa province and Pangasius products move through fishermen, middlemen, processing companies and finally

international markets such as the United States, the European Union and Israel. The Pangasius chain showed an integrated processing sector that produces fillets, ready to cook and ready to eat products as well as by products including collagen, gelatin, oil, fish meal and biofuel. Key challenges include meeting increasingly strict global sustainability standards, converting small scale production into high technology systems and coping with climate impacts such as drought and increased disease risk. Priority actions emphasised a shift from quantity to quality and improvements in environmental and technological performance.

The presentation highlighted post-harvest fish loss at 15 to 20 percent mainly due to poor cold chain systems, fragmented capture activities and household level waste, while also noting that reducing losses could raise export value by up to 15 percent. Vietnam has already demonstrated strong circular economy capacity with by product utilisation reaching about 98 percent in Pangasius and shrimp processing, using shrimp shells for chitosan, fish skin and bones for collagen and gelatin and viscera for oil and feed ingredients. National circular economy plans aim by 2030 to reduce losses annually, ensure complete treatment and reuse of by products from shrimp and Pangasius processing and increase recycling of wastewater and sludge in aquaculture farms.

Trade and traceability systems depend on certifications such as VietGAP and unique farm codes for shrimp and catfish though the sector still faces high logistics costs, technical barriers, climate pressures and coastal development constraints. The presentation ended by identifying opportunities for regional cooperation including harmonised standards, shared climate adaptation knowledge, joint management of shared aquatic resources and technology transfer for advanced processing and bioeconomy-based waste utilisation.

Highlights:

- Vietnam is a global fisheries powerhouse, producing 9.5 million tons in 2024 and exporting USD 10 billion in seafood, with fast growth driven by shrimp, Pangasius, marine fish and molluscs—supporting millions across inland, coastal and marine farming systems.

- National strategies aim to shift the sector from volume to value, promoting reduced fishing effort, expanded and certified aquaculture, low-carbon and environmentally friendly technologies, modern processing, and strong value-chain integration especially evident in advanced Pangasius and tuna chains.

- Key challenges and opportunities centre on sustainability, climate resilience and circular economy innovation, including improving cold chains to cut 15–20% post-harvest losses, meeting global standards, advancing high-tech systems, expanding by-product utilisation (already ~98%), strengthening traceability, and deepening regional cooperation on standards, climate adaptation and advanced processing.

5. Session 3: Nutrition and Small Fish in National Diets

Chair: Dr P. Krishnan

5.1. Nutrition and Small Fish in National Diets

Ms. Quennie Rizaldo, WorldFish

Ms. Quennie Rizaldo outlined WorldFish's mission to improve livelihoods and nutrition through aquatic food systems and described aquatic foods as nutrient dense, versatile, affordable, and low in environmental footprint compared with many terrestrial proteins. Drawing on the Planetary Health Diet, she noted fish's role in closing nutritional gaps and emphasized the need for context specific food based dietary guidelines; the Philippines explicitly highlights small fish while other countries often omit them. She highlighted school meal programs as a strategic market and delivery channel for aquatic nutrition, sharing pilot work where small fish powder and incorporation of fish in menus in India, Timor Leste and Cambodia showed high acceptability and practical promise. Small fish powder can reduce kitchen time if food safety is assured.

She described production interventions such as integrated rice fish systems, homestead pond approaches, and co-management that increase availability of small indigenous species and support women's processing and income generation. Key challenges identified include fish loss and waste, food safety risks including heavy metals in fermented products, microplastics, and antibiotic use, and the need for more evidence on scaled implementation in school feeding. She also flagged underappreciated aquatic foods such as bivalves and seaweeds as important nutrient sources. Her takeaways called for reframing aquatic foods as essential for resilient nutrient adequate planet friendly diets; promoting aquatic diversity rather than single species dependence; expanding incorporation of aquatic foods into school meal programs; and strengthening policies and investments to realize these benefits.

Highlights:

- Small fish and other aquatic foods are nutrient-dense, affordable, and crucial for filling dietary gaps, especially in national diets and school meals.
- Production models like rice–fish systems and homestead ponds increase availability and support women's livelihoods.
- Key challenges include fish loss and waste, food safety risks, and the need to scale evidence-based integration of aquatic foods into policies and programmes.

5.2. India: Fish Loss and Waste Reduction Strategies

Dr. V R Madhu, Principal Scientist, ICAR-CIFT

Dr. V R Madhu presented an overview of India's fish loss scenario and the interventions developed by ICAR-CIFT to address waste reduction across the fisheries value chain. He highlighted the complexity of India's aquatic food systems, characterized by a long coastline,

scattered landing centres, diverse vessel types, and multi-species and multi-gear fisheries. These features contribute to both quantitative and qualitative fish losses. Studies indicate 10–20% quantitative losses in small-scale gillnet and ring-seine fisheries and 15–20% quality losses during glut seasons, especially for small pelagics. Economic losses during peak landings may reach 30–40%. Trawlers, which dominate mechanized operations and contribute significantly to marine landings, were identified as major contributors to low-value bycatch, with recent national studies reporting 30–60% in trawl catches.

Outlining CIFT's work on estimating loss levels across marine and inland value chains, he noted higher losses in riverine fisheries and inland wholesale markets. He emphasised that processing by-products, though traditionally considered waste, are nutritionally rich, containing 15–24% protein and significant mineral content, making them suitable for value addition. Waste generation varies by species, fishing method, fish size, processing approach, machinery, and worker skills.

CIFT's key interventions for loss and waste reduction include the development of bycatch reduction devices such as square-mesh cod-ends, modified trawl designs, and a newly developed Turtle Excluder Device, which together demonstrate up to 50% bycatch exclusion. Onboard quality assurance systems, improved vessel designs, and trials with ammonia–carbon cascade chilling systems aim to reduce post-harvest deterioration. The institute has also developed value-added products from fish waste, including chitin, chitosan, gelatin derivatives, hydroxyapatite, cephalopod ink products, and traditional food items.

To reduce retail-level losses and improve hygiene, CIFT has introduced fish vending kiosks, solar-powered mobile vending units, and hygienic fish market designs. It also functions as a national reference laboratory and has developed a freshness sensor based on eye-colour change to assess fish quality. Case studies indicate that key consumer drivers are price and availability, while barriers include high retail prices, poor hygiene, and inconsistent freshness. These challenges can be addressed through the technologies and interventions presented.

Emerging areas highlighted include digital grading and auction systems, traceability integrated with VMS, AI-based applications, and nutrition-sensitive initiatives with WorldFish and state agencies. He concluded by stressing the need for modernised landing centres, integrated cold chains, scaling of proven technologies, promotion of zero-waste processing, and targeted capacity-building including women-centric training modules to strengthen national fish loss and waste reduction efforts.

Highlights:

- India experiences significant fish loss 10–20% in small-scale fisheries and up to 40% economic loss during glut periods, with trawlers generating high bycatch.

- CIFT technologies (bycatch reduction devices, improved chilling, vessel upgrades) and value addition from waste can substantially reduce losses.

6. Session 4: Gender, Inclusiveness and Trade

Chair: Dr. Omar Penarubia

6.1. Women in Fisheries

Dr. Nikita Gopal

The presentation by **Dr. Nikita Gopal** on Women in Fisheries highlighted that although women are central to aquatic value chains across Asia, their contributions remain largely invisible and undervalued, a persistent issue documented in major regional studies. Women make up nearly half of the fisheries and aquaculture workforce and are vital to household incomes and nutritional security, yet their work is often hidden, especially in fish harvesting, net making, unpaid household and community-based labour and other tasks that support fishing and aquaculture systems.

Women are heavily involved in post-harvest activities such as sorting, drying, smoking, fermenting and retail trading through both formal and informal markets, and they participate widely in aquaculture through seed collection, backyard rearing, finfish and shellfish culture and seaweed farming. Despite this broad involvement, women face significant barriers including exclusion from decision making, limited access to credit, equipment, transport and market spaces and the negative impacts of technological and structural changes that shift landings from beaches to large harbours, reducing women's access to fish and markets and contributing to a slow removal of women from traditional roles.

Evidence from Kerala shows that advances in ring seine fishing increased production but displaced women from fish processing and trade, pushing many into low paid informal jobs. Dr Nikita emphasized that gender analysis must move beyond listing roles to understanding how women work, the conditions they face, how changes affect their income and agency and whether they have control over decisions in fisheries and aquaculture. Climate change further complicates women's work by disrupting fish drying, altering time use patterns and reducing safe spaces for livelihood activities, while their small-scale operations limit access to climate finance.

She described how tools such as the GAFS gender monitoring schema and the GeNA project in Thailand illustrate the way in which shifts in awareness, confidence and decision making can support more gender responsive aquaculture and climate solutions. A case study from Mahasarakham province demonstrated how a young woman moved from assisting her parents to becoming a confident and independent rice fish farmer by adopting new ideas and climate adaptation measures. The presentation concluded that truly inclusive and efficient aquatic value chains require systematic gender analysis, direct engagement with women on the changes they need and ensuring that technological, climate and value chain interventions create opportunities rather than deepen existing inequalities.

Highlights:

- Calls for gender analysis, intersectionality and participatory design to avoid repeating design failures

6.2. Fish Value Chain in the Context of SSF Guideline: Ensuring Inclusivity

Mr. Sebastian Mathew, Independent Adviser, Sustainable Small-scale Fisheries

The presentation by **Mr Sebastian Mathew** used a systems-based approach to a fisheries value chain linking the people and activities that move fish, fish products and algae from inputs and production to consumers through harvesting, processing, packaging and distribution across local, regional and global markets. Small scale fisheries generate significant economic and social value with marine harvesting alone contributing about seventy-seven billion USD in 2018 and providing livelihoods, nutrition and cultural benefits. Employment data from the global small-scale fisheries sector show extremely high participation in inland and marine harvesting and post-harvest activities, with women forming a very large share of the workforce particularly in processing and trading.

Mr Mathew highlighted that the SSF Guidelines call for full recognition of all forms of work along the small-scale fisheries value chain including full time, part time and subsistence activities, and stress a bottom-up governance approach centred on people, especially those who are vulnerable, excluded or discriminated including migrants, displaced groups, women and Indigenous Peoples. The guidelines promote a human rights-based approach that protects access of small-scale fishers to resources and fishing grounds through effective tenure systems including customary rights, ensures their participation in decision making, contributes to poverty eradication and supports social development and sustainable use of fisheries.

Key principles in the SSF Guidelines include addressing threats to access such as eviction or inequitable development, ensuring decent work and sea safety, improving social protection and providing access to savings, credit and insurance. The guidelines also stress the need to strengthen the post-harvest subsector, improve women's participation, reduce power imbalances, develop technologies suitable for women's work and invest in infrastructure, cooperatives and capacity development to improve quality, safety and incomes.

On trade, the presentation emphasized facilitating access to domestic and international markets without compromising local nutrition or sustainability and ensuring fair distribution of benefits along the value chain. It recommended integrating the currently fragmented fisheries value chain into a coherent national policy aligned with the SSF Guidelines through stakeholder consultation, policy coherence and institutional collaboration. The presentation concluded that a key measure of success for fisheries value chains in Asia will be the social development of small-scale fishers, subsistence operators and vulnerable groups whose wellbeing must be central to value chain strengthening.

Highlights:

- SSF Guidelines promote rights-based, people-centred governance and secure access to resources.

- Emphasizes fair markets, social protection, decent work and post-harvest strengthening.

6.3. Trade (including local and domestic and international), Compliance and Traceability

Mr. Sujit Krishna Das, INFOFISH

Mr. Sujit Krishna Das presented an overview of trade, compliance and traceability within the framework of WTO agreements, explaining how INFOFISH, headquartered in Malaysia, supports member states through market intelligence, trade facilitation, technical advisory services, capacity building and specialized publications in collaboration with national administrations, international bodies, research institutions and industry partners. He highlighted Asia's central role in global fisheries, noting that aquaculture surpassed capture fisheries for the first time in 2022 and that Asia maintains the largest share of global exports and imports, driven by major producers such as China, India and Indonesia.

The presentation outlined the growing importance of WTO disciplines on sanitary and phytosanitary measures, technical barriers to trade, trade facilitation and fisheries subsidies which shape the requirements for safe, fair and sustainable seafood trade. Meeting these requirements reduces export rejections, increases product credibility and aligns national systems with global sustainability goals. Mr. Das emphasized that traceability is a core enabler of compliance by providing transparent records of origin, production, feed and chemical use, harvesting, processing, transport and export documentation, and that digital tools such as QR coding, blockchain and electronic certification are essential to prevent illegal fishing and food fraud while strengthening consumer trust.

Examples from Vietnam, India and Indonesia illustrated how digital traceability, residue control plans and vessel monitoring systems improve export readiness and help address illegal and unreported fishing. He called for integrated value chain approaches that connect trade, compliance and traceability, supported by regional harmonization of standards, stronger laboratory and certification systems, accessible technology for small producers, public and private sector data sharing and the promotion of sustainable aquaculture and responsible fisheries. The presentation concluded that WTO frameworks act as enablers of transparent, competitive and sustainable aquatic food value chains and that strengthened traceability and compliance across Asia will contribute directly to improved nutrition, food security, resilience and inclusive economic growth.

Highlights:

- WTO agreements shape SPS, TBT, subsidies and trade facilitation requirements across the region.
- Digital traceability (QR, blockchain, e-certification) is essential for market access and IUU reduction.
- Recommends harmonised standards, stronger labs, data sharing and accessible tech for small producers.

6.4. Session 5: Breakout Thematic Groups Chair: C M Muralidharan

The participants were divided into four groups and assigned a topic each for detailed discussions. At the end of about one and a half hours, the facilitator or a member from each group made a presentation of the group's outputs.

6.5. Group 1. Sustainability and Resilience in Aquatic Food Systems

Facilitator: Dr. P.S. Ananthan (ICAR-CIFE); **Support:** Dr. Anisha Shafni, BOBP IGO

Participants:

- Mr. Sum Odom (Cambodia)
- Mr. Srinivasa Rao (India)
- Dr. Jian Yang (China)
- Ms. Dyah Mayastuti (Indonesia)
- Mr. Aleef Mohamad Saeed (Maldives)
- Ms. Chau Thi Tuyet Hanh (Vietnam)
- Mr. Vidura Sanjaya Gunaratne (Sri Lanka)
- Mr. Mohd Redhvan Bin Arif (Malaysia)
- Ms. Jariya Sornkliang (Thailand)
- Dr. M.C. Remany (India)
- Mr. Sebastian Mathew (India)
- Dr. Aaron Savio Lobo

Key Questions: How can Asian aquatic food value chains balance productivity with long-term resource sustainability? What measures build resilience against shocks (climate change, market disruptions) while ensuring food security? How are countries managing overfishing and environmental pressures, and what community or policy innovations improve resilience?

Regional Relevance: Asia produces over 60% of the world's aquatic foods, yet common challenges like overexploited fish stocks, habitat degradation, and climate impacts threaten this crucial food source. For example, **overfishing** is reported widely – inland and marine stocks show clear overexploitation in countries from **Bangladesh** (e.g. Hilsa fisheries) to **Cambodia** (declining catches in Tonle Sap). **Climate risks** compound these issues, with Bangladesh's fisheries highly vulnerable to floods and cyclones and Mekong Basin fisheries stressed by altered hydrology.

Framing: Discussions will draw on the FAO value-chain approach that views resilience as a **"meta-dimension"** of sustainability – i.e. the capacity of a value chain to continue delivering benefits in the face of shocks. Participants will frame sustainability in **"triple bottom line"** terms (environmental, social, economic) and consider resilience domains (e.g. diversity of livelihoods, community collaboration, adaptive capacity). National reports provide context on issues like **pollution and habitat loss** (e.g. Cambodian fisheries facing agricultural runoff and mangrove decline) and on local successes (community co-management in Cambodia shows signs of stock recovery). This framing ensures the group anchors the discussion in evidence and FAO guidance on sustainable value chain design.

Group Presentation

Dr. Aaron Lobo made the presentation on behalf of the group.

The group agreed that capture fisheries have started to decline in recent years for all countries whereas aquaculture has developed both structurally and in production, and each country is therefore required to develop strategies and best practices to adapt and minimise damage to the environment. The discussions highlighted issues in Maldives, Sri Lanka, India, Bangladesh, Malaysia, Indonesia, Thailand, and Cambodia

Multiple measures are being implemented to strengthen sustainability, including temporal closures with or without incentives, species-specific bans such as those applied for Hilsa and Jatka in Bangladesh, spiny lobster in Sri Lanka, and Indo-Pacific mackerel in Thailand, as well as spatial closures such as fisheries refugia exemplified by the blood clam refugia in Cambodia, with selected areas demarcated as refugia where only certain activities are allowed and trawling is completely banned and maintained by local communities.

Good practices

In the Maldives, the Government is increasing the number of ice plants and cold storage units on each island, aiming to construct 15-ton cold storage facilities to support fishing vessels in refilling ice, alongside the development of fisheries management plans and value-added products such as fishermen's shops.

In Bangladesh, there is a 55-day temporal closure across all capture fisheries, a 22-day ban for Hilsa mostly during the winter, and a ban on Jatka fishing from 1 November to 30 June with incentives provided for eight months; the incentives for these periods for all measures are not monetary, and conservation efforts for Hilsa have contributed to 70 percent of the global catch and 1% of the country's GDP, along with quota systems for industrial trawlers permitted only beyond 40 m depth with restrictions in zonation and catch.

In Thailand, MSY-based controls limit the number of fishing vessels, and the Indo-Pacific mackerel fishery in the Gulf of Thailand undergoes a three-month ban. In Sri Lanka, there are closed seasons for specific fisheries during breeding periods that vary slightly each year, a complete ban on trawling, and in Kalpitiya, a mini-trawl is allowed in open seas for the catch of *Metapenaeus*.

In Malaysia, vessel licenses are not renewed unless VMS achieves 80 percent monitoring, which has been considered an effective method, alongside wider Monitoring, Control and Surveillance systems such as VMS and transponders.

Aquaculture good practices include biosecurity, certification, polyculture, indigenous productivity-enhancing methods, feed improvement, and outreach at all levels; in India, MPEDA emphasised biosecurity measures such as sanitary practices from the tyres of vessels upon entry to the final processing stage, proper disposal of waste in hatchery and farming systems, handling practices, and the need for policy makers to establish standards that meet international requirements, with strict compliance across farms and the export chain throughout the value chain.

Fisheries quotas and the need to scan regional solutions while reinventing approaches for each country's context further reinforce sustainability and resilience in aquatic food systems.

Q&A

Question: Did the group discuss the implications of temporal or spatial fishing closures on the value chain? Specifically, what alternatives or support mechanisms exist for fishers and other value chain actors during these closure periods?

Answer: Yes, the group discussed this topic, and Bangladesh was highlighted as a strong example. During fishing closure periods of 58 days and 22 days for Hilsa conservation, the Government of Bangladesh provides fishers with essential support, including rice, vegetable oil and spices. These subsidies help fishers maintain their livelihoods during the ban. Local communities are also actively involved in the governance system, which has strengthened compliance and outcomes. This closure system is paired with designated Hilsa sanctuaries, which protect breeding and nursery grounds. Long term studies show significant positive impacts: increases in average fish size, production and fisher incomes. As a result, Bangladesh now contributes nearly 95 percent of global Hilsa catch, demonstrating the success of community-based conservation and species-specific management.

Question: Are similar closure or sanctuary-based conservation initiatives being implemented elsewhere in the region?

Answer: Yes. India also implements seasonal fishing closures for conservation, although the context differs. In Bangladesh, closures are complemented by sanctuary systems and strong incentive structures. Bangladesh has established more than 500 fish sanctuaries in inland waters and six sanctuaries for kingfish and other species. The country has also achieved 9.5 percent Marine Protected Area coverage in line with SDG targets.

Question: What lessons can be drawn from these examples for improving value chain sustainability?

Answer: The primary lesson is that conservation measures must be paired with tangible benefits for fishers and effective communication about those benefits. Documenting improvements in fish size, production and income helps fishers understand the value of conservation. Strong community involvement and incentives improve compliance and ensure that conservation gains translate into long term value chain improvements.

6.6. Group 2: Fish Loss and Waste (FLW)

Facilitator: Dr Omar Peñarubia (FAO); **Support**: Dr. Velumani

Participants

- Dr. K.C. Devasenapathi (India)
- Mr. Toni Rudi Hartanto (Indonesia)
- Ms. Charmaine Detera Buitre (Philippines)
- Mr. Yary Soeurn (Cambodia)

- Ms. Sutthinee Seesung (Thailand)
- Mr. Aleef Mohamad Saeed (Maldives)
- Dr. R. Narayanakumar (India)
- Mr. Md. Shamsuddin (Bangladesh)
- Dr. R Ananda Raj (India)
- Dr. P. Jayagopal (India)
- Dr. Naveen Namboothiri (India)

Key Questions: Where along the aquatic value chain do the highest fish losses occur and why? What are the quantitative estimates of post-harvest loss and waste in different countries, and how reliable are these figures? Which practical interventions (improved icing, processing, packaging, etc.) have proven effective in reducing loss and waste? How can stakeholders collaborate regionally to reduce FLW and thereby increase food availability?

Regional Relevance: Reducing fish loss and waste is a priority across Asian fisheries – not only to improve economic returns but also to bolster food security. Estimates from national studies indicate that **20–30% of aquatic production is lost or wasted** in many countries. For example, Bangladesh reports nearly one-third of its caught fish never reaches the consumer, and Cambodia sees up to ~25% losses due to spoilage and mishandling. These losses equate to millions in lost revenue and nutrients. The causes show common patterns: inadequate cold chains, poor handling and hygiene, and infrastructural gaps are cited across multiple national reports. In tropical climates, **rapid spoilage** from heat and bacterial growth is a constant threat when ice or refrigeration is lacking. At the same time, differences exist – e.g. **Thailand** notes that while data on FLW is limited, its robust fishmeal industry absorbs a lot of by-catch and offal, mitigating "outright waste" of fish parts. Such contrasts highlight that solutions must be context-specific even as the overall issue is region-wide.

Framing: The discussion will be framed by FAO's guidance on food loss and waste in value chains, emphasizing both quantitative losses (physical weight) and qualitative losses (nutritional and value deterioration). Participants will consider the full value chain spectrum – from catch/harvest, through transport and processing, to retail – to locate critical loss points. The Value Chain Prospectus underlines practical outcomes like *"reducing fish loss and waste"* as a key workshop deliverable, setting the expectation that this group will generate actionable ideas. To ground the discussion, brief references to national findings will be used (e.g. Bangladesh's loss hotspots at harvest, transport, and markets, or Cambodia's issues with insect damage in traditional drying). This framing ensures a solution-oriented dialogue that blends evidence with technical guidance on improving post-harvest practices.

Dr. Omar Penarubia briefed about the context of the exercise and requested countries to discuss on hotspots of fish loss and waste, specific nodes, best practices are followed in the country to reduce the fish loss and waste and key reaccommodation's countries to reduce fish loss and waste.

The following is a country-wise summary of the discussions.

India

From India, Dr. Naveen Namboothri, Dr. R. Narayanakumar, Dr. K.C. Devasenapathi and Dr. P. Jayagopal provided their inputs.

Hotspot and nodes in the value chain: The discussion highlighted several hotspots in the fisheries value chain where fish loss occurs, particularly at landing centres, onboard during multi day fishing trips, aggregation and transportation points, local markets and export chains. At landing centres large volumes of fish, especially the first day catch from long fishing trips, arrive in deteriorated condition due to insufficient ice and poor handling. Onboard losses arise because boats lack proper storage, making it impossible to maintain quality over trips lasting twenty to twenty-five days at sea. Breakdowns in cold chain systems, especially in remote island regions, further contribute to spoilage during transport. In local markets misconceptions about the quality of iced fish lead to unnecessary rejection, while mismatches with consumer preferences generate additional waste. Export chains face losses due to stringent food safety requirements, certification challenges and disease related rejections. A major emerging concern is the diversion of low value but nutritionally important species such as sardine, mackerel and anchovy into fishmeal plants, driven by economic incentives, which reduces the availability of fish for human consumption and affects women involved in dry fish processing. These issues are compounded by weak policy enforcement, lack of market linkages, limited consumer awareness and absence of cluster based cold storage infrastructure.

Best Practices: The discussion pointed to several best practices for reducing food loss across the value chain. A value chain approach was considered effective for identifying where and why losses occur from producer level to export markets. Awareness creation through government led campaigns, similar to the successful Mission Millet and egg promotion programmes, was seen as important to correct consumer misconceptions about iced fish and improve acceptance. Technological innovations such as smart ice, improved ice making units, better onboard handling practices and options for using rejected consignments in line with bioeconomy principles were highlighted. Digital tools like the Fish Information System developed under NFDP were cited as examples of how market forecasting, species availability tracking and seasonality information can support better planning and reduce loss. Policy instruments such as Minimum Legal-Size notifications in Tamil Nadu and Kerala provide a regulatory basis to prevent harvesting of undersized fish. Government supported initiatives for women's self-help groups in value addition were also noted, though their success largely depends on strong and reliable market linkages.

Recommendations: Key recommendations focused on strengthening cold chain infrastructure, particularly through cluster-based models that enable shared cold storage facilities for groups of landing centres. Improving access to high quality ice, modernising onboard storage systems and enhancing logistics and handling practices were identified as priorities. Stronger market linkages through institutional buyers, e commerce platforms and regular market analysis are needed to ensure that fish and value-added products reach appropriate markets. Policy enforcement must be strengthened, particularly with respect to Minimum Legal-Size rules and the regulation of the fishmeal industry to prevent excessive diversion of edible fish away from human consumption. National level awareness campaigns on fish quality, safe handling and

nutritional benefits were recommended, along with integrating low value fish into school meal programmes to address protein deficiency. Women engaged in value addition require not only technical training but also consistent market access. Exporters need support in meeting international certification and food safety standards in order to reduce rejections and associated food loss in export chains.

Malaysia

From Malaysia, Ms. Mazniza Binti Othman provided her inputs.

Hotspot and nodes in the value chain: In Malaysia, the key hotspots for potential fish loss occur mainly during the handling of bycatch and trash fish, onboard practices in smaller vessels, and at processing facilities where offcuts are generated after filleting. Although spoilage is considered low due to the widespread use of Refrigerated Sea Water systems and ice on vessels operating both above and below twelve hours, portions of fish not used for direct human consumption such as bycatch, low demand species and processing residuals represent areas where loss could occur. These are, however, largely diverted into fishmeal or surimi production, reducing the extent of waste. Weaknesses lie not in spoilage but in the absence of precise data, as the country assumes low loss without concrete evidence. For small-scale fisheries, dependence on middlemen introduces potential risks in handling quality, although the strong cold chain and preservation culture minimise deterioration. Overall, while Malaysia's system is effective, insufficient documentation and measurement remain the main cause of uncertainty regarding true levels of loss.

Best Practices: Malaysia's strong cold chain management serves as a major factor in reducing food loss, with vessels commonly using Refrigerated Sea Water, ice and even Individual Quick Freezing (IQF) for seasonal species. The Department of Fisheries enforces hygiene inspections on vessels to ensure proper handling, sanitation and compliance with export standards. Low demand fish are redirected to surimi and processed products to ensure full utilisation. The country also promotes value addition among women through training and provision of processing machinery. Small-scale fishers are organised into community groups that receive technical support, alternative livelihood opportunities during the monsoon season and training for processing activities, reducing their dependence solely on fishing and minimising waste.

Recommendations: Malaysia would benefit from establishing systematic and standardised data collection mechanisms along the value chain to validate the perception of low food loss and identify hidden loss points. Strengthening documentation at landing sites, middlemen aggregation points and processing plants is essential for accurate assessment. Continued investment in women's groups and small-scale fisher communities should be encouraged to expand value addition and ensure utilisation of low demand species. Maintaining and upgrading cold chain standards through ongoing monitoring and private sector engagement will help sustain high quality. Malaysia could also consider documenting its effective practices for regional sharing, as its cold chain and utilisation strategies may offer models for countries facing post-harvest loss challenges.

Philippines

From Philippines, Ms. Charmaine Detera Buitre provided her inputs.

Hotspot and nodes in the value chain: In the Philippines, the main hotspots for fish loss occur at landing sites, especially within municipal fishing communities that have limited access to ice, poor handling practices and insufficient post-harvest facilities. Many municipalities lack local ice plants, requiring one to two hours of travel just to purchase ice, resulting in spoilage before fish reach the landing centres. While commercial vessels have proper cold chain systems, including seawater chillers and slurry ice, municipal fishers experience the greatest losses due to inadequate preservation on board. Limited availability of government fish ports with cold chain facilities, very few functional ice plants and cold storage units, and insufficient refrigerated vans worsen the problem. Handling practices across the value chain remain inconsistent, with losses also occurring during transportation due to improper containers, poor hygiene and insufficient temperature control. Overall, losses are driven by lack of infrastructure, weak access to ice, delays in transport, uneven adoption of handling standards and limited local government capacity.

Best Practices: The Philippines has several initiatives to minimise losses, such as operating regional fish ports with cold chain facilities through the Philippine Fisheries Development Authority and accrediting ice plants and cold storage units to ensure compliance with sanitation and hygiene standards. The government collaborates with local government units to install hybrid solar ice-making machines or containerised ice plants at landing sites to shorten travel time for ice procurement. Municipal fishers receive training on tuna handling, on board preservation and proper landing-site practices. Women play a strong role in processing activities, supported through cooperatives and government training programmes. Value addition research is ongoing, including efforts by the National Research Development Institute to convert shrimp heads and other by-products into new products like shrimp powder. The government also deploys a limited number of refrigerated vans per region, promotes better transport containers such as high-density polyethylene fish boxes and conducts extensive IEC campaigns to promote proper handling across the value chain.

Recommendations: The Philippines could reduce fish loss more effectively by expanding access to ice and cold chain infrastructure, particularly in remote municipal fishing areas, through wider deployment of hybrid solar ice-making units and scalable containerised ice plants. More refrigerated vans are needed per region to support transport from landing sites to markets. Strengthening the partnership between national agencies and local government units is essential for sustainable operation, maintenance and monitoring of post-harvest facilities. Continued capacity building for fishers, women processors and transport operators should be combined with enforceable policies. The ongoing policy formulation on registration of vehicles for transporting fish, handling protocols and improved traceability should be prioritised to address losses during transport. Phasing out styrofoam boxes and replacing them with HDPE containers and chilling tanks will also improve product quality. Enhanced data collection and monitoring at municipal landing sites will help identify exact loss points and guide future interventions.

Indonesia

From Indonesia, Mr. Toni Rudi Hartanto provided his inputs.

Hotspot and nodes in the value chain: In Indonesia, the main hotspots for fish loss occur at landing sites. This is largely due to poor cold chain systems, long distances to markets, and limited access to ice plants, refrigerated vehicles, and cold storage at ports. Women are heavily involved in the post-harvest sector, carrying out about 70% of the activities.

Recommendations: Limited access to electricity in Indonesia's islands is a primary barrier to adequate ice production. Consequently, the country is increasingly adopting solar-powered ice-making technologies to bridge this gap.

Cambodia

From Cambodia, Mr. Yary Soeurn provided his inputs.

Hotspot and nodes in the value chain: In Cambodia, the main hotspots for fish loss in the marine sector occur at fish landing centres, primarily due to poor access to cold chain facilities and inadequate infrastructure such as ice plants and cold storage units. In inland fisheries, transportation challenges have been identified as a major factor contributing to fish loss.

Recommendations: Major interventions suggested include the development of modern fish landing centres equipped with electricity, ice plants and cold storage facilities. There is also a strong need for capacity-building programmes for fishers, processors and retailers across the entire value chain.

Vietnam

From Vietnam, Ms. Chau Thi Tuyet Hanh provided her inputs.

Hotspot and nodes in the value chain: In the Vietnam, the main hotspots for fish loss in the sector occur at fish landing centres, primarily due to poor access to cold chain facilities and inadequate infrastructure such as ice plants and cold storage units.

Recommendations: Key recommendations include the implementation of guidelines and Standard Operating Procedures (SOPs) to reduce losses in cold chain management. Similarly, standardized protocols are required for equipment and infrastructure facilities at landing centers and fishing harbors. Furthermore, access to finance remains a major concern for women in the sector, necessitating urgent attention and intervention at the national level.

Thailand

From Thailand, Ms. Charmaine Detera Buitre provided her inputs.

Hotspot and nodes in the value chain: In the Thailand, the main hotspots for fish loss in the sector occur at fish landing centres, transportation and market primarily due to poor access to cold chain facilities and inadequate infrastructure such as ice plants and cold storage units.

Recommendations: The major interventions required include capacity building on hygienic fish handling, ice production and the development of by-products such as calcium from fish bones

and fish hydrolysate. Traceability is an essential step to ensure transparency for consumers, and a dedicated study on traceability systems is also needed.

Group Presentation

Dr. Naveen Namboothiri (India) presented the overall summary of group discussions.

1. **Hotspots and Causes**

- Primary hotspots for fish loss occur at landing centres across Malaysia, Philippines, Indonesia, Thailand, Vietnam and Cambodia.
- Losses originate both on board vessels (poor handling, inadequate storage) and after landing (delayed icing, weak infrastructure).
- Insufficient cold chain facilities at landing sites, including lack of ice plants, cold storage and unreliable cold chain connectivity.
- Remote and island areas face long travel distances to buy ice, causing spoilage before landing.
- Poor transport infrastructure and weak temperature control affect export and domestic supply chains.
- Misconceptions about preservation, especially the belief that iced fish is lower quality, lead to poor handling practices.
- Significant diversion of small pelagic fish to the fishmeal industry reduces availability for human consumption.
- Value addition initiatives struggle in many countries because markets for products like fish amino acids are weak or non-existent.
- Malaysia has a strong well managed cold chain system with minimal spoilage and seamless supply chain links
- Philippines uses a combination of policy formulation and capacity building for handling storage and transport across the value chain
- Adoption of hybrid solar ice making machines to solve ice shortages in remote areas
- Thailand successfully converts fish by products into value added products through government and private sector partnerships
- India implements Minimum Legal-Size regulations in some states to reduce juvenile catch and associated waste
- Utilisation of fish by products such as fish amino acids and shrimp powder in several countries
- Strong emphasis on training fishers and processors on hygienic handling and on-board practices

2. **Recommendations**

- Launch large scale national awareness campaigns to change misconceptions about fish preservation and promote acceptance of iced fish
- Strengthen regulation to reduce diversion of small pelagic species into the fishmeal sector
- Develop stable markets for value added products to support community processing initiatives and prevent unsold inventory

- Create clear national and international policies for regulating fishmeal and fish oil production
- Develop SOPs and guidelines for fish handling cold chain management and loss reduction adaptable across countries
- Strengthen end to end cold chain connectivity ensuring continuity from vessel to consumer
- Provide capacity building for all actors in the value chain including fishers' processors transporters cold chain operators and government staff

Q&A

Question: Was any example discussed in the group regarding reversing the diversion of edible fish into fish meal production? Are there initiatives that support shifting fish from fish meal use back to human consumption?

Answer: An example from Malaysia was shared. Anchovy, which in India and other countries often goes to fish meal production, is processed on port using facilities that boil and immediately dry the fish. This prevents diversion and waste and creates a value-added, premium product. While this is not a reversal, it offers useful learnings on how infrastructure and processing practices can reduce diversion to fish meal.

Question: How applicable are minimum legal size (MLS) regulations for trawl fisheries, considering that trawl bycatch varies significantly by depth and region?

Answer: Most states have MLS regulations under their Marine Fisheries Regulation Acts, but implementation in trawlers remains challenging. In shallow waters, bycatch loss may be around 10 percent, while in deeper waters it can reach 90 percent. Deep-sea trawlers mainly target deep-sea shrimp, and non-conventional species are often discarded as bycatch. To address these concerns, the Government of India introduced a scheme for converting trawlers to longline vessels in ecologically sensitive areas. Several states—including Kerala, Karnataka and Tamil Nadu, have already gazetted MLS regulations, with others in progress.

Question: Can culinary promotion help reduce fish loss and enhance acceptance of underutilised species?

Answer: Yes. People consume fish dishes, not raw fish categories. Publicising diverse fish preparations, linking them to nutritional benefits and highlighting species-specific culinary traditions can increase acceptance. This can help reduce rejection of certain species, reduce loss and shift utilisation from low-value uses such as fish meal.

Question: What infrastructural gaps contribute to fish loss, and what improvements are needed?

Answer: Basic infrastructure: water, ice, fuel and electricity are essential for efficient landing sites and harbours. Without these, fish losses increase significantly. Fish loss assessment tools should be revised to explicitly account for the availability of such facilities. Moreover, AI-based tools can be developed to improve assessment beyond purely quantitative measures.

6.7. Group 3: Nutrition-Sensitive Actions in Aquatic Food Systems

Facilitator: Ms. Quennie VI Padulin Rizaldo (WorldFish); **Support**: Dr. Nirmala

Participants

- Ms. Thi Bang Tam Nguyen (Vietnam)
- Ms. Muthuthanthrige Shadishani Aloka Erandi Cooray (Sri Lanka)
- Ms. Nimfa D. Ekong (Philippines)
- Ms. Quennie VI Padulin Rizaldo (Cambodia)
- Mr. C. Muralidharan (India)
- Mr. Sujit Krishna Das (Malaysia)
- Dr. S. Ramachandran (India)
- Ms. Fathimath Shazra Mueen (Maldives)
- Dr. Pranaya Kumar Parida (India)

Key Questions: In what ways can aquatic food value chains be shaped to improve nutritional outcomes? How can fisheries and aquaculture interventions become more "nutrition-sensitive," ensuring that vulnerable populations (children, pregnant women, the poor) benefit from the nutrients in fish? What policies or programs exist (or are needed) to integrate fish into national nutrition strategies (e.g. feeding programs, micronutrient campaigns)? How do countries address both undernutrition and emerging diet-related issues through aquatic foods?

Regional Relevance: Many Asian countries face the dual nutrition burden of persistent micronutrient deficiencies and pockets of overnutrition. Fish is a strategic food to address the former – it's often the **primary animal protein source** (providing 50–60% of animal protein in diets, as in Bangladesh) and a rich source of micronutrients (calcium, iron, zinc, vitamins) especially when small fish are consumed whole. However, these nutritional benefits are sometimes underutilized or not equitably accessible. The prospectus highlights *"underutilization of nutrient-rich small fish species"* as a limiting factor for food security. For example, **Cambodia** reports that small indigenous fish (trey riel, etc.) contribute up to 86% of dietary calcium from aquatic foods, underscoring their importance in rural diets. **Bangladesh** and others note high rates of child stunting and anemia even in fishing communities, indicating a gap between fish availability and nutrition outcomes. Regionally, there is growing recognition that fisheries must be better linked with nutrition and health sectors – through actions like fish fortification, awareness campaigns, and inclusion of fish in safety net programs.

Framing: This discussion will be framed by the concept of **"nutrition-sensitive fisheries"** – ensuring that interventions in the aquatic food sector deliberately aim to improve diet quality and nutrition, not just increase production. Participants will use FAO guidance linking value chains to nutrition (for instance, identifying points where value chain upgrades can enhance food **utilization** and **access** for nutritious fish products). The **Value Chain Prospectus** calls for *"enhancing nutrition through aquatic foods"* as a core outcome, aligning with global efforts to leverage fisheries for better dietary diversity. The group will consider frameworks like the **six dimensions of FSN** (Food Security and Nutrition), which include availability, access, utilization, stability, agency, and sustainability – many national reports scored their value chains against these. For practical insight, framing will include examples such as national policies that integrate

fish into nutrition plans (e.g. **school feeding programs including fish** in Bangladesh and Cambodia) and community-level innovations (like producing fish powder for complementary feeding). This ensures the conversation stays focused on actionable, cross-sector solutions.

Discussion

All countries highlighted the use of fish in school feeding, with finfish being the most commonly incorporated aquatic food. Some countries operate community-level nutrition programmes that promote fish consumption to address nutrient gaps. India has analysed the nutrient content of around 100 fish species, and Bangladesh maintains food composition tables that include fish. Testing is valuable but expensive, limiting the number of species analysed. All countries maintain national FBDGs, including Maldives (although without a nutrition action plan). These guidelines help populations understand diets visually and account for culture and diversity, requiring extensive field testing before national rollout. Vietnam's fisheries department conducts school-based education on the importance of fish consumption for young people. Sri Lanka provides subsidies for small-scale fishers to reduce domestic fish prices and improve affordability.

Affordability remains a constraint, especially in India and other low-income communities. More than 300 species that could support nutrition are diverted for non-food use, reducing availability for human consumption. Countries such as Maldives show high fish consumption yet persistent micronutrient deficiencies due to limited intake of other food groups. This challenge also affects many other countries. In India and other contexts, large populations do not consume animal-source foods or prefer eggs in school meals due to cost and ease of distribution. Traditional cooking practices like deep frying reduce the nutritional quality of fish. There are few documented case studies exist on changing social norms or dietary behaviours related to aquatic foods. Although monitoring exists, misuse of chemicals remains a challenge. Vietnam has strong monitoring systems, not only for exports but also for domestic consumption. Maldives' pole-and-line tuna fishing is a positive example, but sustainable fishing methods require continued support across the region.

The key takeaways were to begin with strengthening nutrition-sensitive approaches across all stages of the value chain. Ensuring affordability and access to nutrient-rich aquatic foods for low-income households and promoting dietary diversity alongside fish consumption was essential. It was necessary to embed behaviour change strategies into national food systems. What was necessary was to reduce misuse of pesticides and antibiotics and maintain strong monitoring while protecting sustainable fishing practices and preventing diversion of edible species to non-food uses. It was essential to coordinate multi-sectoral policies to effectively address malnutrition while ensuring cultural relevance and community acceptance of nutrition guidelines.

Group Presentation

The summary of the group's discussions was presented by Ms Quennie Rizaldo.

1. Nutrition-Sensitive Activities

Common Actions:

- School meal programs (India, Cambodia, Vietnam, Philippines). Community feeding programs
- Nutritional profiling (India) and guidelines All- visual diagram for easy understanding for general population (Pinggang Pinoy in the Philippines)
    - RA 11148- National Feeding for pregnant women
    - RA 11037- National Feeding for school children
- Subsidies (Sri Lanka) and awareness campaigns in schools (Vietnam).

2. Gaps and Challenges
    - Access & Affordability:
        - Processed fish often unaffordable for low-income groups (India).
        - While fish (mostly Tuna) is consumed. There is a lack of diet diversity in the country as they rely on imported products (Maldives).
    - Cultural & Behavioural:
        - Eggs are consumed over fish in school meal programme due to lower cost and easy distribution (India); deep-frying fish (Maldives).
        - Regional differences in fish consumption (fresh vs. marine, fish ghee in India).
    - Environmental & Health:
        - Need for sustainable fishing practices and control of antibiotic use.
3. Policies
    - National Strategies:
        - Philippines, Vietnam, Cambodia: National nutrition strategies and food system roadmaps.
        - India: Mid-day meal schemes, women & children's policies on school feeding and other health related schemes.
    - Quality & Safety:
        - There is a monitoring system in place for exports and domestic markets to ensure safe fish are available for the consumers.
    - Gaps:
        - Maldives: Lack of national nutrition policy.
        - India: Need for policies on promoting small indigenous fish species.
4. General Recommendation:
    - Identify fish value chain (for targeted species) that contribute nutrition outcomes and economic viability.

6.8. Group 4: Aquatic Food Processing Technologies, Systems, and Practices

Facilitator: Dr Nikita Gopal, **Support**: Dr Ahana Lakshmi

Participants

- Dr. Momotazunnesa (Bangladesh)
- Dr. N. Ashwathy (India)
- Ms. Dalad Wattanasin (Thailand)
- Ms. Jenny Alvarez Hernandez (Philippines)
- Ms. Mazniza Binti Othman (Malaysia)
- Dr. I. Sivaraman (India)

- Dr. Ansar Ali (India)
- Dr. Arul Moorthy (India)
- Dr. C.S. Shine Kumar (India)

Key Questions: Are current processing and preservation practices in the aquatic food sector adequate to ensure quality, minimize losses, and add value? What **technologies and systems** (from traditional methods to modern industrial processing) are used across countries, and where are the gaps? How can value chain upgrades in processing improve efficiency, food safety, and incomes for producers (many of whom are small-scale and women)? What regional cooperation or knowledge-sharing could accelerate the adoption of improved processing practices?

Regional Relevance: Across Asia, a huge volume of fish is handled by small-scale processors using traditional methods like sun-drying, smoking, fermenting, and salting. These practices are culturally important and extend shelf-life without requiring costly infrastructure, but they often suffer from inefficiencies and quality issues. For example, in **Bangladesh**, traditional drying and fermentation are vital for preservation in domestic markets, while modern freezing is largely limited to the export-oriented shrimp sector. Similarly, **Cambodia** and others have many village-level processors drying or fermenting fish, but lack of modern equipment (ice, hygienic drying racks, storage facilities) leads to quality deterioration and spoilage. More advanced processing industries do exist in the region – e.g. canned tuna, frozen seafood factories in **Thailand** and **Indonesia** – yet even these countries report infrastructure deficits for their small-scale sector and the need for technology dissemination. Strengthening processing and preservation is regionally relevant not only to reduce post-harvest losses (linking to the FLW theme) but also to meet food safety standards and increase value-added exports. It's also a gender issue: a large proportion of processing work (fish drying, sorting, packing) is done by women, so improvements here have social implications.

Framing: The group will approach this theme through a **value chain upgrading lens**, as encouraged by FAO's sustainable value chain design guide. That means identifying interventions in processing and related systems that can yield economic, social, or environmental gains. The discussion is framed by known strategies such as *improving cold chain and storage*, *introducing low-cost processing technologies*, *training in better handling/hygiene*, and *organizational innovations* (like cooperatives or clusters for processors). According to FAO guidance, critical upgrades include building **capacity in improved processing methods, better transportation, and quality standards**, and increasing access to improved processing technology and storage. The Value Chain Prospectus also implicitly targets this area through its focus on reducing loss and meeting trade compliance (which often hinges on better processing and safety practices). The framing will be evidenced by examples: e.g., **Bangladesh's plans to invest in coastal ice plants and cold storage**, **Cambodia's promotion of solar dryers and insulated boxes under development projects**, and recommendations like creating women-led processing centers with improved infrastructure. This context sets an actionable tone for discussing how to modernize or enhance aquatic food processing.

The group included members from India, Malaysia, the Philippines, Thailand and Bangladesh.

Group Presentation

The summary of the discussions was presented by **Dr Nikita Gopal**. The group first discussed the various gaps beginning with the issues of domestic value chains and concluded that because domestic markets handle a large variety of species and operate through complex, informal pathways, countries lack structured documentation of these value chains, unlike export chains which are already mapped. Many domestic chains lack adequate facilities for hygienic processing, storage, cold chain, and transportation, contributing to quality loss and inefficiencies. Drying, fermenting, smoking and paste making are common, but most techniques have not been modernized to meet current safety or quality requirements. Although standards exist in all countries, enforcement is weak for traditional products and retail handling practices. Many vending and transport systems use poor-quality ice despite regulatory requirements, and monitoring of compliance is limited. Middlemen act as informal financiers and key actors, but their dominance often lengthens the chain and reduces transparency, highlighting the need for better integration rather than elimination.

Although numerous national initiatives exist, they often do not reach intended beneficiaries due to administrative or structural limitations. Adoption of modern processing tools is difficult for small producers because equipment and upgrades are expensive. Women are heavily involved in processing and marketing, yet their needs, safety and access to resources remain insufficiently addressed. Producers and handlers often lack understanding of how poor handling, temperature control and waste contribute to quality loss and reduced income. Waste generated at various nodes is not handled systematically, contributing to food loss and environmental issues.

The group also identified a variety of good practices. Each country has standards comparable to those applied for export products, indicating strong policy foundations even if implementation is weak. A successful collaboration that supports school feeding, which could be adapted by other countries to link nutritious aquatic foods with social protection. This ensures basic hygiene compliance and can be replicated in other countries to improve market safety. Their ability to enforce hygiene and handling rules is a good governance practice. At least five percent of all government programme budgets must target women, providing guaranteed space for gender inclusion (Philippines). Thirty percent participation in all training and capacity building programmes is mandated, although actual implementation needs strengthening. (e.g. Bangladesh). Small-scale processors and vendors organize into groups that improve bargaining, access to finance and market entry. This model can be replicated across the region (e.g. India). A strong example of women-led value addition at the domestic level of processing and marketing tuna flakes in the Philippines, demonstrated replicable business models for empowerment.

Recommendations include the need for shared standards which would facilitate regional cooperation, improve advocacy at international platforms, and encourage consistent quality across borders. Support is needed in safe handling, packaging, branding and improved processing techniques, especially for unpackaged products like dried, smoked and fermented fish. Group formation can enhance bargaining power, improve access to credit and technology, and strengthen value chain efficiency. Countries should share low-cost, adaptable processing

and preservation technologies instead of duplicating development efforts. It was necessary to enforce rules related to ice quality, hygienic vending, transportation, and storage more strictly to raise domestic value chain standards. Improving traditional processing through affordable innovations can be adopted at village and community levels was a good way forward. Behavioural training and communication programmes are needed to highlight the economic and environmental benefits of reducing loss. Policies, training and programme design must address the specific needs and constraints of women in processing, vending and value addition.

- Gaps
    - Documentation of domestic value chain
    - Insufficient infrastructure through the value chain
    - Improve tech used for processing (mostly sun dried, fermented etc, better tech available)
    - Poor implementation of standards (quality standards for traditional products)
    - Ice quality depends on water quality (water often contaminated)
    - Transportation and storage facilities for small sellers (develop appropriate technologies for small sellers)
    - Middlemen in value chain (need to shorten/ reduce/ eliminate)
    - Poor implementation of schemes and programmes
    - High cost of technology leading to poor adoption
    - Overarching gender concerns – women across all nodes of the value chain
    - Lack of awareness about fish loss, waste management - quality
- Good practices
    - Standards for domestic market available in all countries/ similar to export market
    - Public private partnerships (Philippines-Korea partnership in chilling)
    - Sanitary permit for selling in domestic market (Philippines)
    - 5% at least allocation of budget for women in all government agencies (Philippines)
    - 30% women in training /capacity building of all govt progs
    - JLG/SHG (collectivization) in fish vending and other activities (India)
    - All women operation – tuna flakes – local markets (Philippines)
- Recommendations
    - Harmonization of standards at regional level
    - Capacity building for traditional producers (local markets) – selling unpackaged products for e.g.
    - Collectivization especially for women and small-scale processors
    - Leverage technologies across region (e.g. seaweed – Phi, Tha)
    - Capacity building for advanced technologies
    - Regulatory rules should be revisited / strictly followed esp for women

7. Closing Session

7.1. Workshop Summary

Mr. Rajdeep Mukherjee

Mr. Rajdeep Mukherjee presented the outcome of the regional workshop, outlining the process followed in preparing national documents. The country profiles prepared would be updated with data and information from country presentations. A draft of the regional report would be presented through a webinar in late December or early January for validation, while the workshop report itself will be circulated within seven working days, with participants given three working days to review and comment before finalization.

He next highlighted key directions emerging from the workshop, beginning with the need for value retention across the entire aquatic food value chain from pre-production and enabling conditions to retail and waste valorisation, stressing that EAF and CCRF principles must be embedded in value chain management and that modern technological and digital tools should be introduced without marginalizing small actors, especially women. He emphasized the importance of reflecting aquatic biodiversity in national food baskets to support nutrition and avoid excessive pressure on single species.

On value capture, he underscored mounting evidence on the economic, social and environmental costs of fish loss and called for standardised estimation methods aligned with FAO's SDG reporting framework, supported by capacity building. He added that curbing fish loss requires both hardware such as improved infrastructure and cold chain facilities and software such as behavioural change programmes, better on board and on farm handling and training in new technologies, along with a careful review of how low-priced fish used for fishmeal may affect nutrition and the promotion of alternative feeds. Regarding value addition, he stressed the need to upgrade and diversify value chains with stronger traceability and transparency systems while remaining mindful of their potential effects on prices and access for low-income groups.

A key recommendation involved promoting aquatic food in national nutrition programmes, while addressing cultural and dietary barriers to aquatic food consumption and developing products suited to national preferences. learning from regional experiences such as seaweed innovations. For value discovery at the regional level, he called for documenting effective practices, codifying them for wider scaling and integrating aquatic food value chain work with national small-scale fisheries plans under development in countries like Bangladesh, India, Maldives and Sri Lanka to ensure inclusivity and last mile delivery. He also encouraged stronger collaboration among regional organisations and FAO for cross sector learning in areas such as agriculture, culinary practices, management and product development, with group recommendations to be incorporated into the final workshop report.

7.2. Closing Remarks

Ms. Angela Lentisco

Ms. Angela Lentisco thanked the Government of India and the Government of Puducherry for hosting the workshop, noting that although the three days passed quickly, participants felt a strong sense of engagement and connection. She extended her appreciation to BOBP IGO for the excellent organisation of the event and for facilitating the highly informative field visit, which offered valuable learning opportunities and insight into facilities ranging from quarantine centres to aquaculture operations. She also thanked all participating countries, including colleagues joining online from China, as well as representatives from INFOFISH, WorldFish and SEAFDEC and the many experts from India who contributed to the discussions.

Reflecting on the purpose of the workshop, she noted that the meeting provided important insights into existing gaps and opportunities which will help guide future work under FAOs new biennial planning cycle. She highlighted the potential for developing a pilot project in India or in another country to examine aquatic value chains more closely and assess what improvements may be made based on the issues raised during the workshop. She emphasised the value of documenting best practices and fair practices shared by countries and encouraged continued collection of such examples.

Reducing fish loss and waste across the value chain is a key and often overlooked component of improving fisheries productivity and sustainability. With fish loss estimated at around thirty percent on average and likely higher in some contexts, it was necessary to address this issue from a fisheries management perspective. She also appreciated the suggestion of incorporating the consumer perspective, including the idea of developing a regional recipe book featuring aquatic foods that showcases nutritional, health and cultural aspects.

7.3. Address by Chief Guest

Dr. Manikandan, IAS, Secretary, Government of Puducherry

Dr. Manikandan, IAS, said that though he had joined only on the final day of the workshop, even the brief discussions he had heard had made it clear how valuable and insightful the learning had been. India contributes about 3.5 million tonnes to global marine landings andthe country follows international guidelines on sustainable fishing issued by organisations such as FAO. The fisheries sector contributes a meaningful share to the national economy supporting millions of livelihoods and remains a priority for government investment in technology and sustainability.

He appreciated the unique strength of the regional collaboration model of this workshop noting that the eleven participating countries share similar economic and fisheries conditions which makes the exchange of best practices highly relevant. He commended BOBP IGO for revitalising regional cooperation and expressed deep appreciation to FAO for its increasing engagement with Puducherry. He shared that Puducherry has been selected for a Smart and Integrated Harbour project with FAO as the technical agency and expressed strong interest in deepening this partnership. He also described Puducherry's historical ties with France which create advantages

for international cooperation along with its efficient administrative structure that allows quick decision making.

Dr Manikandan reflected on several key themes discussed during the workshop including food safety food security and the need for blue justice particularly in relation to gender equity and access for small scale and traditional fishers. He highlighted the efforts of the Government of Puducherry to empower fisherwomen through mariculture and large-scale seaweed cultivation. He noted challenges such as hesitation among women's cooperatives to take up ownership of deep-sea fishing vessels even with substantial government subsidies and explained that fisheries remain more male dominated than agriculture making gender equity a critical concern. He also emphasised the importance of supporting small scale and artisanal fishers through subsidies improved market access and sustainable practices.

He praised the workshop for enabling participants to learn about a wide range of practices from other countries such as total allowable catch systems which India is now considering. He noted that the workshop itself is a valuable exercise in learning and value addition from the preparatory reports to the final consolidated outcomes. Governments he said appreciate such knowledge because it helps them adopt best practices that are practical and cost effective.

7.4. Vote of Thanks

Dr. P. Krishnan

Dr. Krishnan, the Director, BOBP-IGO, expressed sincere thanks to all country delegates, noting that eleven countries participated in the workshop, with ten attending in person and China joining online. He recognised the contributions of delegates and scientists from Bangladesh, Cambodia, China, India, Indonesia, Malaysia, Maldives, Philippines, Sri Lanka, Thailand and Vietnam, and extended appreciation to those who participated virtually. He explained that the discussions held during the workshop, including key points raised in the technical presentations, will be incorporated into the final workshop report. This report will also include the consolidated group recommendations. He noted that all inputs gathered from the country presentations have been received, and the next step will be to summarise these contributions, compile the final report and share it with participants.

Q&A

Question: You mentioned that high cost is one of the main barriers to technology adoption in processing and value addition. However, another issue is the lack of studies demonstrating whether new technologies actually improve quality or result in better prices in the market. Without evidence on benefits, trade-offs and market outcomes, adoption becomes unlikely. How do you view this challenge, and what should be considered when developing new technologies?

Answer: The concern is valid. Technology adoption requires not only affordability but also clear evidence that it improves product quality and creates market advantages. Research must assess both benefits and potential negative impacts.

However, evidence of improved price is not always guaranteed, as seen in dried fish: products dried using advanced dryers may fetch the same market price as sun-dried fish. Even so, technology may still be worth promoting for long-term sustainability, better hygiene, and quality consistency and reduced losses. Therefore, evidence on quality improvement is essential, but reliance on price improvement alone may hinder the adoption of technologies that ultimately enhance overall value chain resilience.

Question: Was there any discussion on complementarity in value addition, such as producing products not necessarily for food markets but for cosmetics or medical uses? Additionally, could you clarify what is meant by "collectivization"?

Answer: On complementarity: There was some discussion, particularly examples from the Philippines where seaweed is used for cosmetic or medicinal products. While these avenues can potentially increase income and improve household food security, the group did not fully explore their market value or income implications.

On collectivization: This refers to organisational models that allow small-scale processors to work together. These include Joint Liability Groups, Self-Help Groups and cooperatives. Collectivization enables shared access to finance, credit, resources and markets. Cooperatives are one form of collectivization and can support small-scale actors in overcoming structural challenges.

8. Consolidated Q&A

To *Ms Meeta Punjabi Mehta*: What challenges exist in applying a standard method for calculating FLW and reporting progress toward SDG indicators?

There is no standard method for compiling datasets and reporting, despite the FAO having published one. In practice, reporting still relies on our own perception and understanding, which complicates comparisons. All countries are committed to reporting SDG progress, but without national systems for collecting SDG indicator data, there is no mechanism to measure or report real progress. Since more than half of the SDG reporting period has passed, it is now essential that countries recognize and institute mechanisms, including clear definitions and methods.

To *Bangladesh*: Do you have a national food value chain policy?

Yes. The National Fisheries Policy 1998 recently updated and under approval. It has 20 components, including post-harvest activities, climate change, women engagement, and equity. Additionally, the Fish and Fisheries Product Rules 2020 and other related acts and rules cover matters related to post-harvest.

Bangladesh: What is the employment figure in the fisheries sector, including women involvement?

Out of 175 million people, around 20 million are directly and indirectly involved in the fisheries sector, with 12 million directly involved. Of these, approximately 1.2 million women are engaged, mostly in the fish processing industry.

How are benefits of profitable value chain segments redistributed for poverty alleviation and women empowerment?

In the past this was not treated well, but now government has rules and regulations, including those related to child work and common benefits for women, such as paid leave for several weeks. The government is now focusing on their real rights in the industry, and conditions are better compared to the past.

To *Cambodia*: About Pangas, can you share more information on its production and whether it is mainly for domestic consumption?

In Cambodia, the Pangasius production that is exported is "just simply dry fish"; it is not the round fish that is processed. Cambodia is currently trying to comply with EU and other country requirements so that aquaculture products can be exportable, and this is the first time such exports are being tried. The report used in the presentation focuses on overall aquaculture production and does not specify production by species, so detailed Pangasius productivity figures were not provided; it was indicated that this information could be shared later when available.

Is there any possibility to bring back the species in the Mekong River, and how is sustainability of native species being addressed?

In the Mekong River, there are several fish species that are very potential in market price, but due to technological limitations, some of these species cannot yet be produced or cultured in aquaculture. To help sustain fish populations, there is a "Fishing Day" when fingerlings of native species are released into the wild. Both fingerlings and broodstock are released into natural waters in order to refill the loss of wild fish.

What is the role of women in fisheries and aquaculture in Cambodia?

In the fishery sector in Cambodia, women's roles are not different from those in other countries. In aquaculture activities, women are engaged in tasks such as feeding the fish and looking after the ponds. Under an EU-funded "Cage-Free Aquaculture" project, gender aspects were considered, and it was observed that around 40% of those engaged in aquaculture activity are women, mainly involved in finance or managing roles.

How does the Cambodian fish quality certification scheme work, and how many processors have applied or received it since 2020?

The Cambodia Quality Seal (CQF) is a national scheme and standard for certifying processing enterprises that meet defined requirements. It started in 2020. So far, more than 20 processing enterprises have obtained or applied for this certification. The quality seal helps increase consumer trust for national consumption. For export, processing enterprises or companies generally obtain additional certifications such as HACCP (referred to as Hasab/HSAP), while for national consumption they use the Cambodia Quality Seal. The transcript does not provide details on incentives or price differences between certified and non-certified processors.

What was discussed about fried fish powder and fish skins in relation to dietary supplementation programs?

Fried fish powder and fish skins were discussed in the context of their potential use in dietary supplementation programs for malnourished children. It was noted that fish provide nutritional benefits and that such products could be included in dietary supplementation. In Cambodia, these products are seen as part of new technology adoption that the government wants to spread or demonstrate to farmers and investors, showing how fish by-products can be utilized. The information on these products originates from the Department of Post-harvest Technology, while the speaker was from the Department of Aquaculture Development, who indicated that this work is currently at a testing stage to explore how such by-products can be used.

To *Indonesia*: In regard to seaweed being a major product in Indonesia, what is its utilization and how does the value chain operate?

The production of seaweed in Indonesia is 9 million tons per year. The value chain is mostly for export as raw material. Processing of seaweed in Indonesia is "not yet established," and exports are mainly in raw form.

How are different components such as post-harvest, nutrition, and gender connected in the value chain, and how should other economic sectors be considered so they do not conflict with fisheries?

It was noted that when using the term value chain, everything is expected to be connected, but the current experience is that the value chain occurs in separate segments rather than as a connected chain. It was emphasized that bringing together production, post-harvest handling, nutrition, and gender policies is important, as well as considering fiscal policies such as taxation. In addition, activities like oil and gas or shipping need to be considered in relation to the food value chain to ensure that they do not threaten fisheries or aquaculture value chains, which contribute to food, livelihood, and poverty eradication.

What is the national traceability system in Indonesia and how is it applied?

Indonesia uses a traceability system called Stellina, which is for fish traceability and logistics. It has been increasingly demanded for implementation, and its use has encouraged an increase in MSC certification for Indonesian tuna products. Currently, three tuna processing units and one association have obtained MSC certification.

To *Ms Quennie Rizaldo*: Is converting small fish into powder a reductionist approach like fish meal reconstitution?

Powdering small fish is not like producing fish meal oil, because the powder is nutrient dense: the fish are dried and ground, and "it becomes dense." The fish are converted to powder primarily due to the barrier of choking on fish bones, since children cannot eat the small fish fresh. When powderized, the fish can be eaten safely and mixed into complementary foods.

Why is a human rights-based, culturally grounded, and consumer-focused approach important when introducing small fish powder into diets?

It is important to consider how consumers view nutrition from a dietary and health perspective and to respect the "agency of the consumer." Cultural practices such as cooking mola with yam in Bangladesh can enhance nutritional value several-fold. Recipes that improve nutrient bioavailability could be documented and shared so people can make informed choices. Consumer engagement, including dialogue with consumer groups, can support better dietary interventions. Because countries are culturally diverse, national dietary guidance must be contextualized at regional and cultural levels when introducing small fish powder.

What evidence, economic considerations, and practical reasons support using small fish powder instead of whole small fish?

There is no global or comprehensive evidence on the use of small fish powder in school meal programs; existing results are based on pilot tests. Future work aims to examine cost efficiency, especially since meal budgets can be as low as 25 cents per child. Some findings from Timor-Leste suggest cost efficiency but involved very few people, so more evidence is needed for adoption at national levels. While culturally some would prefer eating whole small fish, the powdered form addresses the practical problem of choking on bones and allows nutrient-dense fish to be added into complementary foods.

How can including fish, especially in powder form, in school or midday meal programmes improve nutrition, and what practical issues were noted regarding shrimp, allergy, and cold-chain requirements?

Including fishery products in school feeding programmes can increase domestic fish consumption and improve children's nutritional security. Small fish powder enables easy integration into meals, and there is interest in using shrimp powder as well. However, concerns were raised about possible allergic reactions and about the cold-chain requirement for fresh fish, which is a major challenge compared with the easier storage of powdered forms.

What was stated regarding the introduction of small fish into school feeding policy, and how is this connected to the national traceability system for fisheries and aquaculture?

Before small fish can be widely used in school feeding, sensory evaluation and acceptability tests are necessary, and menu diversity must be ensured rather than relying solely on small fish. A pilot example from Odisha included powdered anchovies supplied to Anganwadi centres and incorporated into curry dishes after regulatory approvals. It was noted that behavioural change among policymakers is important for broader adoption. Additionally, a national traceability framework for fisheries and aquaculture has been introduced through collaborative mechanisms, supporting transparency and accountability in the supply chain.

How was the idea of converting small fish into powder, compared with eating them whole, described?

The discussion clarified that powdered small fish are nutrient dense, resulting from drying and grinding, and are not equivalent to reconstituted fish meal. While some contexts culturally favour eating whole small fish, this preference varies by personal and cultural experience.

What considerations were raised regarding a human right–based approach, cultural dietary practices, and consumer involvement in fish-based nutrition?

It was emphasized that consumer perspectives must be recognized when addressing nutrition. Cultural practices influence nutritional outcomes. For example, cooking mola with yam in Bangladesh significantly enhances nutritional value. Documentation of culturally grounded recipes that improve nutrient bioavailability was suggested, enabling people to choose based on collective experience. Greater engagement with consumer groups, not just producers, was recommended to support informed dietary interventions.

Why is small fish converted into powder, and how is it intended to be used?

Small fish are ground into powder primarily to overcome the risk of children choking on bones, which prevents them from eating the fish whole. In powdered form, the fish can be safely included in complementary foods. This approach is being expanded to address preparation practices and household cooking capacities, but it originated as a solution to the choking barrier.

India: It is very interesting to see that India has been developing new seaweed-related products. Has the Department of Fisheries conducted any studies on food safety issues related to seaweed?

The products have been developed using seaweed sourced from the pristine waters of Lakshadweep, particularly *Gracilaria*. Contamination in other areas can be challenging, but in this case, primary analyses did not detect any negative findings. Ensuring that harvesting is done from clean and pristine waters is essential for maintaining the safety of seaweed-based products.

To *Maldives*: Were all the Fish Aggregating Devices (FADs) deployed by your Department of Fisheries, and are external agencies such as the German Society allowed to deploy similar FADs? Additionally, what was the basis for selecting the total number of FADs deployed?

The FADs were deployed under a programme funded by the World Bank Group. As for external agencies deploying FADs, this information is not available as the presenter is not from the Department of Fisheries. Regarding the total number, the deployment currently covers around 20 FADs across inhabited islands; the Maldives has 26 inhabited islands in total. The number is based on coverage across these islands rather than any specific international regulation.

What is the capacity of the RSW (Refrigerated Sea Water) tanks fitted on pole-and-line vessels?

The exact capacity will be confirmed after checking the technical specifications.

Do tuna and tuna-like species caught by Maldives originate from inside the EEZ, or are vessels fishing beyond national waters?

All tuna fishing by Maldivian vessels is carried out inside the EEZ using sustainable methods. To the presenter’s knowledge, Maldivian vessels do not fish beyond the EEZ, although international vessels may fish in international waters.

Are Maldivian fishing vessels fully self-sufficient in processing and preserving catch onboard?

Vessels are equipped with bait wells and cold storage boxes, enabling primary handling and preservation onboard. However, some vessels still need to visit islands with ice plants to replenish ice when required.

To *Vietnam*: In your presentation on the tuna value chain, you mentioned that tuna comes from trawl fishing. Are fishers in Vietnam catching tuna using trawl fishing?

Yes, tuna in Vietnam is caught using trawlers.

Regarding the circular economy work you mentioned, is this initiative implemented by the Department of Fisheries, or are you collaborating with other government agencies?

Vietnam has a national circular economy strategy with corresponding action plans for each sub-sector. Currently, there is a national strategy and an action plan for the agriculture sector, and within fisheries, some action plan components have also been developed. The circular economy strategy presented is under the Department of Fisheries.

To *Dr Nikita Gopal:* In your presentation, you discussed the introduction of ring seines post-tsunami in 2006. How would you compare the defeminization that occurred after the introduction of ring seines with the earlier introduction of trawlers in the 1960s? Didn't defeminization already begin with trawlers, or did women have a larger role in the trawling sector compared to ring seines?

The introduction of trawlers represented mechanization but did not replace or exclude existing small-scale fisheries. Traditional fishing systems continued to operate alongside trawlers, and although trawling had impacts, it did not displace women's involvement to the same extent. Trawlers initially targeted species like shrimp, which were not commonly targeted by traditional fishers, so the overlap and exclusion were limited. In contrast, ring seines led to structural exclusion. When ring seines operated with outboard motors, landings still occurred on beaches and were accessible to women. However, once they transitioned to inboard engines and larger crews, operations shifted to harbours. This shift created barriers for women, who found it difficult to travel to harbours to access fish for marketing, processing, and related activities. The shift also intensified conflicts between small-scale and large-scale ring seine operators. Thus, defeminization became significantly more pronounced with the growth of inboard-engine ring seine fisheries.

You spoke about the invisibilization of women in the fisheries sector and how this is problematic. In policy and programme design, especially in women-focused projects such as landing centres, dried fish units, or solar dryer initiatives, basic design problems persist despite large investments. Why do these design failures continue, and what are your thoughts on how this can be addressed?

There is indeed a persistent design problem. The primary reason is the lack of stakeholder engagement before policies or programmes are developed. Women's needs are neither adequately assessed nor clearly articulated during planning, which results in interventions that do not align with their realities. Programmes fail because they are designed based on assumptions, often with the belief that policymakers already know what women need. This approach is flawed. Effective programme design must start with asking women themselves and integrating their inputs meaningfully. Yes, there is a definite design problem, and addressing it requires participatory planning from the outset.

In your discussion on gender and fisheries, you highlighted the invisibilization of women. Within the broad category of "women," there are further marginalized groups such as widows, deserted women, elderly women, and women without male family members in the fishing business. They face different levels of access and vulnerability compared to women whose husbands or sons are engaged in the sector. Additionally, in development processes, marginalised groups often become further marginalised because programmes do not adequately consider their realities. Do you think this marginalisation is simply an extension of existing inequities, or is the system inherently biased toward men?

Women within the sector are not a homogenous group. Widows, elderly women, disabled women, gender minorities, and deserted women all face heightened vulnerabilities compared to others. Similarly, in fisheries, even men are differently positioned, small-scale men fishers experienced marginalisation when ring seines expanded. Gender analysis must therefore consider intersectionality. However, the speaker emphasised that policy spaces remain overwhelmingly male-dominated, which creates a structural bias. When decision-making tables are occupied almost entirely by men, women's perspectives and needs are insufficiently represented. This leads to policies, technologies, and programmes that unintentionally marginalise women further. She stressed that the problem persists because programmes are often designed without meaningful stakeholder engagement, particularly with the women who are meant to benefit. Policymakers frequently assume they know what women need, rather than asking them directly. This results in poor design across infrastructure, livelihood interventions, and technological projects. She concluded that gender is a broader concept that includes men, women, and gender minorities, but women require focused attention because they remain the most vulnerable in the fisheries value chain. The priority should be to recognize women's contributions, stop framing them as invisible, and ask them what support they actually need to participate and thrive in fisheries.

There has been considerable discussion on women in fisheries over the past two days. Considering the broader gender issues across the fisheries value chain, how important is gender analysis for understanding the needs of men and women, and how should this inform policy and strategy development?

Gender analysis is essential because it helps identify who the actors are at each stage of the fisheries value chain and what their specific needs are. Men are largely concentrated in production and face serious issues such as safety at sea, while women are often excluded from processing, marketing, and decision-making spaces. By conducting detailed gender analysis, policymakers can understand these differentiated roles and challenges, and then design policies and strategies that address the actual needs of both men and women across the value chain.

To *Sebastian Mathew:* You mentioned indicators used to evaluate the performance of small-scale fisheries. Apart from the "material style of life" indicator, which includes several proxies for economic development, are there other indicators such as those measuring the willingness of fishers to leave the sector that you are aware of?

The main reference is the social development chapter of the SSF Guidelines, which highlights areas such as education, health, housing and sanitation. When these social development needs

are met, it indicates that value chain interventions are supporting equity and that the majority of people employed in the sector are benefiting. Monitoring these social development signals is important. Strong, positive signals suggest interventions are on the right track, while highly varied signals or signs of conflict point to underlying issues such as power imbalances. Some groups are better positioned to influence policy, while poorer groups often lack a strong voice. Strengthening institutions for small scale fishers, including cooperatives and trade unions, and empowering them to engage in informed discussions is essential for ensuring that social development concerns are recognised and addressed for the benefit of both people and resources.

You mentioned equity in value chains. One major concern in value chain work is the lack of transparency about where benefits and profits accumulate and where the costs of maintaining the value chain are pushed. For example, fishers are often required to change their practices to meet management or market requirements, yet the market actors themselves are often absent from these discussions, even though they are major drivers of the system. How do you see meaningful participation from the market side being brought into this process?

This is an important issue. The lack of transparency in the post-harvest segments of the value chain needs to be addressed through systems that promote openness. Transparency cannot be achieved only by raising concerns from time to time; it needs to be institutionalized. Authorities and stakeholders must recognise principles that ensure accountability across all segments of the chain. When projects bring stakeholders together in a shared responsibility framework, it becomes harder for any actor to exploit the system and withdraw without consequences. Institutional arrangements that take a long term, intergenerational perspective can help ensure that all players have a vested interest in looking after the resource base and in ensuring equitable distribution of welfare benefits along the value chain. Workers need fair returns, and investors need confidence, so transparency mechanisms can help align these interests and produce more balanced outcomes.

You mentioned the SSF Guidelines and their relevance for development. The Government of India has recently introduced the new rule on Sustainable Harnessing of Fisheries in India (2025), published in the Gazette on 4 November 2025. The rule aims to strengthen small scale fisheries through community led models, including FPOs and cooperatives, and introduces access passes for fishing beyond 12 nautical miles. Could you elaborate on how this aligns with SSF development and any additional insights from recent data collection, such as on transponder distribution and women's participation?

The new rule indeed focuses on strengthening small scale fisheries using a community-based approach. Through FPOs and cooperatives, small scale fishers can obtain access passes that allow them to fish beyond 12 nautical miles and operate using support vessels. Agencies such as NFDB, MPEDA and EIC are part of the implementation process. Recent transponder deployment data showed that nearly 50,000 units were issued to fishing vessels. During verification, it was observed that in states such as Gujarat and Karnataka, more than 40 percent of boat owners are women, which is an important insight for designing inclusive fisheries policies.

There are definitional challenges when discussing small scale fisheries. Some fisheries, such as tuna, pole and line, handline or large gillnet operations, use vessels of 20 to 24 metres due to safety needs and long distances travelled. Others remain very small scale and nearshore. How should policy account for these sub-sectoral differences?

It is important to avoid treating small scale fisheries as a single residual category. Different subsectors within small scale fisheries have different vessel size requirements, operational characteristics and safety considerations. For example, tuna fisheries require larger vessels for sea safety and storage, while ring seine operations require substantial deck space and labour. A typology for different small-scale subsectors should be developed so that access, rights and management measures can be designed appropriately. Some groups may need specific spatial rights or zonation. Cooperatives should be trained and supported so they can meet expectations and participate meaningfully. This requires stronger institutional coordination across federal and state levels, possibly reviving fisheries boards and improving information exchange.

Large scale players are usually able to comply with international standards and certification requirements. However, small scale producers and processors often face significant challenges. What gaps have you identified for small scale actors, and what types of capacity development are needed to help them benefit from such compliance systems?

We follow the guidelines developed by FAO, as mandated by our governing laws. At present, we are not conducting specific studies on gaps in small scale compliance. However, we are working closely with FAO through various projects and collaborative initiatives, which support capacity development for small scale actors in different ways.

Public–private partnerships are often highlighted as important, and many governments invest substantial effort and public funds to support large commercial companies in meeting compliance requirements. But since these companies already earn significant profits, why should governments invest so much to help them comply? Shouldn't the commercial sector take responsibility for this on its own instead of relying on government subsidies funded by taxpayers?

There are two sides to this partnership. Commercial companies seek to expand their markets, while governments take initiatives to ensure compliance and innovation within their sectors. Technology and innovation often move much faster in the private sector than in the public sector. When governments collaborate with private industry, both sides benefit.

For example, a Japanese company is developing AI based compliance software for tuna. Such innovation may not come from government systems, which usually work with longer planning cycles. The private sector brings speed and technological advancement, while governments provide an enabling environment. Therefore, collaboration ensures timely innovation, supports compliance, and ultimately benefits the sector as a whole.

8.1. Key Findings

1. Persistent inefficiencies across value chains undermine nutrition and incomes.

Across countries, FLW levels range from 15 to over 40 percent, particularly at landing, transport and primary processing stages. Inadequate cold-chain infrastructure, poor handling practices, limited access to ice and energy, and fragmented logistics reduce product quality, shorten shelf life and erode nutritional value, especially of small pelagic and indigenous species that are critical for micronutrient intake.

2. Small fish play a vital but under-recognised nutritional role.

Evidence from Bangladesh, India, Cambodia and other countries confirms that small indigenous species are dense sources of calcium, iron, zinc, vitamins and essential fatty acids, particularly for women and children. However, weak policy integration, low consumer awareness and limited value addition constrain their contribution to national nutrition strategies.

3. Women are central to post-harvest activities but remain marginalised.

Women account for 40–90 percent of employment in processing, curing, peeling and marketing in many countries, yet their work is often informal, low-paid and invisible. Limited access to assets, credit, training, decision-making and markets restricts both gender equity and overall value chain performance.

4. Compliance, traceability and trade readiness are uneven.

Export-oriented value chains are increasingly aligned with HACCP, residue control and traceability requirements, while domestic markets remain largely informal with nil or weak controls. Weak digital systems, fragmented oversight and limited laboratory and inspection capacity constrain market access, particularly for small-scale actors.

5. Climate change and resource pressures threaten long-term sustainability.

Declining capture fisheries in several countries, increased disease risks in aquaculture, and climate-induced shocks highlight the urgency of ecosystem-based management, climate-resilient production systems and diversified value chains.

8.2. Key Takeaways

- Takeaway 1: Address the Triple Burden. Countries: India, Thailand, Bangladesh & Indonesia. Aquatic foods: dense nutrition & affordable
- Takeaway 2: Promote Small Indigenous Species: SIS provide Calcium, Iron, Zinc, Vit-A & B12; Important for child & maternal health
- Takeaway 3: Nutrition & Climate Resilience Link fisheries policy to nutritional outcomes, Climate impacts require resilient systems
- Takeaway 4: Reduce Fish Loss & Waste: Losses: 25–60% (Cambodia, Philippines, Indonesia); Need proper icing, cold chain & hygienic handling

- Takeaway 5: Sustainable Aquaculture: China: 82% aquaculture share (2024); China: 82% aquaculture share (2024)
- Takeaway 6: Traceability & Food Safety: Indonesia's STELINA meets GDST standards; Malaysia myGAP. Malaysia myGAP
- Takeaway 7: Empower Small-Scale Fishers. Increase fishers share in the consumer rupee. Use cooperatives & digital price info; Promote SSF-Guidelines and NPOA-SSF; CCRF
- Takeaway 8: Gender Equity: Women = 95% post-harvest roles in BGD - Need finance, training, recognition
- Takeaway 9: Regional Collaboration. Harmonize approaches (FAO Food Loss Guideline), Share research inputs on value chain; Combat IUU fishing

Way Forward

The workshop underscored that transforming aquatic food value chains in Asia requires coordinated, multi-sectoral and regionally aligned action. As a next step, validated national reports and the consolidated regional synthesis will inform a final technical report with actionable policy guidance. Countries are encouraged to operationalise recommendations through National Working Groups, leveraging FAO tools, BOBP-IGO platforms and regional cooperation mechanisms.

Priority will be given to piloting scalable interventions on FLW reduction, nutrition-sensitive small fish value chains, gender-responsive upgrading and digital traceability, with a focus on learning, replication and impact measurement. Strengthened regional collaboration will be essential to address shared challenges, harmonise standards and accelerate progress towards sustainable, inclusive and nutrition-secure aquatic food systems in Asia.

Path Forward
Nutrition-sensitive, climate-resilient, tech-enabled, gender-equitable value chains

9. Annexures

9.1. Workshop Agenda

TIME	ACTIVITIES	PRESENTER/ MODERATOR
Day 1: Tuesday, 2 December 2025		
8:30 – 9:00	Registration	BOBP-IGO
9:00 – 11:00	Inaugural Session	
9:00 – 10:30	• Welcome Address – **Dr Ahana Lakshmi**, BOBP IGO • Context and Background - **Dr. P. Krishnan**, Director, BOBP IGO • Opening Remarks - **Ms Angela Lentisco**, Fishery and Aquaculture Officer, FAO/RAP, Bangkok, Thailand • Keynote address: Aquatic Value Chain Analysis - An Overview **Ms. Meeta Punjabi Mehta**, *Senior Food Systems Officer,* FAO/RAP, Bangkok, Thailand • Address by Guest of Honour - **Dr. Omar Penarubia,** *Fishery Officer, FAO/RAP, Rome* • Address by the Chief Guest - **Shri. D.V. Swamy, IAS,** Chairperson, MPEDA	
10:30 - 11:00	Group Photo/Coffee/Tea Break	
11:00 -12:45	Session 1: Presentation of Technical Report and Discussion	Chair: FAO
11:00 – 11:45	Aquatic Food Value Chain: Findings from the Regional Study (South and Southeast Asia)	BOBP-IGO
11:45 - 12:15	Aquatic Food Value Chain: Overview of the Status and Concerns for SEAFDEC Countries	SEAFDEC
12:15 – 12:45	Q&A and facilitated discussion	All participants
12:45- 14:00	Lunch Break	
14:00 - 17:15	Session 2: Country Presentations - First Round	Chair: WorldFish
14:00 - 15:30	**Presentations from** Bangladesh, Cambodia, China (virtual), Indonesia, Malaysia (10 mins each + 5 min Q&A)	National delegates
15:30 – 16:00	Coffee/Tea Break	
15:45 - 17:45	Session 3: Nutrition and Small Fish in National Diets	Chair: BOBP-IGO
16:00 – 16:30	Nutrition and Small Fish in National Diets	WorldFish

TIME	ACTIVITIES	PRESENTER/ MODERATOR
16:30 - 17:00	India Fish Loss and Waste Reduction Strategies	CIFT
17:00 - 17:15	Day 1 Wrap-up	BOBP-IGO/FAO
19:00 - 21:00	Networking Dinner	BOBP-IGO
Day 2: Wednesday, 3 December 2025		
09:00 – 10:30	Session 2: Country Presentations - Second Round	
09:00 - 10:30	**Presentations from** Maldives, India, Philippines, Sri Lanka, Thailand, Viet Nam (10 min each + 5 min Q&A)	National Delegates
10:30 - 11:00	Coffee/Tea Break	
11:00 - 12:45	Session 4: Gender, Inclusiveness, and Trade	Chair: FAO
11:00 - 11:30	Women in Fisheries	Dr. Nikita Gopal CIFT
11:30 - 12:00	Aquatic Food Chain in the context of SSF guideline: Ensuring Inclusivity	TBD
12:00 - 12:45	Trade (including local and domestic and international), Compliance, and Traceability	INFOFISH
12:45 - 14:00	Lunch Break	
14:00 -	FIELD VISIT	BOBP-IGO
Day 3: Thursday, 4 December 2025		
9.00 – 10.30	Session 5: Breakout Thematic Groups	Chair: TBD
	1. Sustainability and Resilience in Aquatic Food Systems 2. Fish Loss and Waste 3. Nutrition Sensitive Actions in Aquatic Food Systems 4. Aquatic Food processing technologies, systems and practices	
10.30 -11.00	Coffee/Tea Break	
11.00 - 13.00	Session 5 continues	
11:00 – 13:00	Group presentations and discussion	
13:00 – 14:30	Lunch Break	
14:30 -15:45	Session 6: Towards Regional Action	
	Presentation of Workshop Outputs	FAO
	Plenary	

9.2. Participants List

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59	Rapporteur Team	**Dr. T. Velumani**, Project Scientist, **Dr. K. Nirmala**, Consultant, and **Dr. Anisha Shafni John**, Research Associate. Interns: **Nihal Kumar**, **Bhoomika Kosambi** and **D. D. Vinitha** Bay of Bengal Programme Inter-Governmental Organisation (BOBP-IGO), Chennai – 600 018, Tamil Nadu.	

9.3. Profiles of Speakers

Dr. P. Krishnan is the Director of the Bay of Bengal Programme Inter-Governmental Organisation (BOBP-IGO), Chennai. With more than two decades of experience in marine resource management, coastal conservation, and fisheries governance, he has worked across premier institutions including ICAR-NAARM, NCSCM, and ICAR-CIARI. He has authored numerous scientific papers, policy documents, and conservation plans, contributing significantly to sustainable fisheries development in India and the region. Dr. Krishnan is widely recognised for integrating science, policy, and community priorities to strengthen coastal and marine ecosystem management.

Mr. Rajdeep Mukherjee is a Policy Analyst and Project Coordinator at BOBP-IGO (Bay of Bengal Programme-IGO), Chennai. He joined the organisation in 2004 and has since worked on fisheries policy analysis, monitoring–control–surveillance (MCS) and strategies to combat IUU fishing in the Bay of Bengal region. He holds an M.Phil. in Economics (specialising in Natural Resource Economics) and has led and contributed to national studies and policy briefs including the benchmark socio-economic study on salt workers and work on fisheries insurance and resilience.

Ms. Angela Lentisco is a Fishery and Aquaculture Officer at the FAO Regional Office for Asia and the Pacific, with extensive international experience in fisheries, aquaculture, and gender mainstreaming. She has been a leading voice in integrating gender and social equity into small-scale fisheries and value-chain development. Angela has authored influential studies on women's access, roles, and contributions in fisheries across Asia. Her work supports countries in designing inclusive, evidence-based fisheries and aquaculture policies that enhance resilience, livelihoods, and community well-being.

Meeta Punjabi Mehta is a Senior Food Systems Officer at the Food and Agriculture Organization of the United Nations (FAO), Regional Office for Asia and the Pacific (RAP), based in Bangkok, Thailand. She works on food systems transformation in the Asia–Pacific region, focusing on evidence-based policy support, multi-stakeholder coordination, and regional-level strategy development. She brings expertise in agrifood systems governance, data-driven analysis, rural development and inclusive approaches that strengthen food security and livelihoods across the region.

Omar Riego Peñarubia is a Fishery Officer at the Food and Agriculture Organization of the United Nations (FAO), based in Rome, specializing in aquatic food value chain development. His work focuses on the assessment and optimization of post-harvest processes, fish loss and waste reduction, value addition, and waste valorisation within fisheries and aquaculture systems. Since joining FAO in 2017, he has led technical coordination for initiatives on food loss and waste in fish value chains and contributed to the development of training materials, project concepts, and analytical studies supporting member countries.

Dr D. Manikandan, IAS, Secretary to the Lieutenant Governor, Tourism & Fisheries Department, Puducherry. In his dual roles, he provides strategic leadership and oversight to key sectors that are central to the Union Territory's development. His responsibilities include guiding policy formulation, ensuring effective administrative coordination, and advancing initiatives that strengthen fisheries management, coastal livelihoods, sustainable tourism, and overall governance.

Shri D.V. Swamy is a 2001-batch IAS officer of the Odisha cadre, currently serving as the Chairman of the Marine Products Export Development Authority (MPEDA) and the Coastal Aquaculture Authority (CAA). He is actively involved in advancing India's aquaculture industry, focusing on sustainable practices, high-intensity shrimp farming, and enhancing export quality to achieve zero rejection standards

Jariya Sornkliang is a Fisheries Management and Socio-economics Scientist at the SEAFDEC Training Department in Thailand**.** She works extensively on small-scale fisheries, community-based management, and the socio-economic dimensions of coastal livelihoods. As SEAFDEC's gender focal person, she has contributed significantly to integrating gender considerations into regional fisheries policies and practices. Her research and outreach have helped highlight the vital roles of women in fisheries value chains across Southeast Asia.

Quennie Rizaldo is a nutrition and food systems specialist with a focus on advancing nutrition-sensitive aquatic food production in Myanmar, Lao PDR, Cambodia, Kenya and Zambia. She leads the development and implementation of strategies that promote indigenous small fish species and local plant varieties in homesteads and school meal programs to improve diets and nutrition. Her work also drives post-harvest innovations, including improved kilns, solar driers, and solar freezers, to enhance the safety, shelf life, and marketability of aquatic food products

V.R. Madhu is a fisheries technologist currently serving at ICAR–Central Institute of Fisheries Technology (CIFT) in the Fishing Technology Division. He collaborates actively with national scientific bodies such as ISRO–Space Applications Centre (SAC) and INCOIS**,** working on developing species-specific Potential Fishing Zone (PFZ) forecasts.

Dr. Nikita Gopal is Principal Scientist & Head, Extension, Information & Statistics Division, at the Indian Council of Agricultural Research-Central Institute of Fisheries Technology (ICAR-CIFT), Kochi, Kerala, India. She is a founding member, and Immediate Past Chair of the Gender in Aquaculture and Fisheries Section (GAFS) of the Asian Fisheries Society (AFS). She is also Secretary of the Society of Fisheries Technologists of India (SOFTI) and Chair of the Asian Fisheries Social Science Research Network (AFSSRN). Dr. Gopal has been actively engaged in gender research in fisheries and aquaculture, and has worked on women's contributions and challenges in seafood processing; small scale aquaculture and fisheries; marketing and other post-harvest activities.

Sebastian Mathew is an independent consultant in small-scale fisheries, formerly with the International Collective in Support of Fishworkers (ICSF). He has been a strong advocate for integrating social justice, human rights, and decent-work principles into fisheries policy and governance. Sebastian has contributed to major global and regional consultations under Food and Agriculture Organization of the United Nations (FAO) and other bodies, promoting recognition of small-scale fisheries in sustainable development frameworks.

Sujit Krishna Das is a Technical Officer at INFOFISH, Malaysia, where he has been providing technical advisory and policy support to Member States across the Asia–Pacific region since 2019**.** In this role, he contributes to the development and implementation of projects supported by FAO and other international development partners, while coordinating technical trainings, workshops, global conferences, and consultancy services.

C M Muralidharan is a senior consultant to FAO at present serving as lead technical specialist to GEF aquaculture project in India. He had been serving FAO for 19 years starting with supporting the FAO part of India UN Tsunami recovery activities, Fisheries Management for Sustainable Livelihoods (FIMSUL), the first phase of BOBLME and recently as regional coordinator for the Indonesia Sea Large Marine Ecosystem (ISLME) project among other assignments. Before FAO he had worked both for the Government of India and also for a leading NGO.

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