SOUTHEAST ASIA SEAWEED FACTSHEET

COUNTRY REPORT SEAWEED TECHNICAL WORKING GROUP 2025

OVERVIEW

Seaweed aquaculture is one of the fastest-growing sectors of global aquaculture, with Asia accounting for approximately 99% of the world's seaweed production, total 38.4 million tonnes in 2024, according to the FAO State of Fisheries and Aquaculture 2026. The region's dominance is driven by favorable tropical and temperate coastal environments, strong market demand, established farming systems, and extensive value chains. As the global leader in seaweed production, Asia plays a pivotal role in supporting food security, coastal livelihoods, the blue economy, and the growing demand for sustainable bio-based products and ecosystem services.

Southeast Asia is home to the world's largest tropical seaweed production region. Indonesia and the Philippines lead regional production, while Cambodia, Malaysia, Myanmar, Thailand, Viet Nam, and Lao PDR provide significant opportunities for expansion, diversification, and innovation. Addressing seedstock quality, disease management, market access, value addition, and sustainability standards will be critical to achieving a resilient and competitive ASEAN seaweed industry.

Figure 1 Woman seaweed farmer in Palawan

The region is a major supplier of carrageenan- and agar-producing seaweeds, particularly species of *Kappaphycus*, *Eucheuma*, and *Gracilaria*. Other seaweed species, such as *Caulerpa* and *Ulva*, have also shown commercial potential applications.

Table 1 Seaweed Aquaculture Profile in Southeast Asia[1]

Country	Main Species	Industry Status
Cambodia	*Kappaphycus*	Emerging
Indonesia	*Kappaphycus, Eucheuma, Gracilaria*	Regional leader
Lao PDR	*Spirogyra* (Kai Pen, freshwater algae)	Niche industry
Malaysia	*Kappaphycus, Eucheuma*	Expanding
Myanmar	*Gracilaria, Eucheuma*	Developing
Philippines	*Kappaphycus, Eucheuma*	Mature industry
Thailand	*Caulerpa, Ulva, Gracilaria*	Specialty products
Viet Nam	*Carrageenophytes*	Supply deficit

Seaweed farming in particular generates important economic benefits for coastal livelihood and ecosystem services that support sustainable coastal development, including carbon dioxide uptake and blue carbon sequestration, which significantly contribute to climate change mitigation.

Offshore seaweed farming is also increasingly recognized as a nature-based solution that delivers multiple ecosystem services while supporting sustainable coastal development. When appropriately located and managed, seaweed farms create structurally complex habitats that provide refuge, nursery, and feeding grounds for juvenile fish, crustaceans, mollusks, and other marine organisms, thereby enhancing local biodiversity and ecosystem productivity[2].

[1] Country report Seaweed Technical Working Group Meeting 2025
[2] ISEAS – Yusof Ishak Institute. (2023). *Keeping Southeast Asia afloat: Restorative aquaculture key to its food resilience*

ASEAN SEAWEED PRODUCTION SNAPSHOT (2025)[3]

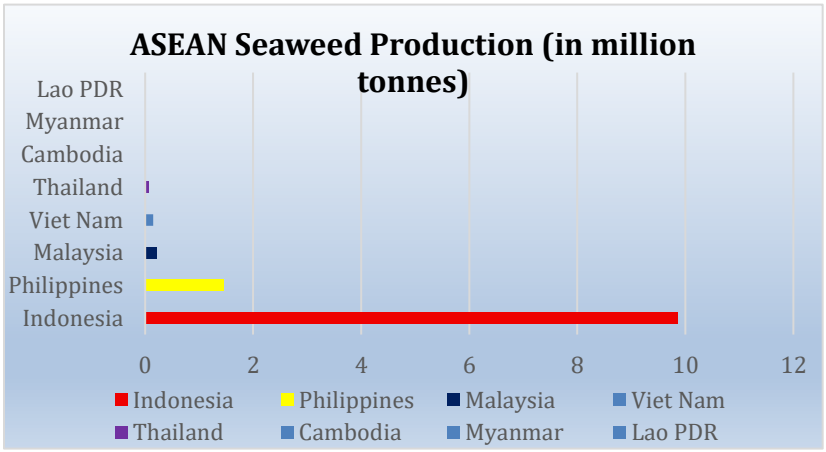

Figure 2 Seaweed production in ASEAN

ECONOMIC IMPORTANCE

Seaweed is one of the most economically important marine commodities in Southeast Asia, providing livelihoods for hundreds of thousands of coastal households and serving as a major source of income for small-scale farmers. The sector generates significant export earnings through the production of carrageenan, agar, and other value-added seaweed products, contributing to national economies while supporting rural employment and coastal community development.

Beyond its direct economic value, seaweed is a strategic raw material for a wide range of industries, including food, pharmaceuticals, cosmetics, animal feed, fertilizers, nutraceuticals, bio stimulants, and emerging biomaterials. As global demand for sustainable and bio-based products continues to grow, seaweed cultivation is increasingly recognized as an important driver of the blue economy, promoting diversified livelihoods, resilient coastal economies, and sustainable use of marine resources.

ENVIRONMENTAL BENEFITS

Beyond its economic importance, seaweed farming delivers multiple environmental benefits that support sustainable coastal development. Seaweed absorbs carbon dioxide and contributes to blue carbon sequestration, helping mitigate climate change. It also removes excess nutrients such as nitrogen and phosphorus from

[3] Country reports of the First Meeting of Seaweed Technical Working Group organized in 2025 by SEAFDEC

coastal waters, improving water quality and reducing eutrophication. In addition, seaweed farms can provide habitat and nursery grounds for fish and invertebrates, enhance marine biodiversity, reduce pressure on wild marine resources by supplying renewable biomass, and support ecosystem restoration when integrated with sustainable coastal management. These environmental services position seaweed farming as a nature-based solution that simultaneously advances climate action, marine conservation, and the blue economy.

COUNTRY STRENGTHS

Indonesia remains the world's largest seaweed producer, supported by strong export capacity and an expanding downstream processing industry. The Philippines has established a globally competitive carrageenan industry and a large base of small-scale seaweed farmers, guided by a national roadmap that focuses on improving productivity, value addition, and farmer livelihoods. Malaysia is strengthening its seaweed sector through research and development, biosecurity measures, and a national roadmap that promotes sustainable value chains and innovation in seaweed-based products.

Other ASEAN Member States also possess significant growth potential. Viet Nam aims to expand seaweed production to 500,000 tonnes by 2030 to meet increasing domestic demand and support its blue economy strategy. Thailand is developing niche markets for high-value edible seaweeds and quality-certified production systems, while Cambodia offers suitable coastal sites for seaweed cultivation, particularly through integrated multi-trophic aquaculture (IMTA). Myanmar has established processing facilities and export linkages that can support industry expansion, whereas Lao PDR has developed a unique market around *Kai Pen* (*Spirogyra*), a culturally significant freshwater algae closely linked to local cuisine and tourism. Together, these comparative strengths provide a strong foundation for regional cooperation, technology exchange, and sustainable development of the ASEAN seaweed industry.

COMMON CHALLENGES IN SEAWEED INDUSTRY

The ASEAN seaweed aquaculture faces several common challenges that constrain productivity, competitiveness, and long-term sustainability. Declining seedstock quality, outbreaks of *ice-ice disease* (IID) and *epiphytic* infestations, and increasing impacts of climate change and extreme weather events continue to reduce farm yields and increase production risks. At the same time, limited processing capacity,

inadequate value addition, fluctuating farm-gate prices, and unstable markets restrict income opportunities for seaweed farmers across the region. In addition,

Addressing these challenges requires coordinated investments in research and development, improved seedstock and disease management, climate-resilient farming technologies, and stronger downstream industries. Expanding access to finance, establishing harmonized quality standards and certification systems, and strengthening extension services and technical training will be essential to enhance farmer capacity, improve product quality, and build a more resilient, competitive, and sustainable ASEAN seaweed value chain.

In many traditional seaweed aquacultures, discarded plastic bottles are commonly used as low-cost flotation devices for seaweed farming systems. While this practice offers an affordable solution for small-scale farmers, damaged, abandoned, or lost plastic bottles frequently become a source of marine debris, contributing to plastic pollution in coastal and marine ecosystems. Over time, these plastics can fragment into microplastics, threaten marine biodiversity, degrade coastal habitats, and pose risks to fisheries and tourism. Promoting environmentally friendly and durable alternatives to plastic bottle floats, together with improved retrieval, recycling, and waste management practices, is therefore essential to reducing the environmental footprint of seaweed aquaculture while supporting the sustainable seaweed aquaculture.

PROJECT INTERVENTION – COMPONENT 1 SEAWEED VALUE CHAIN IN SOUTHEAST ASIA

To overcome these challenges, the project promotes an integrated and sustainable approach to seaweed aquaculture that combines improved seedstock and disease management, climate-resilient farming technologies, stronger value addition and market access, and enhanced research, extension services, and access to finance. Regional collaboration to harmonize quality standards and strengthen technical capacity will further improve industry competitiveness. These combined efforts will strengthen the resilience, productivity, and sustainability of the Southeast Asia seaweed value chain while supporting healthy marine ecosystems and coastal livelihoods.

Component 1 of the project focuses on developing two key regional knowledge products: the Regional Guide to Promoting a Sustainable Seaweed Industry and the Principles and Toolkits of Responsible and Safe Seaweed Aquaculture in Southeast

Asia. These documents will provide practical guidance and regionally harmonized principles to support sustainable seaweed farming, improve farming practices, strengthen environmental stewardship, promote occupational safety, and encourage responsible value chain development across ASEAN Member States.

Together, these regional references will help establish an enabling environment for the sustainable growth of the seaweed industry by promoting common standards, facilitating knowledge exchange, and strengthening regional cooperation. They are expected to enhance the capacity of ASEAN Member States to expand and modernize seaweed aquaculture, foster innovative and sustainable seaweed value chains that deliver ecosystem services such as carbon sequestration, improved water quality, and marine biodiversity conservation while generating socio-economic benefits through enhanced livelihoods, food security, value addition, and inclusive economic opportunities for coastal communities. Ultimately, these efforts will strengthen Southeast Asia's position as a global leader in sustainable and responsible seaweed production and value chains.

OPPORTUNITIES

The ASEAN seaweed sector presents significant opportunities to support sustainable economic growth, environmental resilience, and social development. Seaweed contributes to food and nutrition security while supplying essential raw materials for the carrageenan and agar industries, as well as emerging markets for biofertilizers, bio stimulants, and animal feed ingredients. Growing global demand for sustainable bio-based products further enhances the industry's potential for value addition and export growth.

Beyond its economic prospects, seaweed farming supports carbon sequestration and the blue economy, and can be integrated into Integrated Multi-Trophic Aquaculture (IMTA) systems to improve resource efficiency and environmental sustainability. The sector also offers inclusive livelihood opportunities, particularly for women, indigenous groups, and coastal communities, by creating employment, strengthening household incomes, and promoting community-based coastal development.

ENVIRONMENTAL SOCIAL AND GOVERNANCE: SEAWEED VALUE CHAIN

While seaweed aquaculture provides significant environmental and economic benefits, achieving a truly sustainable seaweed industry also requires strong attention to social sustainability, decent work, and responsible business practices throughout the value chain. As global buyers increasingly demand Environmental, Social and Governance (ESG) compliance and supply chain transparency, ASEAN seaweed producers have an opportunity to position themselves as suppliers of responsibly produced seaweed that respects human rights, protects workers, and benefits coastal communities.

Seaweed value chains involve numerous actors, including seedstock producers, small-scale farmers, collectors, middlemen, processors, exporters, transport providers, and international buyers. Although the industry is largely characterized by smallholder production, workers may face occupational safety and health risks associated with prolonged exposure to seawater, manual lifting, extreme weather, boat operations, sun-heat exposure, and post-harvest processing. In some areas, women and other family members often undertake substantial responsibilities in seed preparation, drying, grading, processing, and marketing, while youth and family members also contribute to production activities. Promoting equitable participation, gender equality, and safe working conditions therefore represents an essential component of sustainable seaweed development.

Responsible seaweed supply chains should be guided by internationally recognized principles on business and human rights, including respect for internationally recognized human rights, prevention of forced labour and child labour, non-discrimination, freedom of association, fair remuneration, occupational safety and health, and effective grievance mechanisms. Applying human rights due diligence throughout the seaweed value chain enables businesses to identify, prevent, mitigate, and address actual or potential adverse impacts while strengthening responsible sourcing and market competitiveness.

Strengthening social sustainability also requires greater investment in farmer organizations, cooperatives, extension services, skills development, financial inclusion, and access to markets. Empowering small-scale producers through training, digital technologies, quality certification, and value addition can increase household incomes while improving traceability and resilience across the supply chain. Integrating environmental sustainability with decent work and responsible business conduct will enable ASEAN's seaweed industry to contribute more effectively to the Blue Economy while supporting inclusive and resilient coastal development.

Key Social and Labour Considerations in Seaweed Aquaculture

- Occupational Safety and Health (OSH) in seaweed farming and processing.
- Prevention of child labour, forced labour, and labour exploitation.
- Gender equality and women's economic empowerment.
- Inclusion of Indigenous Peoples and coastal communities.
- Fair pricing and equitable benefit-sharing along the value chain.
- Responsible recruitment and decent employment.
- Social protection and livelihood resilience.
- Human rights due diligence and grievance mechanisms.
- Supply chain traceability and responsible sourcing.
- Capacity building for smallholder farmers and cooperatives.

FUTURE OUTLOOK OF SEAWEED INDUSTRY IN ASEAN

The future of the ASEAN seaweed industry is highly promising as demand for sustainable, bio-based, and climate-friendly products continues to grow. As the world's leading seaweed-producing region, ASEAN is well positioned to strengthen its role in the global supply chain by expanding value-added industries such as food, pharmaceuticals, nutraceuticals, cosmetics, bio stimulants, animal feed, and biomaterials. Through improved seedstock, climate-resilient farming technologies, regional cooperation, and greater investment in processing and innovation, the seaweed aquaculture can enhance food security, generate higher incomes for coastal communities, and contribute significantly to the region's blue economy.

Beyond its economic potential, seaweed farming is increasingly recognized as a nature-based solution that supports environmental sustainability and human well-being. Its ability to absorb carbon dioxide, improve water quality, and promote marine ecosystem health aligns with ASEAN's commitments to climate action and sustainable ocean governance. At the same time, seaweed provides nutritious food, functional ingredients, and health-promoting compounds that contribute to healthier diets and improved well-being. By integrating economic development with environmental stewardship and social inclusion, the seaweed industry is well positioned to become a strategic pillar of ASEAN's future food resilience, public health, and climate resilience.

The future competitiveness of ASEAN's seaweed industry will depend not only on increasing production but also on demonstrating environmental integrity, social responsibility, and good governance. International markets increasingly require traceable and responsibly sourced products that comply with ESG standards, human rights due diligence, and sustainable supply chain requirements. By integrating environmental stewardship with decent work, occupational safety and health, gender

equality, and responsible business conduct, ASEAN can strengthen its position as a global leader in sustainable seaweed production while creating greater economic opportunities for coastal communities.

ABOUT BLUE HORIZON SEAWEED AQUACULTURE

The **Blue Horizon: Ocean Relief through Seaweed Aquaculture** project is funded by the Global Environment Facility (GEF) and implemented by the World Wildlife Fund (WWF US) as the GEF Implementing Agency, with the Southeast Asian Fisheries Development Center (SEAFDEC) as Lead Regional Executing Agency, and the Bureau of Fisheries and Aquatic Resources (BFAR, Philippines) and the Department of Fisheries and Surveillance (DFiS) as national executing partners. The Project duration covers the period from 2024 to 2028[4], with the possibility for extension. The overarching goal of the project is to develop sustainable seaweed value chains that deliver ecosystem services and socioeconomic benefits.

The project comprises four components: 1): Regional approach and capacity for seaweed value chains in Southeast Asia; 2) Enabling Environment for Seaweed Aquaculture in the Philippines and Viet Nam; 3) Seaweed Value Chains (production, processing, and marketing); and 4) Knowledge Management, M&E, and IW Learn (regional). The Project execution is managed by the Project Management Unit (PMU), under the supervision of the SEAFDEC Secretary-General. The PMU Office is based at the SEAFDEC Secretariat in Bangkok, Thailand. The Project is governed by the Project Steering Committee to oversee implementation throughout the project's duration.

For more information about project please contact:

Muhamad Nour, Project Manager/Technical Advisor
Email: muhamad@seafdec.org
Website: www.bluehorizonseaweed.org
SEAFDEC - Southeast Asian Fisheries Development Center Secretariat
P.O. Box 1046, Kasertsart Post Office, Ladyao, Chatuchak
Bangkok, 10903, Thailand

[4] SEAFDEC's activities will be completed within this period, while implementation in the Philippines and Viet Nam will extend to 2029.