

FISH for the PEOPLE

A Special Publication for the Promotion of Sustainable Fisheries for Food Security in the ASEAN Region

Volume 20 Number 2: 2022

Bangkok, Thailand, ISSN: 1685-6546

Commendation of the significance of **small-scale fisheries and aquaculture** in the Southeast Asian region



Southeast Asian Fisheries Development Center

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The Southeast Asian Fisheries Development Center (SEAFDEC) commemorates the 2022 International Year of Artisanal Fisheries and Aquaculture (IYafa 2022) along with the relevant organizations and bodies around the world. The aim of IYafa 2022 is to raise awareness of the role of small-scale fisheries and aquaculture, strengthen science-policy interaction, empower stakeholders to take action, and build new and strengthen existing partnerships. For more than 50 years, SEAFDEC had always been promoting the sustainability of small-scale fisheries and aquaculture in the Southeast Asian region since most fisheries and aquaculture operations in the region are small-scale in nature. The recently produced SEAFDEC publication “Small-scale Fisheries of Southeast Asia: A Regional Digest” compiles the major key outcomes of SEAFDEC projects and activities on small-scale fisheries and aquaculture since the 1960s.

The EAFM concept has been promoted in Southeast Asia through the implementation of human resource development programs at the regional and national levels. Subsequently, core EAFM teams were established in the ASEAN Member States (AMSs) and they applied the knowledge and capacities they gained from the training courses to facilitate the EAFM implementation in their countries. Case studies were also conducted in selected pilot learning sites in the AMSs where the EAFM concept was promoted.

For the small-scale fisheries value chain, support was extended to small-scale fishers by providing them with fish processing equipment, enhancing their skills in processing and packaging, and improving their knowledge of marketing strategy to enhance their access to markets in the marketing of fish and fishery products from inland fisheries.

Small-scale fishers and fish farmers in the region are significant actors in the fish value chain; however, they are also among the vulnerable groups, especially to the impacts of COVID-19 on their livelihood. Due to the COVID-19 pandemic, their catch and harvest, number of marketing channels, price of catch or harvest, access to transportation, cost, and income reduced. Small-scale fishers and fish farmers could be supported by developing appropriate policies to sustain their livelihood and enhance their resilience to other pandemics and disasters in the future.

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Editor in Chief (Fish for the People)



SEAFDEC Secretariat
Kasetsart University Campus
P.O. Box 1046, Kasetsart Post Office
Bangkok 10903, THAILAND
E-mail: fish@seafdec.org

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Production of this publication is supported by the Japanese Trust Fund.

C O N T E N T S

In anguillid eel fisheries, women are engaged in the whole fish value chain but their participation has often been overlooked. Women possess marketing skills that made them access markets easily and sell their products quickly to support their families. Thus, the participation of women in anguillid eel fisheries should be recognized and they should be provided with support to enhance their capacity.

Urban aquaponics has been an effective alternative source of food and livelihood which improved the people’s well-being during the COVID-19 pandemic when government restrictions were enforced to prevent the spread of the disease. Investing in innovative food production such as urban aquaponics could generate potential socioeconomic benefits that outweighed the costs and risks.

Through its Departments, SEAFDEC would continue implementing programs and activities towards ensuring the sustainable contribution from small-scale fisheries and aquaculture in close collaboration with the ASEAN Member States (AMSs) and partner organizations in accordance with the Resolution and Plan of Action on Sustainable Fisheries for Food Security for the ASEAN Region Towards 2030. These efforts would remain to be in line with the Code of Conduct for Responsible Fisheries, Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries in the Context of Food Security and Poverty Eradication, and other relevant regional and international frameworks to fully recognize and empower small-scale fishers and fish farmers to continue their contributions to food security and poverty alleviation through the sustainable utilization of fisheries and aquaculture resources.

Regional Initiatives

- Driving the sustainability of small-scale fisheries and aquaculture in Southeast Asia 2
- Fostering Ecosystem Approach to Fisheries Management in the Southeast Asian Region through SEAFDEC 14

Country Reports

- Supporting Small-scale Fisheries Value Chain: capacity-building on fish processing and trade in Nam Oon Dam, Sakon Nakhon Province, Thailand 23
- Assessing the impacts of COVID-19 on small-scale fisheries and aquaculture in selected sites in Southeast Asia 27
- Understanding Gender Roles in Anguillid Eel Fisheries of Indonesia 33

Special Reports

- Advancing Innovative and Sustainable Food Production: urban aquaponics in the Philippines 39

- Calendar of Events** 44

FISH for the **PEOPLE** is a special publication produced by the Southeast Asian Fisheries Development Center (SEAFDEC) to promote sustainable fisheries for food security in the Southeast Asian region.

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Driving the sustainability of small-scale fisheries and aquaculture in Southeast Asia

Malinee Smithrithee and Sawitree Chamsai

Small-scale fishing is predominated in Southeast Asian fisheries, whether they are in coastal or inland waters. Small-scale fisheries and aquaculture have the potential to significantly contribute to poverty reduction and food security in Southeast Asia. However, they face habitat degradation and resource depletion, poverty, and restricted access to market and financial products and services, as well as public infrastructures such as health care, education, and communication. To address such concerns, several approaches have been initiated.

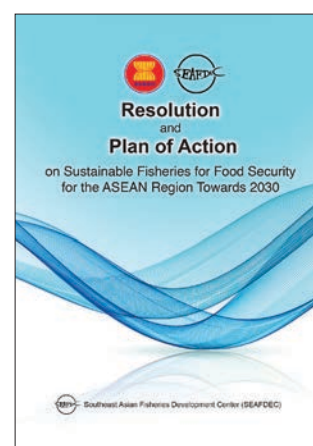
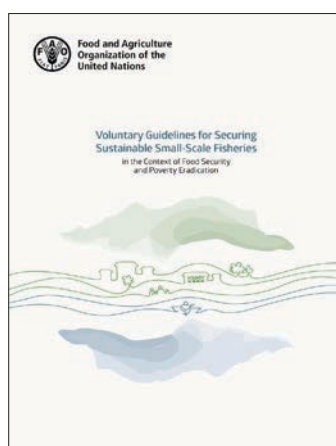
This article, therefore, covers the gradual development of regional and national programs and policies focusing on small-scale fisheries and aquaculture in the region to address the persistent social, economic, and ecological issues such as the developing of international and regional guidelines, enabling policies that can operationalize and safeguard community fishing rights and gender inclusion, integrating aquaculture into rural development, restoring fishery resources and habitats, promoting safety at sea for small-scale fishing vessels, developing technologies to reduce post-harvest losses in small-scale and traditional fish and fishery products, and facilitating access to markets of small-scale fisheries and aquaculture. The key achievements and activities of SEAFDEC, Member Countries, and relevant institutions toward the sustainable development of small-scale fisheries and aquaculture in the region are highlighted in this article to commemorate the International Year of Artisanal Fisheries and Aquaculture 2022 (IYAFA 2022).

Fisheries in the Southeast Asian region are characterized by small-scale or artisanal fisheries as most of the fishers are engaged in small-scale fishing operations in the pre-harvest, harvest, or post-harvest activities. The Guidelines for Responsible Fisheries in Southeast Asia: Responsible Fishing Operations define small-scale fisheries in the Southeast Asian region as fishing units that use small-scale boats, fishing gear, and equipment (SEAFDEC, 2000). Small-scale fisheries are a dynamic and evolving sector, employing labor-intensive harvesting, processing, and distribution technologies to exploit marine and inland water fishery resources. Small-scale fisheries directly contribute to food security by increasing the supply of fish while it may, however, indirectly support food security by generating revenues from production and related processing and marketing operations. Small-scale fisheries also contribute significantly to the local economy through income and employment. In the region, the estimated catch from small-scale fisheries is about 8 million tonnes (average

amount per year in 2013–2017), and engage about 5 million fishers in 2016 (FAO *et al.*, 2022).

However, small-scale fishing operations in “multiuse, multiuser” coastal and inland resources compete with other sectors leading to environmental and socio-economic issues. Small-scale fishers and aquaculture confront habitat degradation and resource depletion, poverty, and limited access to market and financial products and services as well as public infrastructure, *e.g.* health care, education, and communication (FAO, 2019). Small-scale fisheries are overlooked in the decision-making process as the limited catch information of this subsector has not been easily quantified (Teh and Pauly, 2018).

The FAO Voluntary Guidelines for Securing Sustainable Small-scale Fisheries in the Context of Food Security and Poverty Eradication (SSF Guidelines) were developed to raise the profile of and support small-scale fisheries (FAO, 2015a). SEAFDEC also underscored the importance of small-scale fisheries under the framework of the Resolution and Plan of Action on Sustainable Fisheries for Food Security for the ASEAN Region Towards 2030 (RES&POA-20203). Resolution No. 1 stresses “*necessary national fisheries policies, legal and institutional frameworks that encourage and support responsible fisheries and aquaculture operations, including small-scale operations as well as providing supplementary livelihood options*” (SEAFDEC, 2020a).



The FAO Voluntary Guidelines for Securing Sustainable Small-scale Fisheries in the Context of Food Security and Poverty Eradication (*left*) and the Resolution and Plan of Action on Sustainable Fisheries for Food Security for the ASEAN Region Towards 2030 (RES&POA-20203) (*right*)

Small-scale fisheries management

Coastal fisheries

The coastal small-scale fisheries are important because they feed millions of people, support a growing population, and preserve the cultural and social integrity of communities that rely on fishing. Along the Southeast Asian coastlines, small-scale fisheries remain one of the most significant livelihood activities and also provide fishers with direct employment (Pomeroy, 2012). While coastal areas provide vast opportunities to support small-scale fishery communities, these shared resources are in the midst of a devastating environmental collapse and human-induced hazards (Almutairi *et al.*, 2020). Although livelihoods and the marine region in Southeast Asia are always changing, there are increasingly large areas of change and transitions. Diverse forms of maritime zone development such as tourism, land reclamation, infrastructure, and industrial developments further transform the economic and physical landscape of coasts. The governance of resource access, usage, and control is therefore important to be examined critically in light of how rights, claims, and counterclaims. As diversification can increase a household safety net, but in other cases, small-scale fisheries' livelihoods may experience vulnerability (Fabinyi *et al.*, 2022; Kongkeaw *et al.*, 2019; Teh and Pauly, 2018).

Since 1999, SEAFDEC has continued the promotion of several concepts and management tools for small-scale fisheries such as rights-based management and co-management; integrated coastal resources management; locally-based coastal resource management; coastal fisheries management; and ecosystem approach to fisheries management (EAFM). In 2006, the Guidelines on “Co-management Using Group User Rights for Small-scale Fisheries” were created as part of the Special 5-year Program on Sustainable Fisheries for Food Security in ASEAN Region: Towards Decentralized Management of Sustainable Fisheries (SEAFDEC, 2006). Through a series of consultations with SEAFDEC Member Countries, it is built on concepts and techniques, rights-based fisheries, and co-management. The Guidelines provide in-depth information on the delegation of coastal fisheries management authorities



The Supplementary Guidelines that comprise section on Co-management Using Group User Rights for Small-scale Fisheries



to local fisheries organizations, which may allow small-scale fishers to participate in management activities. Furthermore, SEAFDEC trained more than 500 fisheries officers from Southeast Asian countries from 2014 to 2021. SEAFDEC also promoted the EAFM concept in learning sites in Myanmar, Cambodia, Lao PDR, and Thailand (SEAFDEC, 2022).

As EAFM devotes a broader scope to fisheries management, this approach is a significant tool to address common transboundary policy and regulatory concerns including illegal cross-border fishing by small-scale fishers, commercial-scale fishing operations, and transshipment (Pomeroy *et al.*, 2019). In the Sulu-Sulawesi Seas sub-region, the EAFM plan links with international agreements while also linking to local fisheries management units (Pomeroy *et al.*, 2019). Several countries in Southeast Asia had adopted this approach in their policy framework. The Philippines has integrated EAFM into the country's 12 fisheries management areas (FMAs) in accordance with the Fisheries Administrative Order 263 (SEAFDEC, 2022). The case study in the Visayan Sea, Philippines described a long process of consensus-building to prepare and adopt an EAFM plan for a large area managed by multiple agencies and political units. Decision-makers were informed about the status of the resources (overfished) and the effects of suggested actions through the participatory planning process, which incorporated science. The scientific data served as the starting point for discussions between stakeholders to create policies and regulations that protected fisheries resources while reducing the negative effects of harvest control rules. Based on this case, there is a need for new strategies to promote the livelihoods of impoverished fishers without adding to fishing pressure and also a need for capacity-building for key implementers, *i.e.* fisheries officers and local governments (SEAFDEC, 2019a).



In Indonesia, though there is no regulation that is specific to an EAFM, several current laws and policies have addressed an EAFM principle, *e.g.* MMAF Regulation No. 21 of 2015 Concerning Partnership on Management of Marine Protected Areas (Muawanah *et al.*, 2018). This law sets up an institutional framework between the provincial administration and the local community in managing area-based aquatic

conservation (Muawanah *et al.*, 2018). Indonesia as on the countries in the Coral Triangle region established Sulu-Sulawesi Seascape as the Fisheries Management Unit. Several fisheries and coastal resources were included in the EAFM plan such as small pelagic species, live reef food fish, and tunas (Coral Triangle Initiative, 2015). These resources are important for livelihoods in small-scale fisheries livelihoods (Buchary *et al.*, 2006).

In Thailand, the Marine Fisheries Management Plan of Thailand applied EAFM which aims to achieve sustainable development by balancing both ecological (fisheries resources and environment) and human (social and economic benefits) well-being (Department of Fisheries, Thailand, 2015). This demonstrates that EAFM can balance local, national, and regional fisheries management priorities and merge multilevel action plans into conceivable practices. In the promotion of EAFM in Nainang Village, Muang Krabi, Thailand, regular conversations resulted in an agreement to follow the fisheries law in order to stop illegal fishing, and eventually, the illegal bamboo stake traps were taken down. Additionally, the environmental conservation area for aquatic species, such as blood cockles, was designated using a precautionary approach. Additionally, the regular meetings and public discussions, as well as capacity building improved awareness and comprehension of the relevant laws and community rules, as well as the relationships between the various groups of people in the Village. In sum, the aquatic animal resources in this area expanded in quantity and variety, increasing fishers' revenue (Weerawat and Worranut, 2019).

Inland fisheries

Inland fisheries contribute an important protein source embedding food security into the livelihoods of millions of people in the rural areas of the Southeast Asian region. Inland fisheries cover both freshwater and brackishwater in some countries, *i.e.* Indonesia, Myanmar, and the Philippines while some countries mainly refer to freshwater, *i.e.* Lao PDR, Malaysia, Singapore, and Thailand (SEAFDEC, 2003a). Concerning inland water bodies in Southeast Asia, Indonesia has the largest floodplains around 33 million ha, followed by



Thailand (13 million ha), Myanmar (6 million ha), Malaysia (3 million ha), Cambodia (0.7 million ha), and Lao PDR (0.6 million ha) (Muthmainnah *et al.*, 2019). Inland fisheries of the region begin in the rainy season when fish migrates from major rivers to other water bodies for feeding or reproduction, and end when fish returns to major rivers in the middle of the dry season (Muthmainnah *et al.*, 2019). Large quantities of fish are gathered in the floodplain areas generating productive fishing grounds. In 2013–2017, the annual catch and number of people employed in inland small-scale fisheries had an average of about 2.5 million t and 1 million persons, respectively (FAO *et al.*, 2022). Meanwhile, there were over 4.75 million people engaged in inland small-scale fishing primarily for their personal subsistence in 2016 (FAO *et al.*, 2022).

However, inland fisheries in the region encounter a number of potential threats such as dam development for hydropower and irrigation, overexploitation, pollution, land use change, introduction of invasive species, diversion of water for agriculture, and others (Welcomme *et al.*, 2016). In order to effectively manage inland fisheries from the rising demand for multiple usages of inland water resources, co-management

and collaboration at local, national, regional, and international levels urgently has to be reformed (Welcomme *et al.*, 2016).

In order to safeguard the sustainability of inland fisheries in the region, several aspects should be considered, *e.g.* improving data collection, analysis, and dissemination, enhancing inland aquatic organisms and habitats, applying EAFM in inland fisheries management, applying fish passage to mitigate the impacts of cross-river obstacles (Baumgartner *et al.*, 2021; Muthmainnah *et al.*, 2019; Weerawat *et al.*, 2022). There were extensive researches and programs on inland fisheries in the Southeast Asian region, *e.g.* fish species composition in inland waters (Coates, 2002; Isa and Ibrahim, 2004; Muthmainnah and Rais, 2020; Sarnita, 1983; Sarnita, 1987; Talawat, 2004); application of geographical information system and mobile technology for inland capture fisheries (Muthmainnah *et al.*, 2020; Siriraksophon *et al.*, 2004); negative effects of building water barriers on inland fisheries (Le *et al.*, 2007); restocking and stock enhancement (Htun, 2014; Ingthamjitr and Sricharoendham, 2015; Kartamihardja, 2015); fish abundance and diversity monitoring (Ngor *et al.*, 2014); co-management and community-based management (Phounsavath, 2015; Try and Sitha, 2011). These research results could serve as a reference for tackling issues with inland fisheries growth and management, particularly through the formulation of policies, capacity building, networking, and technology verification and dissemination.

Community rural aquaculture

Aquaculture contributes to the region's economic growth while also meeting the needs of its population, particularly those living in rural areas for adequate protein (Salayo *et al.*, 2012). Taking into consideration the issues and constraints faced by the aquaculture industry, especially on the need to enhance the role of aquaculture in securing food and income which is critical in rural development in the region, the



RES&POA-2030 highlighted the significance of small-scale aquaculture operations as it provides supplementary livelihood options as well as the contribution of integrated aquaculture to rural development activities concerning multiple-use of land and water resources through interagency coordination (SEAFDEC, 2020a). Such provisions, therefore, encourage national programs and policies on aquaculture in the region to address the persistent social, economic, and ecological aspects of sustainable aquaculture that directly impact rural development.

Integrating aquaculture into rural development requires government engagement and support for regional initiatives to assess the role of aquaculture in poverty alleviation for better policymaking. In order to integrate aquaculture activities into community development plans realistically, such plans will require adherence to national employment practices, promotion of financial incentives and credit systems, aid and other support structures to motivate aquaculture entrepreneurs (SEAFDEC, 2020a).

Several aquaculture techniques have been developed to suit small-scale aquaculture development in rural areas (Baticados, 2015; SEAFDEC/AQD, 2009). The farm-system shifts from agricultural crops to shrimp farming or producing other high-value aquatic species were observed in several areas in the region (Fabinyi *et al.*, 2022; Pham *et al.*, 2021). Though technological advances have been introduced, the adoption of appropriate technologies is slow among rural aquaculture farmers (Baticados, 2015; Salayo and Agbayani, 2012). One such slow adoption would be the financial inaccessibility of these farmers (Salayo and Agbayani, 2012). Several programs, therefore, have been developed to increase the technology adoption both by government and non-government agencies. For example, Yusoff (2015) reported that the Malaysian government has started a program to provide areas for the culture of a number of highly valuable aquatic species. The initiative is designed to plan the Malaysian government's objectives for greater income, job opportunities, and food security (Yusoff, 2015). The Vietnam Bank for Agriculture and Rural Development and the Vietnam Bank for Social Policies, in collaboration with the Women's Unions of Vietnam, implemented an investment program for developing small-scale aquaculture communities with the overall goal of reducing poverty and improving local food security among underprivileged ethnic fishing communities (World Bank, 2019). Concerning limited infrastructure assets in the rural areas, public-private partnership and/or inter-agency coordination to secure sustainable small-scale rural aquaculture should be guided by the abovementioned provision.

Gender inclusion

It is important that gender issues should be identified in small-scale fisheries, especially marginalized and vulnerable people that require special attention. In order to ensure that both men's and women's perspectives are heard, decision-makers should make sure that such identification and application are driven by meaningful and substantial participative, consultative, multilevel, and objective-oriented processes. As necessary and pertinent, all stakeholders should support and take part in such processes (FAO, 2015a). As official statistics frequently neglect or underrepresent women's work in the fisheries industry including small-scale fisheries. This creates a recurring cycle in which a lack of sex-disaggregated data results in gender-blind policy-making, which then results in insufficient financing for the economic sectors where women are well-represented (FAO, 2015a).

As people of different genders, ages, and social and economic statuses have different needs, priorities as well as unequal access to opportunities, gender inclusion in the fisheries sector, therefore, require interagency collaboration to promote gender inclusion and fisheries management. The RES&POA-2030 thereby encouraged the ASEAN Member States (AMSs) to promote capacity building of relevant organizations and stakeholders to support fisheries-related organizations to implement necessary actions towards increased resilience, improved livelihoods, and poverty alleviation, in support of achieving sustainable development with gender integration in the process. SEAFDEC stepped into this path and developed the SEAFDEC Gender Strategy in 2019. It intends to support the integration of gender perspectives in fisheries and aquaculture of the SEAFDEC Member Countries. Its five main strategies are: 1) Mainstreaming Gender at all levels of the organization, 2) Integrating gender in SEAFDEC programs and projects, 3) Incorporating gender perspectives in all events organized by SEAFDEC, 4) Boosting the visibility of SEAFDEC as a gender-responsive and gender-sensitive organization, and 5) Strengthening further the cooperation and collaboration with Member Countries and other organizations on gender aspects (SEAFDEC, 2019b).

Moreover, the SSF Guidelines also provide the guiding principles for gender equity and equality, especially for small-scale fisheries. The SSF Guidelines demand that men and women participate equally in fishing organizations and decision-making processes. Equal rights must be supported by laws and policies, and both men and women must have access to the right tools and resources to do their jobs.

With the abovementioned strategies and principles, gender inclusion has received strong institutional support within SEAFDEC and related program executions. SEAFDEC continues its support to SEAFDEC Member Countries in the integration of gender into fisheries management.

With the adoption of the SEAFDEC Gender Strategy (SEAFDEC, 2019b), SEAFDEC mainstreams gender issues at all levels of the organization and integrates gender in its programs, projects, and activities. In practice, there are many instruments that could be used such as gender in coastal and fisheries resource management including Practical Guide for Gender Analysis in Small-scale Fisheries and Aquaculture in Southeast Asia (SEAFDEC, 2020b). This guide was developed by SEAFDEC in 2020 to support mainstreaming and integrating gender perspectives into SEAFDEC programs and projects concerning small-scale fisheries and aquaculture in Southeast Asia. This guide could be used by countries without any framework in place to support the development and implementation of gender inclusion programs.



Gender inclusion related programs have been implemented and supported by several SEAFDEC programs. SEAFDEC-Sweden Project during 2013–2019 had successfully formed SEAFDEC Gender Team and designated SEAFDEC Gender Focal Persons for the SEAFDEC Secretariat, and its four sister Departments; conducted in-house capacity building on gender aspects for staff of SEAFDEC Secretariat and Training Department; developed “Gender Synthesis Review” and “Gender Analysis Toolkit” to improve gender integration and mainstreaming in coastal resource management programs in South and Southeast Asia in collaboration with IUCN/SEI; field level work and local capacity building on gender-based activities and reporting by the sub-contracted partners; disseminated and promoted the “Policy Brief: Applying Human Rights-based and Gender Equality Approaches to Small-scale Fisheries in Southeast Asia”; developed the Practical Guide for Gender Analysis in Small-Scale Fisheries and Aquaculture in Southeast Asia (SEAFDEC, 2019c).

Some activities of the project supported by the Japanese Trust Fund “Small-scale Fisheries Management for Better Livelihood and Fisheries Resources” during 2020–2024 has conducted a study on the status of fisheries socio-economic assistance, and gender assessment in the SEAFDEC Member

Countries as well as capacity development on gender integration in small-scale fisheries. The project on “Gender Dimension in the Value Chain of Small-scale Fisheries and Aquaculture in Southeast Asia” supported by FAO in 2021–2022 has collected and analyzed data on gender dimension in the value chain of small-scale fisheries and aquaculture (Sornkliang and Chumchuen, 2022).

In addition, another SEAFDEC-Japanese Trust Fund project on “Assistance for Capacity Development in the Region to Address International Fisheries-related Issues” conducted the Regional Capacity Building Network activity emphasizing the transfer of technical knowledge and building up network among the AMSs on a particular subject. In 2022, to commemorate the International Year of Artisanal Fisheries and Aquaculture (IYAFA) 2022 the theme is small-scale fisheries and aquaculture. In this connection the “Regional Training Course on Gender Mainstreaming in Small-scale Fisheries and Aquaculture for Sustainable Development in Southeast Asia” was conducted in September 2022 in Thailand. A total of 19 participants from the AMSs attended the training. They gained knowledge of gender concepts, roles, mainstreaming tools, and analysis framework. Data collection for gender analysis was conducted in Rayong Province. Moreover, the trainees learned to identify actions to integrate gender into small-scale fisheries and aquaculture development projects and developed the action plans to be implemented in their works with the engagement of their top management and colleagues towards gender mainstreaming in their respective countries (Kaewnuratchadasorn, 2022).

Fishery resource enhancement

The rich biodiversity and productivity of fishery resources in the region made populations heavily dependent on marine and inland fisheries (Lebata-Ramos and Doyola-Solis, 2005). However, the depletion of fish stocks and habitat degradation have been observed due to many factors for instance overfishing, illegal fishing, use of destructive fishing practices, environmental degradation, and aquaculture intensification in mangrove areas (Theparoonrat *et al.*, 2016). Ecologically sound measures such as the installation of artificial reefs, mangrove reforestation, coral plantation, fish passage construction, good aquaculture practices, and others have been undertaken in Southeast Asian countries to restore aquatic resources for small-scale coastal and inland fisheries (Ali and Arnupapboon, 2022; Hai, *et al.*, 2020; Kongkeaw, *et al.*, 2019; Kusmana, 2017). To improve fish stocks in critical habitats and fishing grounds, several efforts on restoration and rehabilitation of fishery resources and habitats have been initiated (Ahmad *et al.*, 2004; Theparoonrat *et al.*, 2016). SEAFDEC/Training Department has grouped several resource enhancement projects into five protocols that could be applied in the Southeast Asian region (**Box**) (SEAFDEC/TD, 2021);

Box. Resource enhancement protocols applied in the Southeast Asian region

Catch Management Area is a marine area where particular management measures are used to increase habitat productivity and support resource recruitment. It normally has to do with fishing prohibition policies, *e.g.* marine protected areas (fishing gear are permanently prohibited), closed season areas (some fishing gear, mostly commercial scale, are prohibited during a specific time), fisheries refugia (catching target species at their critical stages of life cycles is prohibited). For example, the project “Establishment and Operation of a Regional System of Fisheries Refugia in the South China Sea and Gulf of Thailand” has established community-based refugia management plans in six participating countries. The plans contain specific regulations, including those on how to operate types of fishing vessels or fishing gear inside of refugia, how to change management measures over time, and how to enforce them. This benefits small-scale fisheries as they operate in the coastal habitats where the adoption of sustainable fishing practices is needed (UNEP, 2015)

Habitat Rehabilitation is the effort to rehabilitate the degraded coastal ecosystem such as coral reefs, seagrass beds, and mangrove areas in order to protect spawning and nursery grounds of fishery resources. A study on the relationship between habitat improvement initiatives and fish abundance found that restoration of mangrove areas in Indonesia initially resulted in increased catch production of small-scale fisheries (Debrot *et al.*, 2022)

Artificial Reef Employment is manmade underwater structures that are employed to serve as shelter and habitat, source of food, breeding area, and shoreline protection. For instance, the management of artificial reefs in Sabah, Malaysia was established by the local fishers community to safeguard the installed artificial reef sites as local fishers would be advantageous from the construction plans, especially the economic returns (Theparoonrat *et al.*, 2016)

Restocking or stock enhancement usually refers to the release of cultured stock usually in an early life stage into depleted wild populations. For example, SEAFDEC/AOD restocked donkey's ear abalone as this mollusk is one of the most traded species by small-scale fishers in Molocaboc Island, Philippines during 2007-2014. They found that stock enhancement needs significant financial investments and massive transaction expenses over a long period of time, which are typically out of the price range of local governments in Southeast Asia. As a result, community-based collaborations could support restocking and enhancing goals (Salayo *et al.*, 2016)

New Policies for Fisheries, this has been employed to mitigate the effects of high fishing pressure. Despite the fact that it is tough to make new measures since they affect a wide variety of communities. These are for example EAFM concepts and principles for participatory community engagement, implementation of a vessel monitoring system, control of catch size of mackerel fish by Malaysian purse seiner, and fishing quota by limiting the number of fishing days in Thailand. These measures are to ensure the abundance of fishery resources and reduce conflict between stakeholders and improve the relationship between government agencies and fishing communities (SEAFDEC, 2019a)

Safety at sea and adaptation to climate change

The majority of fishery vessels in Southeast Asia are small-scale. The respective countries have their own legislations pertaining to the safety requirements for fishery vessels. The RES&POA-2030 thereby encouraged the AMSs to strengthen measures for the safety of fishery vessels. SEAFDEC conducted a series of workshops in 2003, 2010, and 2011 to review the measures for the safety at sea of small-scale fishery vessels in the region. The recommendations include registration of small-scale fishery vessels, interagency coordination on monitoring and control of small-scale fishing vessels' safety, identification of basic requirements for safety at sea, development of appropriate communication systems on weather forecast information, development of a mechanism to record the accidents of fishing boats at sea (SEAFDEC, 2003a; SEAFDEC, 2010). SEAFDEC has developed and publicized the translated versions of the Safety Recommendations for Decked Fishing Vessels of Less Than 12 Meters in Length and Undecked Fishing Vessels FAO/ILO/IMO in Vietnamese (2013), Burmese (2013), Bahasa-Indonesia (2014), Filipino (2014), Thai (2014), Khmer (2015), and Bahasa-Malaysia (2017).

Moreover, the FAO Safety at Sea for Small-scale Fishers was developed in 2019 in support of the implementation of the SSF Guidelines. The manual is intended for small-scale fishers who use vessels of less than 12 meters in length and provides guidance on safety matters related to the work on a small-scale fishing vessel (*e.g.* fire safety, deck safety, lifesaving equipment, lighting, and ventilation), personal safety, and navigation safety. The manual also includes examples of accidents that may occur onboard fishery vessels and useful instructions to prevent such accidents. In addition, the manual provides the checklist and procedures that small-scale fishers should follow prior to a fishing trip to increase the likelihood to survive accidents at sea. Other information on safety for small-scale fishing vessels includes Safety Recommendations for Decked Fishing Vessels of Less than 12 meters in Length and Undecked Fishing Vessels (FAO/ILO/IMO, 2012), Best Practices to Improve Safety at Sea in the Fisheries Sector





(FAO, 2015b), and Safety Guide for Small Fishing Boats (Gulbrandsen, 2009).

Besides following those guidelines, risks associated with small-scale fishing operations at sea should be insured through several insurance schemes. To mediate economic risks resulting from adverse impacts of climate change, insurance complement such impacts and help reduce various risks. It was estimated that 4 million fishers in Asia in 2020 were covered by specific insurance programs (Van Anrooy *et al.*, 2022). Accident, life, and health insurance services for small-scale fishers that meet their specific needs and conditions should be promoted to increase the resilience of small-scale fishing operations in the Southeast Asian region.

Post-harvest

Small-scale fishers and fish workers in Southeast Asia use traditional methods of fish processing (such as fermenting, smoking, sun-drying, salt-drying, among others) to preserve large catches during peak season or increase the shelf life of fish and fishery products. The RES&POA-2030 suggested the development and application of technologies and best practices that optimize the utilization of catches/farmed products, reduce post-harvest losses and wastes, add value to byproducts, and valorize fish waste/trimmings in small-scale fisheries (SEAFDEC, 2020a). To ensure that processing could be readily managed under local conditions with little input, SEAFDEC has improved such traditional processes in terms of safety and quality as well as in the technical elements despite inadequate resources and infrastructure by improving the ability of countries to comply with quality assurance systems, including HACCP and GMP, among others, in processing establishments as necessary; making accredited laboratories available to detect contaminants in food products, such as chemicals, antibiotics, and biotoxins that are subject to trade regulations; and by implementing cold chain management throughout the fishery supply chain from catching/harvesting until reaching consumers (SEAFDEC, 2022). SEAFDEC/MFRD assisted the Department of Fisheries of Myanmar to create HACCP plans for some traditional fermented fish



products such as fish sauce, whole fish, and fish paste. Product descriptions, manufacturing flow diagrams, hazard analyses, and HACCP plans were created for these products (Eong and Chung, 2011).

By combining conventional, cutting-edge, and cost-effective techniques with proper technologies, sustainable practices can help reduce losses and wastes and enhance inclusive value chains for small-scale fisheries and aquaculture. The effect of food loss and waste, as well as the management techniques used to minimize these losses and wastes, differ among AMSs. In Indonesia, less-skilled workers may waste more fish parts when separating the flesh from the bones and skin of fish. Similarly, during distribution, an excess supply of fish and a lack of customers resulted in the waste of unsold products while delays in distribution/transportation also resulted in food loss and waste. Currently, several initiatives have been implemented, *e.g.* utilization of shrimp shell waste into chitin/chitosan, byproduct utilization training, post-harvest facilities assistance, development of cold storage and integrated cold storage, regulation on increasing value added of fishery products (Eu and Siok, 2022). The Malaysian Standard of Hygiene on Board (MSHOB) enhanced the willingness of local fishers in practicing proper fish handling procedures and reducing food loss onboard fishery vessels. In the Philippines, the Community Fish Landing Centers (CFLCs) located in strategic coastal communities provided postharvest facilities

and give more fishers access to ice-making facilities to reduce food loss due to inappropriate storage temperatures (Eu and Siok, 2022).

Fish Trade

The production from small-scale fisheries in Southeast Asia is mostly intended for household consumption and local markets. The RES&POA-2030 encouraged the AMSs to assist small-scale producers from both capture fisheries and aquaculture in securing and maintaining access to markets at the national, regional, and international levels, and in the process, develop marketing systems that are not capital intensive but are accessible for local producers. The countries are also encouraged to develop and implement institutional and policy frameworks that support fair, stable, and transparent prices to ensure adequate compensation for small-scale artisanal fisheries and aquaculture work and investments through the gradual application and use of pertinent international instruments and guidelines (FAO, 2022).

SEAFDEC/TD organized the training course “Market Access for Small-scale Fisheries Product in the Next Normal” in December 2021 at the pilot site in Nam Oon Dam, Sakon Nakhon Province, Thailand. The aim was to help the group build its marketing plan. The analytical findings from research on the production, distribution, and market situation of fish



processing goods as well as the profitability of fishery products were presented to the participants.

In Malaysia, although there are no specific national guidelines or procedures for trading of fish and fishery products from small-scale fisheries, in the National Agrofood Policy (NAP 2.0), small-scale industries including fish and fishery products were given priority on market access facilitation along the fish value chain. In Thailand, the Office of Agricultural Economics regularly produces and disseminates data on market prices of agricultural crops including fisheries products. In addition, the Department of Fisheries, Thailand, farmers, and processors of white leg shrimp have collaborated in a program on purchasing of marine shrimp at prices that do not lower than the production cost and farm-gate prices across Thailand (personal communication).

Way Forward

At the national level, many countries in the region have decentralized its fisheries administration, however, small-scale fisheries have not been properly managed. Therefore it is necessary to investigate new data collection techniques and analysis methods suitable for small-scale and multispecies characteristics of both coastal and inland capture fisheries, choose appropriate reference points for a range of fishing gears and multispecies catch, implement appropriate catch documentation and traceability systems of fish and fishery products from small-scale fisheries, and increase the involvement of local institutions and communities in the decision-making process.

Since aquaculture would continue to grow, engaging small-scale fish farmers with the access to good quality seed would enhance food security and alleviate poverty in the rural areas. The implementation of good aquaculture practice should also be continued especially with small-scale farmers as disease prevention is a key for sustainability. Cooperation among the AMSs and relevant research institutes in the areas of fish nutrition and feed development should be promoted. Initiatives should be developed to teach small-scale fish farmers on how to properly handle alternative feed ingredients to increase their usage in aquaculture feed formulations. Market-based governance through third-party certification programs may assist small-scale fishers and farmers to access markets. An inclusive and certification scheme that adapt to local context should be promoted while group certification among small-scale producers could be an option.

At the regional level, relevant upcoming SEAFDEC projects in relation to small-scale fisheries and aquaculture include “Promoting the Blue Economy and Strengthening Fisheries Governance of the Gulf of Thailand through the Ecosystem Approach to Fisheries” to be implemented in 2023–2027 will promote the implementation of the SSF Guidelines in particular the knowledge of transboundary sustainable fisheries practices and aquatic ecological corridors. In addition, the “Blue Horizon: Ocean Relief through Seaweed Aquaculture Project” to be implemented in 2023–2026 consider that seaweed could strengthen the economic resilience of coastal communities as it can be integrated in multitrophic system as well as stabilize the health of surrounding ecology. Moreover, the USAID/SEAFDEC/Sustainable Fish Asia-SEA Project in 2023–2027 will implement activities to sustain inland fisheries production through small-scale fisheries livelihood improvement including inland fisheries data collection system establishment. Furthermore, SEAFDEC/AQD continues promoting alternative feeds for sustainable production of freshwater aquaculture species focusing on small-scale fish farmers.

At the global level, in continuing the celebration of the International Year of Artisanal Fisheries and Aquaculture 2022, the 35th Session of the Committee on Fisheries emphasized the significance of sustainable small-scale fisheries and aquaculture in attaining sustainable and resilient food systems and future food demands, and welcomed global initiatives to enhance collaborations and promote food from inland and marine waters. The importance of small-scale and artisanal fishers, fish farmers, and fish workers was further emphasized in this respect, as well as the necessity of addressing gender equity and inequities in the fisheries and aquaculture industry.

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About the Authors

Ms. Malinee Smithrithee is the Secretary-General of SEAFDEC based at the SEAFDEC Secretariat in Bangkok, Thailand. She is also the Chief of the SEAFDEC Training Department in Samut Prakan Thailand.

Ms. Sawitree Chamsai is a Policy Officer at the SEAFDEC Secretariat in Bangkok, Thailand. She can be reached at sawitree@seafdec.org.

Fostering Ecosystem Approach to Fisheries Management in the Southeast Asian Region through SEAFDEC

Panitnard Weerawat



Small-scale fisheries are widely recognized as a large and important source of protein food and for its contribution to the coastal and rural communities for multiple socio-economic benefits. This is especially true for the Southeast Asian region where a large number of people are dependent on harvesting fishery resources to support food security, livelihoods, and income generation. Countries in the region have been working towards sustainable fisheries development for several decades.

However, the management of small-scale fisheries in tropical developing countries is generally constrained by insufficient government funding, lack of political will, open access regimes, multiple and scattered landing sites, and low participation of resource users in decision-making (Andrew *et al.*, 2007; Salas *et al.*, 2007; Kato *et al.*, 2012). In the past, fisheries were managed based on traditional management approaches such as catch-quotas and size limits for target species. However, such management approaches exhibit several practical difficulties when applied in multi-gear and multi-species tropical small-scale fisheries (Salas *et al.*, 2007; Purcell and Pomeroy, 2015).

Therefore, over the past two decades, a shift in fisheries management has been observed from a single-species approach – in which the main objective was to obtain the maximum sustainable yield (MSY) of target species – to a more holistic approach that also considers the impacts of fishing at the community and ecosystem level, for which two main frameworks are commonly used: the Ecosystem Approach to Fisheries – EAF (Garcia, 2003) and the Ecosystem-Based Fisheries Management – EBFM (Pikitch *et al.*, 2004). Both frameworks take into account the undesired effects of fishing on ecosystems due to the inherent selectivity of the fisheries for a particular size range and/or taxonomic group; these effects may include impacts on biodiversity, taxonomic composition, population abundance, size structure, trophic structure and trophic dynamics of biological communities (Jennings and Kaiser, 1998; Arias-González *et al.*, 2004; Pikitch *et al.*, 2004).

Throughout the past decade, the Southeast Asian Fisheries Development Center (SEAFDEC) has been working towards ensuring the sustainable development of fisheries

with a special focus on ensuring sustainable contribution from small-scale fisheries in close collaboration with the ASEAN Member States (AMSs). One of the important policy frameworks that guided SEAFDEC in the development of programs and projects to support the AMSs is the “Resolution and Plan of Action on Sustainable Fisheries Development for Food Security for the ASEAN Region Towards 2030” or RES&POA-2030 which was adopted by the ASEAN Senior Officials and Ministers during the Special Senior Officials’ Meeting of the 41st Meeting of the ASEAN Ministers on Agriculture and Forestry on 5 August 2020 and the 42nd Meeting of the ASEAN Ministers on Agriculture and Forestry on 21 October 2020, as well as the Senior Official and Minister responsible for fisheries of Japan. The specific aims of the RES&POA-2030 toward ensuring the sustainability of small-scale capture fisheries are:

Resolution #6: *Implement effective management of fisheries that integrates habitat with fishery resources management and aims to improve the social and economic benefits of all stakeholders, especially by delegating selected management functions to the local level and promoting co-management as a partnership between government and relevant stakeholders.*

Plan of Action #14: *Strengthen the adoption of fisheries management approaches, e.g., co-management and ecosystem approaches to fisheries management, at all levels with all relevant stakeholders involved in the process of planning and policy formulation for management of natural resources, conservation, rehabilitation of habitats and protective geographical features, and improvement of human well-being.*

Plan of Action #15: *Strengthen the capacity of fisheries communities and the capability of fisheries-related organizations (e.g., by empowering such organizations as appropriate) to implement necessary actions towards increased resilience, improved livelihoods, adoption of supplementary livelihoods, and poverty alleviation, in support of achieving sustainable development with gender integration in the process.*

Introduction of the EAFM Concept in Southeast Asia

Since 2000, several management concepts and approaches aiming toward ensuring the sustainability of small-scale fisheries were promoted by the SEAFDEC Training Department (TD), particularly rights-based fisheries, community-based fisheries, and co-management. However, with the development of the more recent concept of the ecosystem approach to fisheries management (EAFM) as an integrated management approach across coastal and marine areas and their natural resources that promotes

conservation and sustainable use of the whole ecosystem, and the development in 2012 of the Essential Ecosystem to Fisheries Management (E-EAFM) Training Course by the Food and Agriculture Organization (FAO), the U.S. National Oceanic and Atmospheric Administration (NOAA), and IMA International with technical assistance from several consultants; TD has expanded its activities to promote the EAFM concept in the region by developing human resource development program at the regional and national levels.

At the initial stage, the training materials developed by FAO, NOAA, and IMA International were used in the conduct of the EAFM training by TD; however, the materials were subsequently simplified to make them more suitable for the region with different types and targets of the training, *i.e.* E-EAFM training course, EAFM training-of-trainers, and LEAD EAFM training course. Through the training courses conducted by TD during 2014–2022, there were a total of 530 trainees from Member Countries, comprising 121 trainees in the regional training courses and 409 trainees in the national training courses.

Promotion of EAFM in Pilot Learning Sites

In addition to the conduct of a series of training courses to build up the understanding and capacity of the AMSs on the EAFM concept, TD also facilitated the EAFM implementation in the AMSs. A core EAFM team was established in each AMS with knowledge and capacities related to sustainable fisheries provided by TD through a series of training courses to ensure that the teams would be able to apply the knowledge and skills gained from the training courses in real situations. The EAFM concept was further promoted in selected pilot learning sites as case studies.

The EAFM implementation at different pilot learning sites (**Figure 1**) started in different years, *i.e.* in 2016 for Tharthon, Myanmar, in 2017 for Trapaeng Ropov, Cambodia, and Baan Nainang, Thailand, and in 2018 for Pak Kradun, Lao PDR. A series of activities were conducted, starting from an initial workshop with key persons to select an appropriate learning site and identify/prioritize key stakeholders. Subsequently, a series of workshops were organized with the participation of the key stakeholders to obtain information and understand the main issues of fisheries in the learning site and to develop a fisheries management plan. This was followed by a series of workshops with all key stakeholders to finalize and formalize the EAFM plan. After the development and implementation of the EAFM plan, collaboration was maintained with other sectors and stakeholders in monitoring the progress of activities relevant to the EAFM plan at the learning sites based on the management actions and the objective indicators.

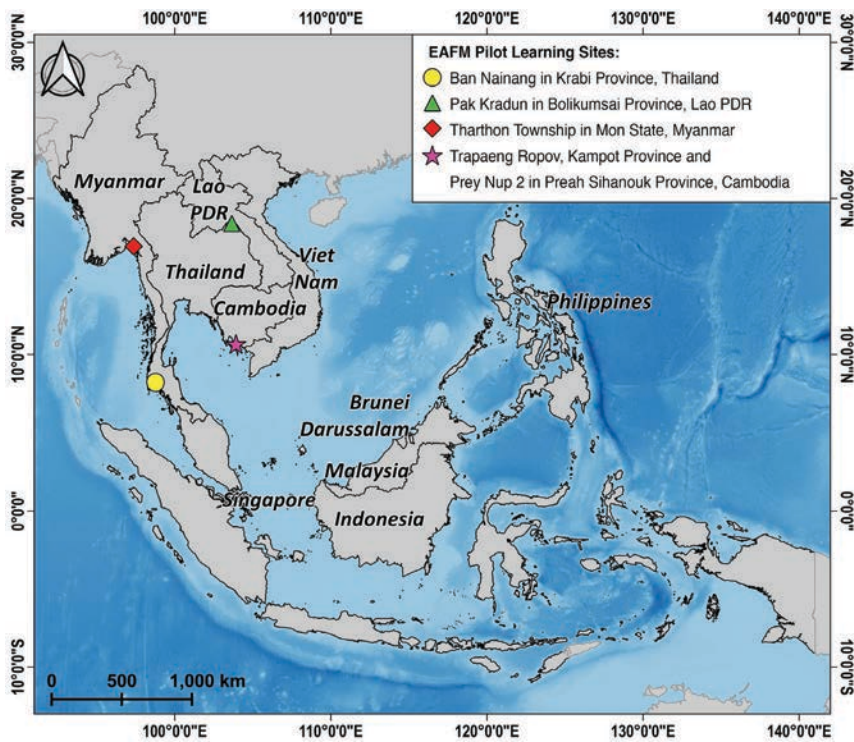


Figure 1. EAFM pilot learning sites in Tharthon Township in Mon State, Myanmar; Trapaeng Ropov, Kampot and Prey Nup 2 in Preah Sihanouk Provinces, Cambodia; Ban Nainang in Krabi Province, Thailand; and Pak Kradun in Bolikumsai Province, Lao PDR

Issues and threats

Managing multispecies and multigear fisheries in Southeast Asia requires dealing with multiple stakeholder groups and with disparate uses of fisheries and marine and coastal resources. All the learning sites, *i.e.* in Myanmar, Cambodia, Thailand, and Lao PDR, had once enjoyed the benefits from abundant fishery resources, productive coastal and marine habitats (*e.g.* coral reefs, seagrasses, and mangroves), and high biodiversity. However, the threats were examined and found to be similar in all learning sites, *i.e.* overexploitation of resources, destructive fishing methods, and illegal activities, degradation or loss of habitats, and declination of the fishery resources. The four sites also had similar management issues and challenges, *i.e.* ineffectiveness of fisheries governance, weak enforcement, lack of cooperation among stakeholders, and little understanding of rules and regulations among resource users. The situation has been aggravated as the communities were highly dependent on fishery resources and have limited types of livelihoods. The fishing grounds of small-scale fishers have been invaded by large-scale fishers with higher productive fishing capacities. At the same time, the market access of small-scale fishers is often limited and is conducted by middle people. Across all sites, following catch declines and decreases in fisheries-related income, livelihoods have become insecure, and the lack of the resources, skills, and capacities needed to initiate and successfully pursue supplementary and/or alternative livelihoods has become a critical problem.



Freshly caught fishes from small-scale fisheries in Ban Nainang, Krabi Province, Thailand

Lessons learned

The four pilot learning sites applied the EAFM principles (**Box 1**) in their EAFM implementation, the lessons learned from the different case studies could be summarized as follows:

Box 1. Key EAFM principles (adopted from www.eafmlearn.org)

Good governance: Process for developing rules and regulations for sustainable management and ensuring their compliance through a participatory process that improves acceptance, transparency, and accountability

Appropriate scale: Suitable levels and processes at which management is applied, taking into account the nature of the fishery and the people involved, as well as the issues being addressed. This can cover political, geographic, socioeconomic, and temporal scales

Increased participation: The need for stakeholders to become involved and work effectively together in the planning and implementation of EAFM

Multiple objectives: Addressing multiple objectives takes account of the various objectives of different stakeholders and considers trade-offs. It also strives to balance the multiple, often conflicting, objectives relating to human and ecological well-being

Cooperation and coordination: Voluntary but conscious and organized efforts of various stakeholder groups working together to achieve the EAFM objective. *Horizontal* cooperation and coordination refer to efforts across sectors and agencies while *vertical* cooperation and coordination are across levels of government

Adaptive management: Iterative and systematic process for continually improving management by learning from the outcomes of the previous management objectives and actions
Precautionary approach: Cost-effective measures to deal with uncertainty or risk without delaying action because of a lack of full information and being risk averse

Good governance

Good governance is fundamental for addressing any ecosystem-based fisheries issues, whether they are related to natural resource conditions or people's livelihoods. Fisheries reforms and amended or new fisheries laws were created and implemented to sustain fisheries and improve the livelihoods of local communities. In Cambodia, new fishery laws aim to ensure fisheries and fishery resources management; enhance aquaculture development; management of production and processing; and improve the socioeconomic conditions of the local communities.

In Myanmar, fisheries laws, rules, and regulations have been amended and updated to align with international standards, best practices, and provisions. Additionally, the management in Myanmar emphasized transparency and participation in co-managing and conserving fisheries resources. From Thailand, we learned that enforcing laws effectively requires fair legal frameworks, following the rule of law impartially, and commitment to protecting human rights, particularly the rights of those who are disadvantaged or marginalized.

The clear benefits and equal treatment motivated people to comply with relevant laws and to support law enforcement efforts. Good fisheries governance has expanded from the conventional focus on fisheries production alone to broader and more holistic approaches to fisheries management that also respond to the needs for conserving fisheries habitats and ecosystems and for securing the livelihoods of the communities. Restoring habitats and increasing household income have been identified as primary management objectives at all sites. The communities at each of the sites had limited alternative and supplementary livelihood opportunities, and most community members lacked the relevant skills to add value to fisheries products or to pursue non-fisheries livelihoods. Good governance, therefore, includes commitments to and strategies for improving sustainable livelihoods and food security, and for the sustainable development of fisheries sector.

In Trapaeng Ropov, improving the livelihoods of community members has been considered the most urgent issue. Supplementary livelihood development projects were initiated to be locally appropriate as well as being low cost, low technology, and geared toward locally available materials. The projects include ecotourism, value-added fisheries products, and mariculture. In Tharthon, the Japanese Trust Fund (JTF) supported SEAFDEC to organize a workshop to identify how to engage stakeholders and conducted a survey to identify appropriate activities for increasing fishing community incomes. Skill training with the women in Tharthon was conducted to enable them to create value-added products as supplementary livelihoods. Products included dry fish, fish crackers, and packaged dry shrimps. In Nainang, community-based tourism and apiculture were initiated to increase additional income and to help protect fisheries resources and habitats. The livelihood diversification initiated by different groups including fish processing, beekeeping, ecotourism, souvenir making, traditional snacks, and mixed agriculture.

Appropriate scale

While the case study sites share issues, backgrounds, and some similar fisheries habitats, the scale and scope of fisheries management are different. Decisions about appropriate scales have taken into consideration not only existing administrative and management structures but also the feasibility and practicality of implementation. Attention has been particularly given to ensuring that EAFM is integrated into fisheries management at multiple levels, including the community-based level and the level of national policy. While Thailand and Myanmar have their fisheries management areas (FMAs) at the village level, Trapaeng Ropov defined a transboundary marine area as their FMA, jointly managed under one set of regulations by two provinces sharing responsibilities to rehabilitate the overlapping fishery resources, to promote supplementary and alternative livelihoods, and to strengthen law enforcement focusing on reducing IUU fishing in an area important to both jurisdictions. In the case of Nainang,

while the EAFM initiative started at a small local scale of a single village, its success has awakened the interest of the provincial fisheries of Krabi and started expanding the EAFM to encompass the rest of the Krabi Province in 2021.

Increased participation

EAFM encourages and strengthens the participation of communities and other stakeholders. Increased participation should be practiced at all stages of the EAFM, including understanding the needs, issues, and contexts of different sectors and groups and possible solutions, developing fisheries management plans together with fisheries officials, and implementing management activities in collaboration with relevant stakeholders. Increased participation helps build shared ownership and shared responsibility among the groups. It also helps balance gender participation and provides opportunities for involving those who are under-represented. In the case studies, we found that the willingness to participate can come from building stakeholders' awareness of the importance of sustaining resources and the value of rules and regulations. In all sites, levels of awareness raised on the importance of fishery resources and frequencies of awareness and outreach activities were set as indicators in the EAFM fisheries management plans, reflecting the importance of these as foundations of achieving good governance. The learning from the case studies showed that fisheries management cannot be successful with only one or two stakeholder groups and that it is important to involve the different groups early in the planning process to understand, support, and agree to be involved in management actions.

In Cambodia, Communities Fisheries (CFi) were established to help manage fisheries and related ecological systems and to improve communities' standard of living. By 2015, there were over 507 CFis in Cambodia. In Trapaeng Ropov, key stakeholder groups have extended to include community representatives, community chiefs, the Fisheries Administration Cantonment (FiAC), District Governor, Chief of Commune, and local non-government organizations. Progressively, the local groups grew to include the CFi, Provincial Department of Agriculture, Forestry, and Fisheries, and national level stakeholders grew to include the Ministry of Environment, marine police, navy, Ministry of Tourism, Ministry of Public Works and Transport, National Committee for Marine Security, and inclusion of local and international non-government organizations also increased.

In Nainang, the revised management plan has been used as an adaptive fisheries resources management tool that has also enabled different stakeholder groups (small-scale fishers and commercial fishers, different community-based groups, and the Sub-District Administration Organization) to participate in the decision-making processes of revising the plan and activities, and of developing budget proposals. This expanded



Development of the Fisheries Management Plan in Krabi Province, Thailand

participation created a sense of belonging in managing fisheries resources, a willingness to collaboratively resolve conflicts, and a greater understanding and positive attitudes toward fisheries officers among different types of fishers.

It was recognized that equitable and inclusive participation and collaboration among governmental officials, community members, and other stakeholder groups were instrumental in achieving good governance. Gender equity and equality are important for the social safeguarding and sustainable development at which EAFM aims. In the Tharthon case, for example, a livelihood project was developed especially for women, while in Nainang men and women have worked in a complementary manner to benefit from different aspects of product development related to apiculture. Men construct the bee houses and take care of the beekeeping and honey extraction, while women take care of marketing and developing other value-added products from honey and beeswax, and for the case of Trapaeng Ropov, Cambodia both men and women were involved in most of the process for fish sauce production and the local business went well.

Multiple objectives

In all sites, coastal and marine resources are being used by different sectors and for multiple purposes, including tourism, small- and large-scale fisheries, and coastal development, while these sites serve as habitats for endangered species



Training/Workshop to Revisit/Finalize the Existing Fisheries Management Plan for Pak Kading, Bolikhamsai Province, Lao PDR

and others. To balance ecological with social goals, several activities have been developed to achieve multiple objectives. These objectives include improving and conserving the habitat conditions, creating a better understanding of rules, regulations, and ways to sustain marine life, promoting shared management and enforcement of illegal fishing activities, and establishing quality and value-added fisheries products, as well as non-fisheries livelihood options.

Competition among multiple objectives occurred. Management actions need to take into consideration the varied impacts of different actions taken to improve and restore fishery habitats and resources and to ensure that those who are dependent on them can sustain their livelihoods. This requires balancing the ecological and human components and understanding how actions can benefit one component at a cost to others. Within the human component itself, there are often different groups with different societal objectives. In all sites, there are competing interests between small-scale and large-scale fisheries, between fishing community well-being and larger-scale coastal development, or between those living inside and outside an FMA. Recognizing the multiple objectives in an FMA is critical for the success of EAFM. It is essential for officials implementing EAFM to be involved with and understand the communities well so that they can analyze the situation, identify issues, and engage stakeholders to fairly discuss and negotiate the trade-offs in a transparent way. For Nainang, the village leadership felt strongly that collective results and benefits were most important. There the aim was for all to have reasonable livelihoods rather than for some to be better off while others are marginalized.

Some objectives are complementary to one another. The apiculture project in Nainang was a good example of how a local enterprise for supplementary community income can help support the conservation of local mangrove forests, and how the restored forests in turn benefit not only the livelihoods

of both women and men in the community but also improve fisheries resources, ecosystem sustainability, and biodiversity.

Cooperation and coordination

Fisheries issues are better addressed when there is a collaboration among stakeholder groups and coordination with non-fisheries sectors and programs to better achieve the multiple objectives of different EAFM components and to avoid possible conflicts. Different stakeholder groups need to understand that cooperation and coordination allow everyone to better contribute to the success of an EAFM plan and improve shared benefits. Conducting regular meetings to strengthen cooperation among relevant stakeholders is also critical. In the case studies, the coordination efforts were often led and/or supported by a champion or a group of champions in the FMAs and supported by management structures.

The background of several case studies showed that fisheries law enforcement had been ineffective in reducing illegal fishing due both to insufficient resources and weak cooperation among stakeholders. Ultimately, it has been recognized that illegal fishing needs to be addressed collaboratively. Consequently, efforts to combat illegal fishing have extended to include different stakeholder groups, emphasizing cooperation and coordination among them, as well as the importance of community participation in the monitoring. In Trapaeng Ropov and in Tharthon, community-based monitoring has been established. In Tharthon, the monthly frequency of monitoring by fishers was included as the main indicator for good governance. Similarly, in Trapaeng Ropov, a benchmark for the number of days per month for joint patrols with relevant stakeholders was set as an indicator for the EAFM management plan. In Nainang, the frequency of collaborative monitoring with an enforcement plan being in place became an important indicator for good governance alongside laws and community-based rules and regulations to reduce illegal fishing and commitments to monthly informative meetings.



Participants using the Venn diagram during an activity on stakeholders' analysis

Adaptive Management

Adaptive management started in 2012–2013 with the modifications of the E-EAFM course to better suit national and regional capacity-building needs for ecosystem-based fisheries management in Southeast Asia. In 2019, the course materials were reviewed and modified to reflect lessons gathered from the delivery of the E-EAFM course by TD at both the national and regional levels since 2014. Specifically, it has been identified that technical EAFM modules should be developed to address the needs for sustainable fisheries management tools (*e.g.* harvest control rules, territorial use rights in fisheries, total allowable catch, individual transferrable quota, fish refuges, seasonal closures, marine protected areas, bycatch/juvenile reduction devices, and others), methods, and mechanisms that support sustainable livelihoods development in fishing communities (microcredit schemes, insurance, alternative value chains, ecolabelling, rights-based approach, etc.).

As the EAFM plans and activities are being implemented and applied in the FMUs, management continues to adapt to be more effective in addressing issues and in balancing human well-being with ecological health. In Nainang, Trapeang Ropov, and Tharthon, adaptive management involves better engaging stakeholders and benefits from their contribution, cooperation, and contribution. This is particularly important for combating illegal fishing. Monitoring and evaluation are important parts of an EAFM process. In all EAFM learning sites, indicators were established in the EAFM plan to track and understand changes related to ecological, human, and governance objectives, and to produce data that allows for informed management adaptation. While information from monitoring and evaluation is still often lacking, the importance is now recognized of supporting and sustaining monitoring programs at the EAFM sites over the long run to ensure valid and reliable results and to help guide down-the-line adaptations. Adaptive management also extends to mainstreaming an EAFM in national, regional, and transboundary fisheries management policies. The EAFM in Nainang is adapting its geographical and administrative scales from those of a village to those of a province and is supporting related activities that come with the scaling up.

Precautionary Approach

To proactively plan for sustainable fisheries, science was used to support informed decision-making. In cases where data is incomplete, decisions were made in a precautionary manner. It is fundamental to the precautionary approach to ensure that fisheries communities and other stakeholders understand both the values of coastal and nearshore habitats (such as mangroves, sea grasses, and coral reefs) and the importance of sustainable fisheries resources for the next generations. This understanding helps initiate habitat and fisheries resource conservation for future generations, as well as other activities to reduce vulnerability to natural disasters and climate change impacts. In Nainang, conservation areas were established for blood cockles, dog conch shells, and other important economic species. In Tharthon and Nainang, mangrove conservation was strengthened through different activities with the community appreciating the mangrove providing coastal protection. In Trapeang Ropov, seagrass was considered an important habitat that should be sustained. In Nainang, crab banks were established by sustainability-minded middle people and have proven effective in sustaining the crab population while enabling higher quality products with better prices and stronger appeal to be brought to consumers.

Sharing of lessons learned

In sharing the lessons learned and information on the EAFM implementation, TD through its project “Small-scale Fisheries Management for Better Livelihood and Fisheries Resources” with support from the Japanese Trust Fund conducted an online survey among the EAFM trainees from Indonesia, Malaysia, Myanmar, Cambodia, Lao PDR, and Thailand. The results showed that the knowledge that the trainees have gained from the EAFM training courses included the concept of EAFM, development of fisheries management plan, importance of participation, systematic and analysis thinking process on fisheries management. The respondents also realized that the EAFM concept should be promoted to all fisheries stakeholders and all respondents applied the EAFM in their work. Subsequently, the Online Meeting on Survey Results of SEAFDEC/TD HRD and Implementation of Ecosystem Approach to Fisheries Management (EAFM) in Learning Sites in 2021. The Meeting shared the results of the online survey on the usefulness and applicability of the EAFM training and the EAFM implementation of the learning sites.

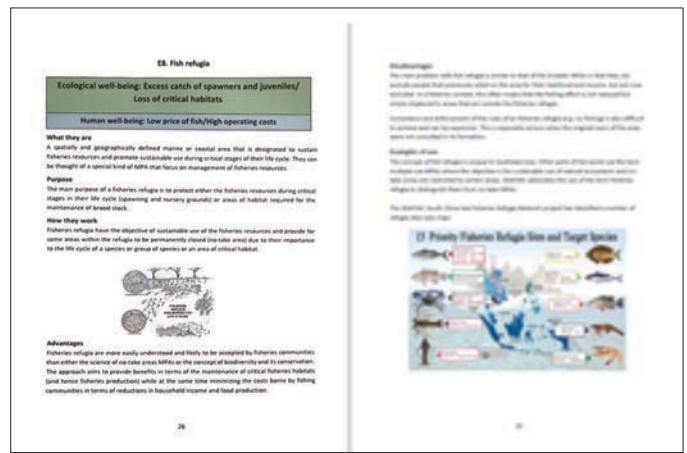
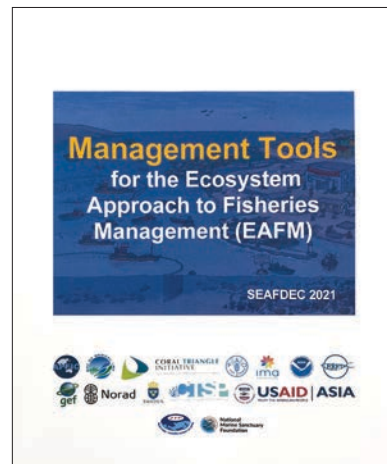
Way Forward

The duration for EAFM implementation is one year for each site with a view to starting up the EAFM process. After the one-year period, the implementation was transferred to the respective countries, and the activities were carried out mainly by the key stakeholders. It should be noted that one of the key success factors for implementing EAFM in the pilot learning sites is the EAFM core teams as the implementation processes at the sites were carried out mainly by the key national officers of the respective country supervised by the core team with SEAFDEC only playing a support role in enhancing the core teams' capacities. The strengthening of the core team would therefore ensure that the EAFM implementation could be maintained by the respective country in the future after the completion of the project supported by TD.

Over the period of the EAFM training and implementation, the E-EAFM course was found to have some gaps, and one of the major gaps was identified to be the insufficiency of information on the different management tools that can be used to implement the EAFM. Considering that EAFM is quite broad with respect to conventional fisheries management, it has also become necessary to broaden the scope and number of relevant fishery management tools that could be applied in the implementation of the EAFM. Thus, a supplementary course module that provides an introduction and summary of these tools has been added to the E-EAFM course. This supplementary course is based on a series of fact sheets that focus on managing fishery activities under the EAFM, including the tools to manage broader environmental issues, as well as on achieving social, economic, and governance objectives.

The supplementary course aims to provide the participants with knowledge and skills that would enable them to identify the appropriate management tools that address common EAFM issues in their countries. The expected outcomes are increased capacity of participants to select the management tools that could be used for implementing the EAFM in their works and enhanced awareness of and familiarity with the EAFM management tools.

During the course, the participants will be provided with training materials such as worksheets and the fisheries management tool booklet which was developed as part of a revision of the Essential Ecosystem Approach to Fisheries Management training course undertaken during 2019–2020. The revision was funded by the U.S. Agency for International Development/Regional Development Mission for Asia (USAID/RDMA) implemented by NOAA and administered by the National Marine Sanctuary Foundation (NMSF). The management tools booklet was further improved through a regional workshop conducted by TD in August 2021, with the support of the Japanese Trust Fund.



Training materials for management tools for EAFM

Moreover, TD in collaboration with the DOF Thailand translated the Management Tools for EAFM booklet to the Thai language in March 2022 and used this as training materials for the national and regional training courses. The first national training course was conducted for officers of the DOF Thailand in August 2022, and this was followed by the first regional training course conducted with the participation of fisheries officers from the SEAFDEC Member Countries in September 2022. While these training courses are the activities carried out by TD that are envisaged to contribute to human resource development toward achieving sustainable fisheries management in the Southeast Asian region, it is expected that the tools developed by SEAFDEC in collaboration with several partners could be further used by the respective AMSs for amplifying the implementation of EAFM concepts and approaches in additional sites and wider areas with the support from the core team of the respective country in the future.

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Acknowledgments

The author would like to express appreciation to *Dr. Derek Staples* and *Dr. Supin Wongbusarakum* for their support the activities of TD in introducing and promoting the EAFM concept in the Southeast Asian region and for being the main contributing authors of the newly developed booklet on Management Tools for EAFM, as well as for Dr. Michael Abbey for editing the booklet. Moreover, the author also gives special gratitude to *Dr. Kungwan Juntarashote* for his support in the promotion of EAFM, especially in Thailand, and in the translation of the booklet to the Thai language.

About the Author

Ms. Panitnard Weerawat is the Fisheries Management Senior Researcher at the Research and Development Division of the SEAFDEC Training Department in Samut Prakan, Thailand. She is the Lead Technical Officer of the project “Small-scale Fisheries Management.” (Email: panitnard@seafdec.org)



Supporting Small-scale Fisheries Value Chain: capacity-building on fish processing and trade in Nam Oon Dam, Sakon Nakhon Province, Thailand

Thanyalak Suasi, Rattana Tiaye, and Krit Phusirimongkol

Under the project “Small-scale Fisheries Management for Better Livelihood and Fisheries Resources,” the Training Department of SEAFDEC (SEAFDEC/TD) conducted a series of capacity-building activities to support the Ban Dong Kham Pho Fish Processing Group in Nam Oon Dam, Sakon Nakhon Province, Thailand. The three main processed fishery products of the Group are fermented fish, fermented fish meat wrapped with banana leaves, and dried fish using the raw materials from inland capture fisheries. The members of the Ban Dong Kham Pho Fish Processing Group acquired equipment and skills in processing and packaging technology and improved their knowledge of marketing strategy. The Group now is being supported by the government under the One Tambon, One Product (OTOP) program for formal branding to promote their processed fishery products.

Small-scale fisheries play an important role in food security and nutrition. The small-scale fishing communities are commonly located in remote areas, earning low incomes, and tend to have limited access to markets. Along the value chain, the majority task of men is catching or harvesting fish while women are mostly engaged in post-harvest activities such as processing and marketing. Value chains of small-scale fisheries include all the activities from pre-harvesting to harvesting to consumption. This includes gear making; capture or harvesting; sorting, cleaning, and processing; transport, marketing, and selling; and finally, the consumption of fish and seafood. The activities are often manual, using low-cost technologies which are accessible to millions of people with limited assets but can use their skills to benefit from the livelihood opportunities available. However, small-scale fishers and fish workers need skills and tools to avoid food losses and waste along the value chain (FAO, 2022).

The FAO Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries in the Context of Food Security and Poverty Eradication (SSF Guidelines) recognize the importance of value chains, post-harvest, and trade to improve the livelihood of the small-scale fishers by building the capacity of individuals, strengthening organizations, and empowering women; reducing post-harvest losses and adding value to small-scale fisheries production; and facilitating sustainable trade and equitable market access (FAO, 2015; Zelasney *et al.*, 2020). Moreover, the ASEAN-SEAFDEC Resolution on Sustainable Fisheries for Food Security for the ASEAN Region Towards 2030 also considers the significance of developing fish and fishery products to support the fishing

community livelihood, as indicated in Resolution No. 22 “*Improve and exchange technologies, and enhance facilities to ensure that fish quality assurance and safety management systems are in place and operational, taking into account the importance of traditional fishery products and food security requirements, and promote the development of fishery products as supplementary livelihoods for fisheries communities*” (SEAFDEC, 2020).

In this connection, SEAFDEC Training Department (SEAFDEC/TD) is currently implementing the project “Small-scale Fisheries Management for Better Livelihood and Fisheries Resources” with support from the Japanese Trust Fund. The goal of the Project is to achieve sustainable management of small-scale fisheries for improving the livelihood and well-being of fishers in Southeast Asia. The pilot site of the Project was at Nam Oon Dam, Sakon Nakhon Province in the northeast part of Thailand (Figure 1). SEAFDEC/TD conducted a series of activities in November–December 2021 to support the small-scale fisheries value chain through the promotion of fish and fishery products from inland fisheries of the Ban Dong Kham Pho Fish Processing Group.



Figure 1. Location of Nam Oon Dam, Sakon Nakhon Province, Thailand (Source: Google maps)

Ban Dong Kham Pho Fish Processing Group

The Ban Dong Kham Pho community is situated close to the Nam Oon Dam. Most community members are engaged in agriculture and inland fisheries for livelihood and household consumption. Moreover, they also carry out household fish processing to preserve fish during the peak fishing season. In 2014, the Ban Dong Kham Pho Fish Processing Group was established under the poverty alleviation program of the Government of Thailand. In addition to fish processing, the Group also engages in other livelihood activities including microfinance and ecotourism. As of 2021, the Group is composed of 29 members.

The three main fishery products of the Group are fermented fish, fermented fish meat wrapped with banana leaves, and dried fish using the fish species caught from the Nam Oon Dam (**Figure 2**). The fermented fish called “pla som” uses common silver barb fermented with salt, garlic, and cooked rice. 2) The fermented fish meat wrapped with banana leaves called “pla som hor” uses the meat of featherback mixed with salt, garlic, and cooked rice and wrapped with banana leaves. The dried fish called “pla haeng” uses Siamese mud carp soaked in salt water and sun-dried on a sieve.



Figure 2. Main fishery products of the Ban Dong Kham Pho Fish Processing Group: fermented fish (*above-left*), fermented fish meat wrapped with banana leaves (*above-right*), and dried fish (*below*)

The focus group discussion was conducted with the members of the Ban Dong Kham Pho Fish Processing Group to obtain a deeper understanding of their fish processing activities as well as address the constraints in the processing and marketing of their processed fishery products. It was found that the Group produces its processed fishery products based on the availability of raw materials and orders from customers. Their products are sold directly to customers including government officers, teachers, and factory workers in Sakon Nakhon Province as well as delivered to customers in other provinces such as Bangkok and Chonburi Province by courier. However, the Group lacks processing and packaging technology and has limited knowledge of marketing strategy.

The economic analysis was carried out to assess the cost structure and profitability of processed fish products. The fixed cost was the depreciation cost of the production equipment while the variable cost was the expense incurred in producing processed fishery products such as raw materials, ingredients, water supply, and electricity. The total cost was the sum of fixed cost and variable cost. The processed fishery products are packed using plastic bags. The packaging of fermented fish is 1 kg or 2–3 fish per bag and sold for THB 150.00 (USD 3.95) per bag. Six pieces of fermented fish meat wrapped with banana leaves packed in the bag are sold at THB 50.00 (USD 1.32) per bag. The dried fish is packed at 100 g with the price of THB 50.00 (USD 1.32) per bag. The profit was computed by deducting the total cost from the selling price. Results of the economic analysis revealed that among the three processed fishery products, the fermented fish meat wrapped with banana leaves had the highest profit despite its cheaper selling price than fermented fish. On the other hand, fermented fish had the lowest profit in spite of being sold three times higher than the other two products (**Table 1**).

The total cost of producing processed fishery products greatly affected the net income of the Group. Therefore, it is necessary to improve the business plan to reduce the total cost of production as well as develop a marketing strategy to increase income. For fermented fish, it is recommended to modify the packaging quantity by packing 1–2 fish per bag instead of 1 kg per bag and increasing the selling price that is commensurate with the production cost. Also, the package should be improved by using the technology in sealing the bags to prevent liquid spillage and extend shelf life. A high profit could be gained from fermented fish meat wrapped with banana leaves. However, they use their hands to mix fish meat and ingredients which takes about one hour. Thus, it would be better to use a machine for the mixing process to save time and improve hygiene. For the dried fish products, it is difficult to dry fish during the rainy season and might be good to improve the drying system by using solar drying houses which could reduce contamination by dust and prevent the infestation from insects and other animals. That could enhance the quality of the dried fish products to meet the standards.

Table 1. Economic analysis of processed fish products produced by Ban Dong Kham Pho Fish Processing Group in Nam Oon Dam, Sakon Nakhon Province, Thailand

	Fermented fish	Fermented fish meat wrapped with banana leaves	Dried fish
Fixed cost per bag (THB, USD)	4.41, 0.12	0.40, 0.01	0.28, 0.007
Variable cost per bag (THB, USD)	126.96, 3.34	18.72, 0.49	23.29, 0.61
Total cost per bag (THB, USD)	131.37, 3.46	19.12, 0.50	23.57, 0.62
Selling price per bag (THB, USD)	150.00, 3.95	50.00, 1.32	50.00, 1.32
Profit per bag (THB, USD)	18.63, 0.49	30.88, 0.81	26.43, 0.70

Furthermore, SEAFDEC/TD also performed the SWOT analysis to assess the status of fish processing activities of the Group including the internal and external factors and current and future potential to develop the strategic plan for fish processing products. As shown in **Box 1**, The strengths of the Group include unity among the members and transparency in management as the group members are designated with clear roles and responsibilities; thus, they could efficiently perform their work and manage the group. However, the group members lack the technology and knowledge of processing and packaging techniques which made it difficult for them to obtain standard certifications (*e.g.* Food and Drug Administration, Halal, among others) for processed fishery products.

Box 1. SWOT analysis of Ban Dong Kham Pho Fish Processing Group in Nam Oon Dam, Sakon Nakhon Province, Thailand

Strengths

- United group members
- Transparent management
- Unique taste of products

Weaknesses

- Lacking technology and knowledge of processing and packaging techniques
- Lacking standard certifications

Opportunities

- High demand and marketing channels
- Abundant raw materials
- Strong support from government and other organizations

Threats

- Less fish during the closed season
- No sunlight for dried fish in the rainy season
- Lacking processing and packaging technology

Because of the unique taste of the products, there is a high demand from regular customers and the Group had the opportunity to venture into more market channels. The Group is supported by the government and other organizations such as the Department of Fisheries of Thailand, Community Development Department, and Sakon Nakhon University which educate the group members on improving fish processing techniques, packaging, and quality. Nevertheless, there is a low supply of raw materials during the annual closed season of Nam Oon Dam from 16 May to 15 August which made the Group buy raw materials from other areas adding to production costs. Also, it is difficult to process dried fish in the rainy season.

Capacity-building activities

Since the plastic bag packaging of fermented fish is sealed only by a rubber band, the liquid could easily leak and the fish could not be kept for a long time making it difficult to sell and deliver the product to farther areas. Therefore, SEAFDEC/TD through the Project provided the Group with a vacuum sealer machine to improve the packaging. Moreover, the meat mixer machine was also provided to the Group for processing the fermented fish meat wrapped with banana leaves to save time and improve product hygiene. Then, the members of the Group were trained on the proper and safe use and maintenance of the vacuum sealer and meat mixer machines (**Figure 3**). The machines provided to the Group could help them improve the quality of their products to obtain certification standards and enhance access to markets.



Figure 3. Practical training for the members of the Ban Dong Kham Pho Fish Processing Group on the proper and safe use of vacuum sealer and meat mixer machines



Figure 4. Training on enhancing marketing access for small-scale fisheries participated by the members of the Ban Dong Kham Pho Fish Processing Group

Furthermore, SEAFDEC/TD organized the training on market access for small-scale fishery products to enhance the marketing strategy of Ban Dong Kham Pho Fish Processing Group (Figure 4). The marketing strategy model of the small-scale fishery products was presented to the Group members including packaging and value chain from producers to customers. During the Training, the Groups were taught to consider the 3Rs for developing a marketing strategy, namely: right target, right channels, and right message. The Group should know their customers and how to distribute their products to their customers with the right communication message. Moreover, the Group would still need support from the government and other organizations to progress in their fish processing activities.

Way Forward

The Ban Dong Kham Pho Fish Processing Group is planning to apply for standard certification for their processed fishery products. They are seeking new marketing channels by introducing their products to academic institutions in Sakon Nakhon Province and selling in festivals and tourist areas. Also, the Community Development Department, Thailand would assist the Group in the promotion of their products as a One Tambon, One Product (OTOP) brand. Tambon means Sub-District, and OTOP is a local entrepreneurship stimulus program of Thailand that supports unique locally made and marketed products of each Tambon all over the country.

Acknowledgments

The authors are grateful to the provincial offices of the Department of Fisheries Thailand, namely: Sakon Nakhon Provincial Fisheries Office, Pang Khon District Fisheries Office, and Nam Oon Dam Inland Fisheries Patrol Unit for the support in the conduct of the activities on promoting community fish products in Nam Oon Dam. We appreciate the Ban Dong Kham Pho Fish Processing Group for their active participation in the activities. We thank the Japanese Trust Fund for funding support to the activities as well the lead technical officer of the project “Small-scale Fisheries Management for Better Livelihood and Fisheries Resources,” Ms. Panitnard Weerawat, for her kind advice.

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About the Authors

Ms. *Thanyalak Suasi* is the Head of Fisheries Management Section, Research and Development Division, SEAFDEC Training Department, Samut Prakan, Thailand. Email: thanyalak@seafdec.org

Ms. *Rattana Tiaye* is a Fisheries Management Scientist of Fisheries Management Section, Research and Development Division, SEAFDEC Training Department, Samut Prakan, Thailand. Email: rattana@seafdec.org

Mr. *Krit Phusirimongkol* is a Training and Extension Officer of Training and Information Section, Training and Research Supporting Division, SEAFDEC Training Department, Samut Prakan, Thailand. Email: krit@seafdec.org

Assessing the impacts of COVID-19 on small-scale fisheries and aquaculture in selected sites in Southeast Asia

Jariya Sornkliang, Thanyalak Suasi, and Rattana Tiaye

The COVID-19 pandemic severely impacted economies worldwide, including the fisheries and aquaculture value chain. In the Southeast Asian region, although small-scale fishers and fish farmers are significant actors in the fish value chain, they are also among the vulnerable groups. Therefore, it is necessary to assess the impacts of COVID-19 on their livelihood to provide appropriate support and carry out measures to mitigate such impacts. SEAFDEC Training Department conducted a study to assess the impacts of COVID-19 on the small-scale fisheries and aquaculture sub-sectors, *i.e.* marine capture fisheries, mariculture, inland capture fisheries, inland aquaculture, and aquatic bank in Lao PDR, Myanmar, Philippines, and Thailand from 2020 to 2021. The small-scale fishers and farmers were interviewed in selected sites using a questionnaire based on the recommendations of FAO to describe the impacts of the COVID-19 pandemic specifically on their quantity of catch/harvest, number of market channels, price of catch/harvest, access to transportation, cost, and income. It was found that the impacts of the COVID-19 pandemic on small-scale fishers and fish farmers include reduction in catch and harvest, reduction in the number of marketing channels, reduction in the price of catch or harvest, reduction in access to transportation, reduced cost, and reduced income. The recommendations provided in this study should be considered to mitigate such impacts. The results of this study could support the development of appropriate policies to sustain the livelihood and enhance the resilience of small-scale fishers and farmers to other pandemics and disasters in the future.

On 11 March 2020, the World Health Organization (WHO) declared coronavirus disease 2019 (COVID-19) as a global pandemic (World Health Organization, 2021). Consequently, countries around the world enforced regulations and containment measures such as lockdowns, curfews, home confinement, travel restrictions, border closures, business terminations, and others to control and prevent the COVID-19 outbreak. As of the end of 2021, the ASEAN Member States (AMSs) had a total number of confirmed cases of 14,876,739, a total number of confirmed deaths of 304,755, and a total number of people fully vaccinated against COVID-19 of 204,412,6350 (Figure 1). The COVID-19 regulations and measures imposed by the governments of the countries disrupted all human activities and resulted in severe impacts on livelihood, food security, social activities, and economies at various levels and scales, including the fisheries and aquaculture sector of the Southeast Asian region.

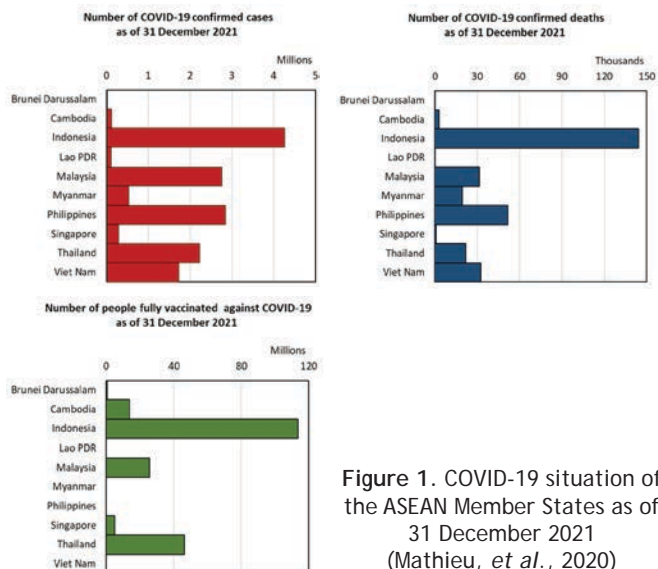


Figure 1. COVID-19 situation of the ASEAN Member States as of 31 December 2021 (Mathieu, *et al.*, 2020)

In Southeast Asia, the majority of fishers and fish workers are engaged in small-scale fishery activities including pre-harvest, harvest, and post-harvest. Small-scale fisheries and aquaculture use relatively small production units with low input and output, and low levels of technology or capital investment where fishing for sport or recreation is excluded (FAO, 2022). In 2016, small-scale fisheries contributed at least 40 % of the world's catch, and 90 % of the people employed along capture fisheries value chains operated in small-scale fisheries (FAO *et al.*, 2022) making this sector crucial in food security and nutrition, poverty eradication, and sustainable resource utilization. However, small-scale and aquaculture in the region face several challenges such as resource decline, habitat degradation, illegal fishing, post-harvest loss, and climate change, among others (SEAFDEC, 2022), which are aggravated by the COVID-19 pandemic.

To assess the impacts of the COVID-19 pandemic on small-scale fisheries and aquaculture in the Southeast Asian region, SEAFDEC Training Department (SEAFDEC/TD) conducted a series of surveys in 2020–2021 at the sites of the projects “Gender Dimension in the Value Chain of Small-scale Fisheries and Aquaculture in Southeast Asia” and “Small-scale Fisheries Management for Better Livelihood and Fisheries Resources” (Figure 2 and Table). SEAFDEC/TD developed a questionnaire based on the recommendations of FAO (2020) which was utilized to interview the fishers and fish farmers from the small-scale fisheries and aquaculture sub-sectors, *i.e.* marine capture fisheries, mariculture, inland capture fisheries, inland aquaculture, and aquatic bank. The respondents were

Table. Study sites and date of data collection for assessing the impacts of the COVID-19 pandemic on small-scale fisheries and aquaculture in Southeast Asia

Small-scale fisheries and aquaculture sub-sectors	Study site	Date of data collection
Marine capture fisheries	Ranong Province, Thailand	5-11 Oct 2020
	Infanta, Quezon Province, Philippines	16-19 Nov 2021
Mariculture	Surat Thani Province, Thailand	28 Aug-1 Sep 2020
Inland capture fisheries	Kyauktan, Yangon Region, Myanmar	24-28 May 2021
Inland aquaculture	Bolikhamsay Province, Lao PDR	25-29 Jan 2021
Aquatic bank	Buriram Province, Thailand	1-5 Mar 2021



Figure 2. Map of study sites for assessing the impacts of the COVID-19 pandemic on small-scale fisheries and aquaculture in Southeast Asia

asked about the impacts of the COVID-19 pandemic on their fishing and aquaculture activities specifically on the quantity of catch/harvest, number of market channels, price of catch/harvest, access to transportation, cost, and income. The results of this study will be useful for developing appropriate policies to support the sustainable livelihood of fishers and farmers during the pandemic and other disasters.

Impacts of the COVID-19 pandemic

Marine capture fisheries

- Ranong Province, Thailand**

The study site in Ranong Province was located at Ban Ha Sai Khao Village. The village has approximately 137 families who are engaged in fisheries, agriculture, and labor. About 90 % of the households do fishing, and there were 60 small-scale fishery vessels in the village. The main species caught include shrimp, cuttlefish, sillago, and cuttlefish.

There were 42 respondents including 12 females and 30 males. Among the interviewed fishers, 69 % indicated that there was no change in the quantity of catch, while 60–74 % said that



there was a reduction in the number of market channels, price of catch, and access to transportation. About 55 % said that there was no change in cost; however, 96 % of the respondents said their income was reduced (Figure 3).

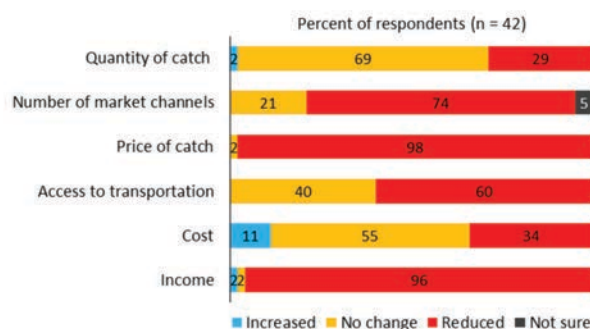


Figure 3. Impacts of COVID-19 on marine capture fisheries in Ranong Province, Thailand

- Quezon Province, Philippines**

Infanta was the study site in Quezon Province located along the coast of the Philippine Sea. As of 2021, the total number of registered fishers and fish farmers was 5,005 composed of 1,312 females and 3,693 males. The livelihoods are fish capture (44 %), gleaning (16 %), fish vending (14 %), aquaculture (8 %), and others (18 %). The common fishing gear includes handline, longline, multiple hook and line, squid jigger, fish spear, crab pot, beach net, gillnet, and scissor net.



a population of 1.06 million. For aquaculture, the freshwater species are fish and frogs, while the marine species are shrimp, fish, and crab. More than 900 small- and large-scale mariculture farms are registered in the province.



A total of 40 respondents composed of 18 females and 22 males were interviewed. For the quantity of catch, 46 % indicated that it did not change and 46 % said it reduced. From 50 % to 73 % of the respondents specified that there was a reduction in the number of market channels, price of catch, and access to transportation. More than half of the interviewed fishers said that there was no change in the cost, but 83 % had reduced income.

The total number of respondents was 93 composed of 29 females and 64 males. Among the interviewed fish farmers, about 63 % said that there was no change in the quantity of harvest. About 66 % said that the number of market channels reduced and 95 % indicated that the price of harvest decreased. There was no change in access to transportation and in cost which was specified by 78 % and 67 % of respondents, respectively. Nonetheless, 93 % of the interviewed fish farmers had a reduction in income.

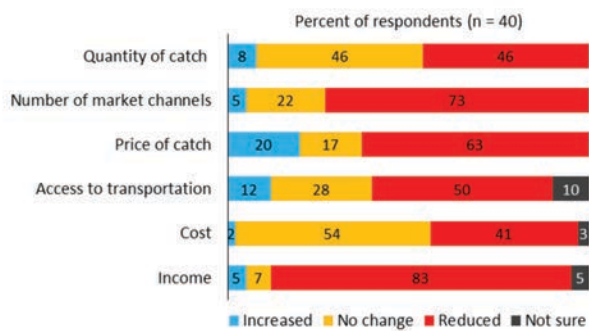


Figure 4. Impacts of COVID-19 on marine capture fisheries in Quezon Province, Philippines

Mariculture

• Surat Thani Province, Thailand

The study site in Surat Thani Province includes seven Districts, namely: Mueang, Kanchanadit, Don Sak, Chaiya, Tha Chana, Tha Chang, and Phunphin. Surat Thani Province is in the southern part of Thailand with an area of 12,891 km² and

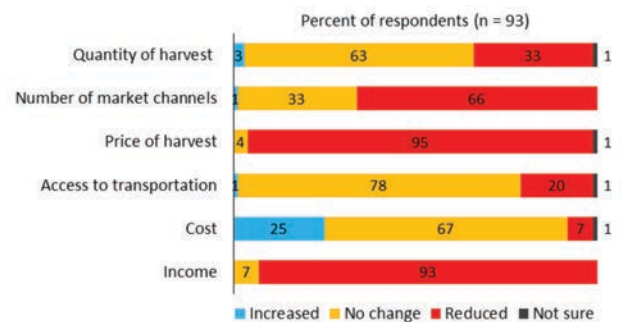


Figure 5. Impacts of COVID-19 on mariculture in Surat Thani Province, Thailand

Inland capture fisheries

- **Yangon Region, Myanmar**

The study site in Yangon Region was located in Kyauktan with a total population of 170,635 (86,795 females and 83,840 males). The livelihoods of the people include farming rice, bean, and crop, industry/factory, aquaculture, and fishing. There were 472 fishers and the fish species they caught included threadfin (*Polynemus* sp.), catfish (*Arius* sp.), croaker (*Johnius* sp.), hilsa (*Tenualosa ilisha*), and basa fish (*Pangasius* sp.)



A total of 40 fishers were interviewed including 12 females and 28 males. Almost all of the respondents specified that the COVID-19 pandemic resulted in a decrease in the quantity of catch, number of market channels, price of catch, level of accessibility of transportation, cost, and income.

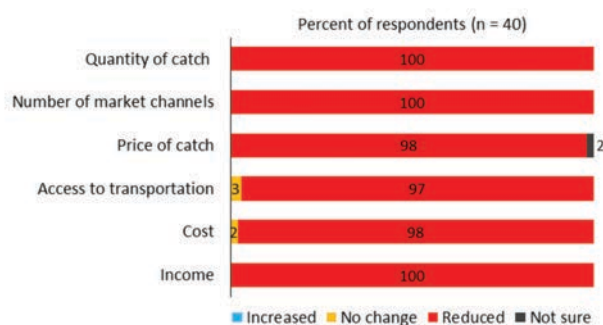


Figure 6. Impacts of COVID-19 on inland capture fisheries in Yangon Region, Myanmar

Inland aquaculture

- **Bolikhamxay Province, Lao PDR**

Bolikhamxay Province is in the central part of Lao PDR with an area of 14,083 km² and a population of 273,691. The study sites were located in three villages of Pakxan District, namely: Pakxan, Pakpeuk, and Sivilai. The cultured species for inland aquaculture are fish, frog, and shrimp with an average annual production of 5,469 t.



The total number of respondents was 28 fish farmers, comprising 20 males and 8 females. About 57% of interviewed fish farmers said that there was no change in the quantity of harvest. The reduction in the number of market channels and price of the harvest was experienced by 61% and 71% of the respondents, respectively. The access to transportation did not change for 57% of respondents, while it reduced for 43% of respondents. About 39% of respondents indicated that there was an increase in cost, while 22% of respondents specified that there was a reduction. About 64% of interviewed fish farmers had reduced income.

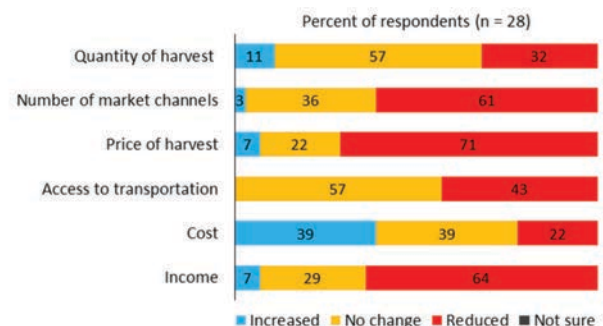


Figure 7. Impacts of COVID-19 on inland aquaculture in Bolikhamxay Province, Lao PDR

Aquatic Bank

- **Buriram Province, Thailand**

The study site in Buriram Province is located at Ban Sub Sombon Village. The village has an Aquatic Bank which was established in 2017 with support from the Department of Fisheries, Thailand. The Aquatic Bank is a natural pond that serves as the food source of the community. The fish species in the Aquatic Bank include silver barb, tilapia, giant freshwater prawn, and others.

The total number of respondents was 49 fishers composed of 32 females and 17 males. About 65% of the respondents said there was no change in the catch quantity. For the number of



market channels, 44 % said there was no change while 46 % indicated that there was a reduction. The reduction in the price of catch, access to transportation, and cost was experienced by 74 %, 69 %, and 58 % of the respondents, respectively. There was no change in the income of 74 % of the respondents. The adverse impacts of COVID-19 were not significant on the community since fishing is not the main livelihood and the catch is mainly for household consumption; and the people were able to secure their food from the Aquatic Bank.

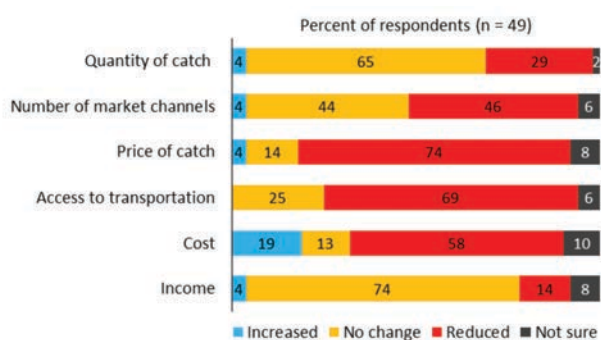


Figure 8. Impacts of COVID-19 on Aquatic Bank in Buriram Province, Thailand

Generally, an average of about 60 % of all respondents in all study sites specified that there was no change in the quantity of catch/harvest, while 45 % experienced a reduction. The reduction in the number of market channels, price of catch/harvest, and access to transportation was endured by 57–83 % of all respondents in all study sites. This reduction could be attributed to the COVID-19 lockdown and restriction measures imposed by the governments of the respective

countries where the movement of people, transportation, and other activities were limited. For the cost, 38 % of all respondents specified that there was no change while 43 % said there was a reduction. Nevertheless, the income of about 75 % of all respondents in all study sites was reduced.

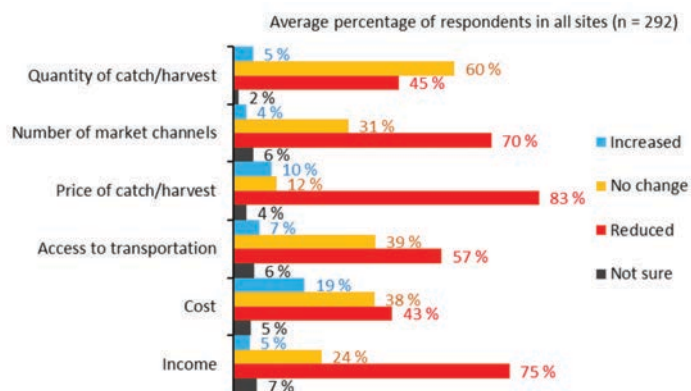


Figure 9. Impacts of COVID-19 on small-scale fisheries in selected sites in the ASEAN Member States in 2020-2021

Conclusion and Recommendations

The impacts of the COVID-19 pandemic on small-scale fishers and fish farmers in selected sites in Southeast Asia include reduction in catch and harvest, reduction in the number of marketing channels, reduction in the price of catch or harvest, reduction in access to transportation, reduced cost, and reduced income.

The reduced catch and harvest of small-scale fishers and fish farmers could result in a decrease in their income and a shortage in the supply of fish and fishery products. In order to sustain the quantity of catch and harvest, a special permit should be provided to small-scale fishers/fish farmers for them to continue fish trade activities in markets during curfew/lockdown. Furthermore, the provision of subsistence supplies or allowance, building the capacity to engage in other marketing strategies (e.g. online marketing), and promoting the expansion of market channels (e.g. online market, special market) would mitigate the impacts of COVID-19 on small-scale fishers and fish farmers.

The consequence of the reduction in the number of marketing channels would be a decrease in the income of small-scale fishers and fish farmers. Thus, it is recommended to promote other market channels such as online markets, enhance the skills in preserving the freshness of fish and fishery products, and promote fish processing to develop value-added fish and fishery products.

The reduction in the price of catch or harvest would decrease the income of small-scale fishers and fish farmers. Therefore, the development of value-added fish and fishery products should be promoted to increase the price.

Although a reduction in cost is a positive impact, it was because the catch and harvest were reduced which resulted in a decrease in the income of small-scale fishers and fish farmers. Promoting other marketing strategies such as online selling as well as enhancing the skills in preserving the freshness of fish and fishery products are necessary.

Due to the reduction in access to transportation, the number of market channels and income of small-scale fishers and fish farmers could also decrease. It is recommended to promote other marketing strategies such as online selling as well as enhance the skills in preserving the freshness of fish and fishery products.

The decreased income of small-scale fish and fish farmers could force them to spend their savings and loan money which could bring about stress to their families. The promotion of other marketing strategies such as online selling as well as enhancement of the skills in preserving the freshness of fish and fishery products are recommended. Moreover, enhancing the accessibility to microfinance services would augment the incomes of small-scale fish and fish farmers and mitigate the impacts of COVID-19.

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Acknowledgments

We acknowledge the small-scale fishers and farmers who shared their time for interviews. Sincere thanks to the fisheries officers from the Department of Fisheries, Thailand, Department of Livestock and Fisheries in Lao PDR, Department of Fisheries in Myanmar, and Philippine Bureau of Fisheries and Aquatic Resources for providing the fisheries and aquaculture information and in data collection.

About the Authors

Ms. Jariya Sornkliang is a Fisheries Management Scientist at SEAFDEC/TD in Samut Prakan Province, Thailand (Email: jariya@seafdec.org)

Ms. Thanyalak Suasi is the Fisheries Management Section Head at SEAFDEC/TD in Samut Prakan Province, Thailand (Email: thanyalak@seafdec.org)

Ms. Rattana Tiaye is a Fisheries Management Scientist at SEAFDEC/TD in Samut Prakan Province, Thailand (Email: rattana@seafdec.org)

Understanding Gender Roles in Anguillid Eel Fisheries of Indonesia

Dina Muthmainnah, Ni Komang Suryati, Nurwanti, and Zulkarnaen Fahmi

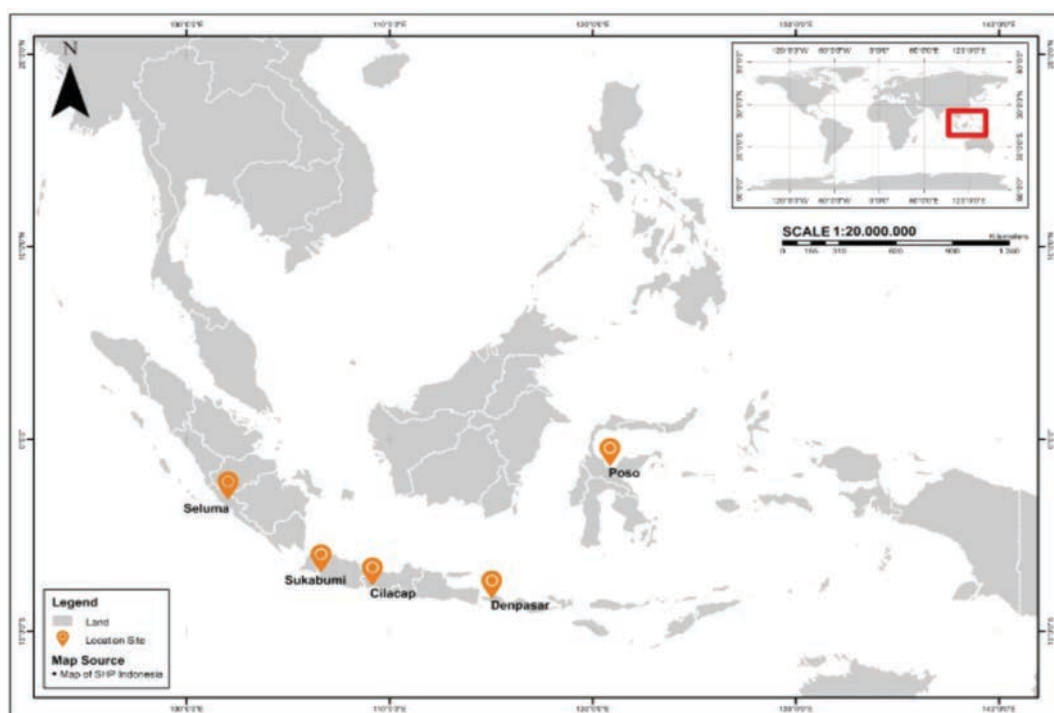
Indonesia is endowed with rich anguillid eel resources. The women are engaged in the whole fish value chain; however, their participation in eel fisheries has often been overlooked. To understand the roles of women and men in anguillid eel fisheries, SEAFDEC Inland Fishery Resources Development and Management Department (IFRDMD) conducted a series of surveys in selected sites from October to December 2021. It was found that the participation of women in anguillid eel fisheries is significant because they possess the marketing skills that can access markets and sell their products quickly which is beneficial for the family's economy.

Sustainable fisheries are important for securing food, alleviating poverty, and increasing the global economy. In small-scale fisheries and aquaculture, the situation, involvement, constraints, challenge, options, and benefits are often different between women and men. Women are limited in involvement in real economic opportunities and decision-making, ultimately restricting their potential. Nevertheless, women play a significant role in subsistence and small-scale fishery production, mainly in the primary production systems. Traditionally, fish catching received central attraction from men, who played a leading role, and female roles were dedicated primarily to fish handling, grading, and small-scale home-based processing (De Silva, 2011).

In the fisheries sector of Indonesia, more than 42 % are women who are engaged in fisheries activities (Marine Trends, 2020). However, women's participation in fisheries has been often overlooked, especially in inland fisheries where the involvement of women has not been well recorded. There is limited gender-specific data and information on fishing activities. Despite women's significant labor and economic contribution, statistics focus on male-dominated activities and not on processing and marketing where most women in the fisheries sector work.

Anguillid eels are becoming a more important food fish and the global demand has been increasing. It should be considered that women are actively engaged in the anguillid eel value chain. Therefore, stakeholders must be aware of the need to manage the resources for the sustainability of eel fisheries.

In this regard, SEAFDEC Inland Fishery Resources Development and Management Department (IFRDMD) conducted a gender analysis of anguillid eel fisheries of Indonesia from October to December 2021. The Study was under the project "Sustainable Utilization of Anguillid Eels in the Southeast Asia Region" implemented in 2020–2022 with support from the Japan Trust VI Phase 2. The study areas were in Seluma Regency in Bengkulu Province, Sukabumi Regency



Study sites for the gender analysis on anguillid eel fisheries of Indonesia

in West Java Province, Cilacap Regency in Central Java Province, Denpasar City in Bali Province, and Poso Regency in Central Sulawesi Province. The data were collected through interviews. Moreover, IFRDMD delivered presentations about gender. The roles of women and men in different eel fishery activities were described based on the gender analysis framework which is composed of an activity profile, access and control profile, and factors and trends.

Role of women and men in anguillid eel fishery

• Seluma Regency, Bengkulu Province

In Seluma Regency, Bengkulu Province, the two species of anguillid eels include *A. bicolor bicolor* and *A. marmorata*. Yellow eels are captured by using PVC traps in the middle

Table 1. Gender roles in anguillid eel fisheries in Seluma Regency, Bengkulu Province, Indonesia

Eel fishery activity	Activity profile	Access and control profile	Factors and trends
Capture	<ul style="list-style-type: none"> Men dominate in capture fishing, while women play a significant part in fish handling, trading, and processing No children are engaged in fishing activities Fishing activities are done in the Riak Siabun River and Jenggalu River 	<ul style="list-style-type: none"> Women play important roles as fishing partners with men, but women's works are still limited Men's works are oriented toward extensive or medium-scale commercial activities, while women do small-scale activities 	<ul style="list-style-type: none"> Women's involvement in fishing activities is slightly augmented
Trading	<ul style="list-style-type: none"> Women dominate the small-scale fish trade Women involve in making decisions on selling and buying fish Women know the value of the different sizes of anguillid eels more than men 	<ul style="list-style-type: none"> Women have more responsibilities in fish marketing including making decisions on buying and selling fish and involving in buying and selling activities 	<ul style="list-style-type: none"> Women dominate fish marketing and trading activities more than fishing

Activity profile

- Mainly focuses on what women and men (adults, children, and elders) do, and where and when these activities take place
- Usually considers all categories of activities; namely: productive, reproductive, and community-related services

Access and control profile

- Clarify who has access to and control of resources, and decision-making
- Considers productive resources such as land, equipment, labor, capital and credit, education, and training
- Differentiates between access to a resource and control over decisions regarding its allocation and use
- Examines the extent to which women are impeded from participating equitably in projects

Factors and trends

- Discusses how activity, access, and control patterns are shaped by structural factors (demographic, economic, legal, and institutional) and by culture, religion, and attitude
- Considers the structural and sociocultural factors that influence the gender patterns of activity
- Factors are described below demographic factors, general economic conditions, cultural and religious factors, and education levels and gender participation rates

Gender analysis framework (De Silva, 2011)



Interview with women and men on fishing gear and eel value chain in Sukabumi Regency, West Java Province, Indonesia

basin of rivers and swamps (Suryati *et al.*, 2018). The gender roles in anguillid eel fisheries are shown in **Table 1**.

• **Sukabumi Regency, West Java Province**

Glass eels are captured only in Palabuhan Ratu, Sukabumi Regency, West Java Province, which are abundant from October to March with a peak occurring in January. The capture activity is carried out from the evening to midnight between September and December. While eels for consumption are usually caught in April–September by lift net. The anguillid eel resource in Sukabumi Regency is in good condition since the fishers sustainably manage the resource by using environment-friendly fishing gear such as scoop nets to capture glass eels in the river mouth and elvers in the river. Moreover, meeting the market demand for glass eels for the development of eel aquaculture has recently resulted in the shift of procuring eel seeds from capture fisheries to cultured eels. Nevertheless, success in eel aquaculture still remains largely dependent on the availability of seeds that rely heavily on nature. The eel fishery system in Sukabumi Regency has been in existence for decades but still requires proper management for the sustainability of the eel resources. **Table 2** shows the gender roles in anguillid eel fisheries.

• **Cilacap Regency, Central Java Province**

While in Cilacap District, elvers and yellow eels are mainly caught from October to November using scoop net or PVC traps. A traditional drinking industry in Cilacap Regency supports disadvantaged women to sustain their livelihoods as they were trained to oversee marketing and sales which included setting up shops at food fairs and markets. Gender roles in eel fisheries are described in **Table 3**.

• **Denpasar City, Bali Province**

In Bali Province, the local people buy anguillid eels as ornamental fish for the Hindu religious ceremony. In the eel fishery in Denpasar City, women are involved as collectors. They connect the fishers with the buyers. One of their tasks is handling and grading the anguillid eel from the water tank. Moreover, they set up the retail price of the fish (**Table 4**).

• **Poso Regency, Central Sulawesi Province**

The glass eels, elvers, and yellow eels in Poso Regency are mainly caught from July to August by fyke nets or barrier traps. Since women know the value of the different sizes of anguillid eels more than men, women dominate the small-scale fish trade and make the decisions on selling and buying fish (**Table 5**).

Table 2. Gender roles in anguillid eel fisheries in Sukabumi Regency, West Java Province, Indonesia

Eel fishery activity	Activity profile	Access and control profile	Factors and trends
Capture	<ul style="list-style-type: none"> Men are the main actor in capture fishing, while women play a significant part in fish handling and trading Some women capture glass eels using the scoop net in the river mouth No children are engaged in fishing activities Fishing activities are done in the Cimandiri River 	<ul style="list-style-type: none"> Women play important roles as fishing partners with men, but women's works are still limited Men's works are oriented toward extensive or medium-scale commercial activities, while women do small-scale activities 	<ul style="list-style-type: none"> Women's involvement in fishing activities is slightly augmented
Marketing	<ul style="list-style-type: none"> Women dominate in marketing including making decisions on selling and buying fish, especially glass eels 	<ul style="list-style-type: none"> Women have more responsibilities in fish marketing including making decisions on buying and selling fish as well as involving in buying and selling activities 	<ul style="list-style-type: none"> Women dominate in fish marketing more than fishing
Financial management, decision making, and planning	<ul style="list-style-type: none"> Women have the responsibility of keeping the money earned from fishing activities and aquaculture Based on Indonesian culture, wives control the money of the family including spending and saving Both men and women do fishing and fish growing techniques, but men do heavier work 	<ul style="list-style-type: none"> Both men and women have equal rights to access/borrow money in the family 	<ul style="list-style-type: none"> Women dominate in the bookkeeping of money

Table 3. Gender roles in anguillid eel fisheries in Cilacap Regency, Central Java Province, Indonesia

Eel fishery activity	Activity profile	Access and control profile	Factors and trends
Capture	<ul style="list-style-type: none"> Men are the main actor in capture fishing, while women play a significant part in fish handling, trading, and processing No children are engaged in fishing activities Fishing activity is carried out in the Serayu River and its tributaries 	<ul style="list-style-type: none"> Women are the fishing partners of men Women do little work in fishing Men do medium or large-scale, and more visible and commercially oriented activities Women are involved in the small-scale, subsistence, and non-commercial sectors 	<ul style="list-style-type: none"> Women's involvement is relatively increased in fishing activities
Aquaculture	<ul style="list-style-type: none"> Mostly men plan the aquaculture activities Mostly men dominate in the decision-making of ponds and culture species Mostly men are engaged in seed rearing, seed nursery, fingerling releasing, and harvesting Mostly women are involved in feed preparation and keeping the water quality 	<ul style="list-style-type: none"> Men have more access to and control of resources Women prefer to be involved more in aquaculture Women have low participation in decision-making in the fisheries management process 	<ul style="list-style-type: none"> Women dominate in fish feeding and keeping the water quality of ponds
Marketing	<ul style="list-style-type: none"> Women dominate in marketing including making decisions on selling and buying fish 	<ul style="list-style-type: none"> Women have more responsibilities in fish marketing including making decisions on buying and selling fish as well as involving in buying and selling activities 	<ul style="list-style-type: none"> Women dominate in fish marketing than in fishing
Processing	<ul style="list-style-type: none"> Women dominate fish processing activity Women play a role in the processing work, mainly small-scale or family fish processing Women with children work together but they have greater responsibilities in ingredient preparation, fish cleaning and drying, and marketing 	<ul style="list-style-type: none"> Women prefer to work in fish processing work; nonetheless, both women and men are working together 	<ul style="list-style-type: none"> Women dominate in fish processing
Financial management, decision making, and planning	<ul style="list-style-type: none"> Women have the responsibility of keeping the money earned from fishing activities and aquaculture Based on Indonesian culture, wives control the money of the family including spending and saving Both men and women do fishing and fish growing techniques, but men do heavier work 	<ul style="list-style-type: none"> Both men and women have equal rights to access/borrow money in the family 	<ul style="list-style-type: none"> Women dominate in the bookkeeping of money

Table 4. Gender roles in anguillid eel fisheries in Denpasar City, Bali Province, Indonesia

Eel fishery activity	Activity profile	Access and control profile	Factors and trends
Trading	<ul style="list-style-type: none"> Women dominate the small-scale fish trade Women involve in making decisions on selling and buying fish Women know the value of the different sizes of anguillid eels more than men 	<ul style="list-style-type: none"> Women have more responsibilities in fish marketing including making decisions on buying and selling fish and involving in buying and selling activities 	<ul style="list-style-type: none"> Women dominate fish marketing and trading activities more than fishing



Presentation of gender issues in fisheries and gender analysis of the anguillid eel fishers in Cilacap Regency, Central Java Province, Indonesia

Table 5. Gender roles in anguillid eel fisheries in Poso Regency, Central Sulawesi Province, Indonesia

Eel fishery activity	Activity profile	Access and control profile	Factors and trends
Trading	<ul style="list-style-type: none"> • Women dominate the small-scale fish trade • Women involve in making decisions on selling and buying fish • Women know the value of the different sizes of anguillid eels more than men 	<ul style="list-style-type: none"> • Women have more responsibilities in fish marketing including making decisions on buying and selling fish and involving in buying and selling activities 	<ul style="list-style-type: none"> • Women dominate fish marketing and trading activities more than fishing



Women as eel collectors in Denpasar City, Bali Province

Conclusion and Recommendations

The participation of women in anguillid eel fisheries is significant. Nevertheless, there is a need to improve their knowledge and skills in modern techniques for capturing, culturing, processing, and marketing. The marketing skills of women should be improved to sustain their livelihoods and income. Better tools and skills in the marketing of fish and fishery products should be developed to address the barriers that women face in entering markets. One intervention is enhancing access to information and communication technologies such as radios, mobile phones, and television regarding updated information on fish prices, banking services, and new fishing technologies.

Moreover, the gender roles in anguillid eel fisheries in Indonesia could be strengthened by enhancing the ability (*e.g.* selling skills) of women to access markets, promoting equal access and rights in the utilization of eel fish resources, and adapting to local wisdom that recognizes men (leading actor) as a partner and not as competitors with women, and women are not considered as supplementary actors in the management and utilization of eel.

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About the Authors

Dr. Dina Muthmainnah is the Special Departmental Coordinator of SEAFDEC/IFRDMD, and a senior policy analyst of Research Institute for Inland Fisheries and Extension, Ministry of Marine Affairs and Fisheries, Indonesia.

Ms. Ni Komang Suryati is the Head of Fishery, Limnology, and Resource Enhancement of SEAFDEC/IFRDMD, and a policy analyst of Research Institute for Inland Fisheries and Extension, Ministry of Marine Affairs and Fisheries, Indonesia.

Ms. Nurwanti is the Head of Administration and Financial Section of SEAFDEC/IFRDMD, and Fishery Extension Coordinator of Research Institute for Inland Fisheries and Extension, Ministry of Marine Affairs and Fisheries, Indonesia.

Mr. Zulkarnaen Fahmi is the Chief of SEAFDEC/IFRDMD and Head of Research Institute for Inland Fisheries and Extension, Ministry of Marine Affairs and Fisheries, Indonesia.

Advancing Innovative and Sustainable Food Production: urban aquaponics in the Philippines

Joseph Christopher Rayos, Elymi-AR-J Subang-Tuñacao, Imelda Calixto, and Angelica Rose Lopez

During the COVID-19 pandemic, people were looking for ways to utilize their time while they were compelled to stay at the four corners of their homes. Some dedicated their time to recreation while others spent it on livelihood. Aquaponics has become one of the emerging trends that not only served as a source of income but also contributed to food production and improvement in the well-being of the people. The project “Urban Aquaponics” under the “Plant, Plant, Plant Program” of the Department of Agriculture (DA) was launched in 2020 by the Bureau of Fisheries and Aquatic Resources (BFAR) to address the growing need for sustainable food production during the COVID-19 pandemic. The DA-BFAR conducted a social cost-benefit analysis to assess the costs and benefits of Urban Aquaponics taking into account its social impacts. The social cost-benefit analysis was applied to the small-scale model and large-scale model. In addition, the risks including threats, trade-offs, and opportunity costs were also identified.

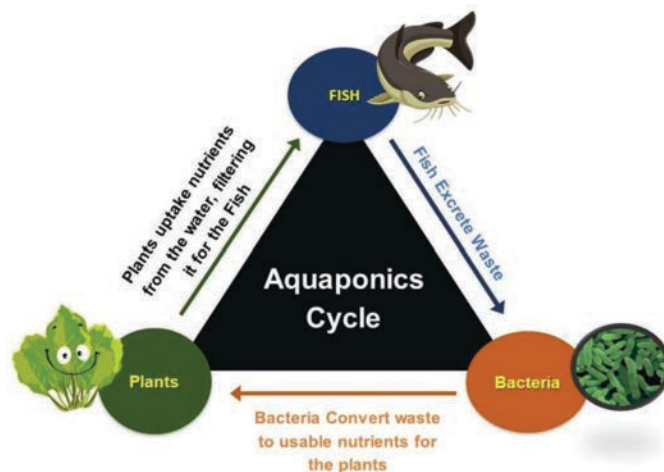


Figure 1. Aquaponics cycle

Geponics vs Aquaponics

Geponics or traditional farming refers to the utilization of soil in the cultivation of plants. This farming method is practiced by many Filipinos as the Philippines is considered an agricultural country with vast land areas. But with the rapid population growth and urbanization, land areas are being converted for residential and commercial purposes. Consequently, traditional farming brought adverse effects such as water inefficiency, high land requirements, high nutrient consumption, and soil erosion (Alshrouf, 2017).

On the other hand, aquaponics is a sustainable food production system that combines traditional aquaculture (raising aquatic animals in tanks) with hydroponics (cultivating plants in water) in a symbiotic environment (FAO, 2022). This technology does not require soil to grow plants as it uses water as its growing medium. Through the ecological cycle of reusing the nutrients of the fish feed and waste for plant cultivation, the production of food through aquaponics is considered highly efficient (Konig *et al.*, 2016). A large amount of water is conserved and efficiency is observed. Further, the cost of inputs is reduced as synthetic and commercial fertilizer is omitted with the use of fish waste as an organic fertilizer for the plants. With this, the growing problem in geponics is addressed through aquaponics. **Figure 1** shows the cycle of an aquaponic system where fish and plants simultaneously grow.

Urban Aquaponics

In the Philippines, the increased rate of urbanization and scarcity of land area in the metro call for the need for sustainable ways to utilize limited spaces. Under the “Plant, Plant, Plant Program” of the Department of Agriculture (DA), the project “Urban Aquaponics” was launched in 2020 by the Bureau of Fisheries and Aquatic Resources (BFAR) to address the growing need for sustainable food production during the COVID-19 pandemic utilizing a minimal space such as in a household backyard (Rayos and Tuñacao, 2021). Moreover, the Project was intended to introduce a cost-efficient urban aquaculture technology using a solar-powered aquaponics system to ensure food security and give access to clean and healthy food while augmenting the income of urban communities. Since launching the Project, the different regional offices of DA-BFAR have developed several models of aquaponic systems and distributed them to local government units, research institutions, academe, and non-government organizations all over the Philippines.

Social cost-benefit analysis

Since Urban Aquaponics is one of the new development projects implemented by the Government of the Philippines, the DA-BFAR conducted a social cost-benefit analysis in 2020 to assess the costs and benefits of Urban Aquaponics taking into account its social impacts. As an extension of economic cost-benefit analysis, the social cost-benefit analysis was applied to determine the personal or private and social or external effects which are intangible impacts on the society and environment. In addition, the risks including threats,

trade-offs, and opportunity costs were also identified. The small-scale model (Model 1) (Figure 2) developed by DA-BFAR Central Office and the large-scale model (Model 2) (Figure 3) developed by DA-BFAR National Capital Region were used in this study.

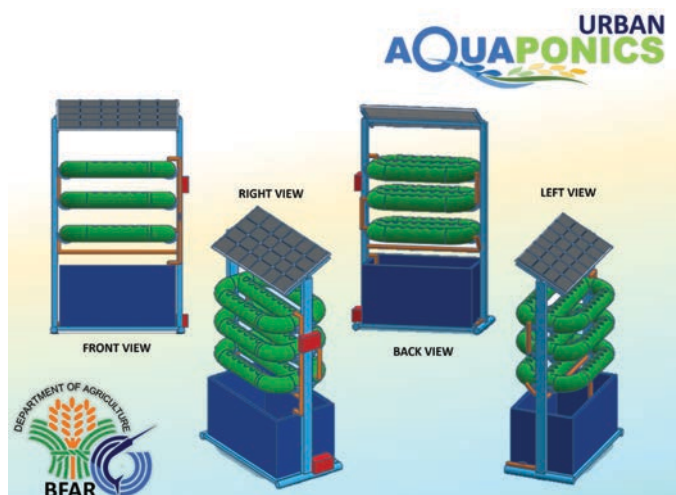


Figure 2. Urban Aquaponics Model 1: small-scale aquaponic system developed by DA-BFAR Central Office



Figure 3. Urban Aquaponics Model 2: large-scale aquaponic unit developed by the DA-BFAR National Capital Region

Model 1 is popularly known as “Isdayan ni Ani at Kita: Munting Palaisdaan at Gulayan sa Syudad” (Small-scale Fishpond and Vegetable Garden in the City). Its fiberglass tank could withstand different weather conditions and other elements. The vertical design of the aquaponic unit is space-saving which is efficient for household backyards. The water

pump of Model 1 is using green energy via a solar panel which is movable and can be set to face the direction of the sun. For Model 2, the tank is made of framed canvas while the grow beds are made of PVC pipes with holes to hold the plants. The pump of Model 2 is powered by solar panels and it is also designed to use electricity as an alternative source of energy. In conducting the social cost-benefit analysis of Urban Aquaponics based on technical assumptions, the costs and benefits were identified and measured in terms of monetary value. The assumed commodities for Model 1 and Model 2 were catfish and lettuce. Catfish are vigorous and able to survive adverse conditions in aquaponics (Mamat *et al.*, 2016), while lettuce has greater economic value compared to other vegetable greens in terms of yearly crop, diverse production structures, and diversity (Suslow *et al.*, 2003).

The fixed cost of an aquaponic unit includes materials and labor. While the inputs such as fish, feeds, and plants are considered variable costs. The annual net income was determined by subtracting the variable cost from the annual gross income. To assess the profitability of an aquaponic unit, the return on investment (ROI) was measured by dividing the annual net income by the fixed cost. Furthermore, the payback period which is the number of years required to recuperate the initial investment was calculated by dividing the fixed cost by the annual net income.

Social Costs and Benefits

The fixed cost, variable cost, and annual net income were lower for Model 1 compared to Model 2 considering the size, materials, and other inputs. Nevertheless, both Model 1 and Model 2 were found to be profitable for having a positive ROI of 26.54 % and 24.41 %, respectively (Table 1). This indicated that the computed benefits or revenues exceeded the total costs incurred. With this, a household that decides to invest in Urban Aquaponics will gain profits. The revenue generated from the products sold may then be used as an additional budget and be utilized by the household to buy their basic needs. The proceeds may also be saved by the family for future and emergency use.

Besides, the payback period or the time that the investment is recovered for both Model 1 and Model 2 is less than four years. The initial investment costs spent on building an aquaponic unit could be eventually recovered in a short period. This implies that for the succeeding years, the household will only focus on investing for the production cost of the next culture period. With this, a positive cash flow will be obtained in the succeeding years and more profits will be gained while there is also enough supply of fish and vegetables for household consumption.

Table 1. Cost and return analysis

	Urban Aquaponics Model 1 (Small-scale)	Urban Aquaponics Model 2 (Large-scale)
Tank material	Fiberglass	Framed Canvas
Tank Size (height × length × width)	1.0 m × 0.7 m × 0.7 m	2.0 m × 3.0 m × 1.0 m
Stocking density	Catfish: 75 Lettuce: 54	Catfish: 700 Lettuce: 100
Culture period (no. of days/crop)	Catfish: 120 Lettuce: 30	Catfish: 120 Lettuce: 30
Annual net income (PHP)	9,556	23,800
Return on investment (%)	26.54	24.41
Payback period (no. of years)	3.77	3.79

It is also worth noting that the expected fish production from Model 1 is greater than the fish production from a pond culture. Depending on the design, the stocking rate in Urban Aquaponics ranges from 50 to 80 fish per m². In conventional pond culture, the stocking rate is 3–12 fish/m². This shows that investing in Urban Aquaponics would yield greater profits compared to growing in pond culture. In addition, vegetables are also cultivated in an aquaponic unit, unlike in pond culture which focuses entirely on fish culture. Thus, there would be more harvested produce or commodity readily available for consumption and livelihood in Urban Aquaponics.

• **Personal or private effects**

The owner of an aquaponic unit could gain personal or private effects from culturing to harvesting fish and vegetables. One is the health benefits since the farmed fish and plant commodities are safe and good quality sources of nutrients as no harmful fertilizer is used in aquaponics. Besides, managing an aquaponic unit may also be considered a simple exercise. Since the unit is built vertically, the owners tend to extend their arms to reach up the vegetables in the pipes and bend their knees when monitoring, cleaning, and harvesting the fish in the tank. These basic bodily movements may help improve the owners’ flexibility and agility.

The financial gains that could be obtained from Urban Aquaponics include the income that may be generated by selling the excess fish and vegetables grown in the backyard and

Urban Aquaponics could also enhance family bonding. In carrying out the simple aquaponics process only, all household members including children and elderlies could enjoy together culturing and harvesting the fish and vegetables. Then, they can cook and eat the produce together and have a nice chat or celebration at home. Moreover, the whole family could also help each other in doing business. Each family member could be assigned in doing different tasks in the production, harvesting, processing, and marketing of fresh,

cooked, or processed fish and vegetables. With this, the bond, cooperation, and teamwork are strengthened in the family.

Apart from food security and income generation, Urban Aquaponics could maintain good mental health. The COVID-19 pandemic has brought stress to people due to the restrictions on in-person gatherings and conventional assemblies to avoid social movement and prevent the spread of the virus (Tee *et al.*, 2020). But with Urban Aquaponics, the owners could make their free time at home healthy and productive as they divert and focus their attention on taking care of the fish and cultivating the plants.

• **Social or external effects**

With regard to social or external benefits, Urban Aquaponics could indirectly affect the society. For instance, when a household decides to sell their excess produce, the people around them could have easy access to food as they opt to buy the produce from Urban Aquaponics. Instead of going to the local markets, people do not need to go far to buy food and their exposure to COVID-19 is minimized.

In addition, Urban Aquaponics also brings environmental benefits because of its closed-loop system. The waste of the fish provides nutrients for the vegetable and in turn, the water from the fish tank is filtered and cleaned. Through the utilization of the waste, the use of commercial fertilizer is eliminated and water is conserved.

• **Risks**

Adverse weather conditions may depreciate an aquaponic unit and degrade its performance. Also, the fluctuation of market prices may affect the projected profits. Further, Urban Aquaponics management requires technical knowledge concerning the installation and management of a unit. An aquaponic unit may not function to its full potential and lead to unfavorable results if not properly installed and maintained. For example, if the pipes are not properly aligned, water

may stagnate, accumulate, and become a breeding ground for mosquitoes. This could cause threats to health such as dengue fever.

The trade-offs in investing in Urban Aquaponics that need to be considered are money, time, and space. The money spent on buying an aquaponic unit may have been spent on home appliances or saved in the bank. The time spent in maintaining an aquaponic unit may have been spent doing other recreational activities. Lastly, the space where the aquaponic unit is installed may have been utilized as storage of household materials or an area for small business endeavors.

The opportunity cost in investing in Urban Aquaponics is putting up a “sari-sari” store, a small community variety shop, on the land where an aquaponic unit is installed. In the Philippines, “sari-sari” stores are considered the backbone of the community due to their accessibility to basic household goods. A study made by Velasco (2014) revealed that 75 % of the total generated sales of a particular global food company were gained from “sari-sari” stores. Although “sari-sari” stores are conventional and profitable microbusinesses in the country, it is worth noting that innovations such as Urban Aquaponics are worth the try considering the potential socioeconomic benefits.

Conclusion

The findings from the social cost-benefit analysis of the two small-scale models of Urban Aquaponics are essential as these will help people decide to invest in Urban Aquaponics, especially when there is a need for action to address food security, health safety, and income opportunity while the world is still facing a pandemic. The results from the social cost-benefit analysis showed that the benefits outweighed the costs and risks of investing in Urban Aquaponics. Specifically, Model 1 and Model 2 are profitable and will further yield profits after the investment costs have been recovered in the succeeding years.

From its official launch in 2020, the Urban Aquaponics project of the DA-BFAR has been categorized as a national program where national and regional focal persons were designated through the Fisheries Office Order No. 174, series of 2020. The focal persons could be reached for inquiries or requests for assistance about the management of Urban Aquaponics. The support provided by DA-BFAR including the donation of aquaponic units and the provision of training and seminars would help the beneficiaries reduce start-up costs and effectively manage their aquaponic units. With this, the beneficiaries will only need to invest in production costs in operating their aquaponic units at home.

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Acknowledgments

The authors appreciate the support and management of DA-BFAR and the Philippine National Fisheries Research and Development Institute (NFRDI) to conduct the study on aquaponics.

About the Authors

Dr. Joseph Christopher C. Rayos is the Chief Science Research Specialist of the National Fisheries Research and Development Institute in Quezon City, Philippines. He can be reached at josephrayosphd@gmail.com.

Ms. Elymi-AR-J Subang-Tuñacao is the Chief of the Inland Fisheries and Aquaculture Division of the Bureau of Fisheries and Aquatic Resources - Central Office in Quezon City, Philippines.

Ms. Imelda Calixto is the Supervising Aquaculturist of the Inland Fisheries and Aquaculture Division of the Bureau of Fisheries and Aquatic Resources - Central Office in Quezon City, Philippines.

Ms. Angelica Rose Lopez is a Technical Staff of the Inland Fisheries and Aquaculture Division of the Bureau of Fisheries and Aquatic Resources - Central Office in Quezon City, Philippines.

Guide to Contributing Articles

Fish for the People is a policy-oriented Special Publication produced by the Southeast Asian Fisheries Development Center (SEAFDEC). The first issue of the Special Publication was launched in early 2003 to commemorate the first anniversary of the ASEAN-SEAFDEC Conference on Sustainable Fisheries for Food Security in the New Millennium: "Fish for the People" organized in 2001 from which the Special Publication got its banner title *Fish for the People*. Through the years, *Fish for the People* has been recognized by various stakeholders as a significant source of information to support their works on the sustainable development and management of fisheries and aquaculture in the region. The SEAFDEC Secretariat publishes three issues of the Special Publication each year with support from the Japanese Trust Fund. The publication of articles in *Fish for the People* is free of charge.

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CALENDAR OF EVENTS

Date	Mode/Venue	Event	Organizer
2022			
23-24 August	Online	7 th Meeting of Scientific Working Group on Neritic Tunas Stock Assessment in the Southeast Asian Region	SEAFDEC/MFRDMD
23-24 August	Pattaya, Thailand	Regional Workshop on Monitoring, Control and Surveillance for Combating IUU Fishing in Southeast Asia	SEAFDEC/TD
23-26 August	Pattaya, Thailand	2 nd Regional Technical Consultation on Fishery Statistics and Information in Southeast Asia	SEAFDEC Secretariat
12-17 September	Samut Prakan, Thailand	Regional Training Course on Fisheries Management Tools for Ecosystem Approach to Fisheries Management (EAFM)	SEAFDEC/TD
13-15 September	Sumut Prakan, Thailand	Regional Training on Port State Measures Inspection in Focus of Shipping Container for Fish and Fisheries Product	SEAFDEC/TD
19-28 September	Iloilo, Philippines	Training Course on Mangrove Crab Nursery and Grow-out Operations	SEAFDEC/AQD
20-29 September	Samut Prakan and Rayong Provinces, Thailand	Regional Training Workshop on Gender Mainstreaming in Small-scale Fisheries and Aquaculture in Southeast Asia	SEAFDEC Secretariat & TD
28-29 September	Online meeting	2 nd Core Expert Meeting on Fisheries Management Strategies for Pelagic Fish Resources in the Southeast Asian Region	SEAFDEC/MFRDMD
2-6 October	Kuala Terengganu, Malaysia	Regional Training and Workshop on Chondrichthyan Taxonomy, Biology and Data Collection	SEAFDEC/MFRDMD
17-19 October	Bangkok, Thailand	1 st Meeting of the Regional Scientific and Technical Committee(RSTC) for the Project Implementing the Strategic Action Programme for the South China Sea and Gulf of Thailand (SCS SAP Project)	SEAFDEC/TD/SCS project
18 October	Samut Prakan, Thailand	Smart Infrastructure for the Mekong Closeout Workshop	SEAFDEC/TD/US-DOI Project
7-11 November	Samut Prakan, Thailand	Training Course on Ecosystem Approach to Fisheries Management for Mekong River Fisheries Community	SEAFDEC/TD
7-21 November	Rizal, Philippines	Training Course on Community-based Freshwater Aquaculture for Remote Rural Areas of Southeast Asia	SEAFDEC/AQD
8-10 November	Jakarta, Indonesia	7 th Meeting of the Regional Scientific and Technical Committee (RSTC7) for the Project Establishment and Operation of a Regional System of Fisheries <i>Refugia</i> in the South China Sea and Gulf of Thailand (Fisheries Refugia Project)	SEAFDEC/TD/Fisheries <i>refugia</i> project
9 November	Online	FAO Workshop on Fisheries Data Collection and Statistics (Global)	FAO
14-25 November	Panama City, Panama	19 th Meeting of the Conference of the Parties of the Convention on International Trade in Endangered Species of Wild Fauna and Flora	CITES
15-27 November	Samut Prakan, Thailand	Regional Training Course on Fish Larvae Phase I: Larval Identification and Early Life History of Marine Fishes	SEAFDEC/TD
22-24 November	Australia (and online)	15 th RPOA-IUU Coordination Committee Meeting	RPOA-IUU Secretariat
26-27 November	Thailand	Regional Training Course on Fish Larvae Phase I: Larval Fish Identification and Fish Early Life History Science	SEAFDEC/TD/ <i>Refugia</i> Project
28 Nov-3 Dec	Samut Prakan, Thailand	Regional Training Course on Fish Larvae Phase II: Determining Spawning-nursing Ground and Season Using Larvae Survey Result	SEAFDEC/TD
29 November	Kayu Agung, Indonesia	Workshop of Manual Guidelines for Remodelling of Swamp Fisheries: Conservation Area	SEAFDEC/IFRDMD
29-30 November	Thailand	Regional Workshop to Exchange Information on Catch Documentation Scheme and Traceability of Fish and Fishery Products	SEAFDEC/TD
5-7 December	Iloilo, Philippines	45 th Meeting of SEAFDEC Program Committee	SEAFDEC Secretariat & AQD
6-9 December	Samut Prakan, Thailand	Regional Practical Training Course on Geographic Information System and Remote Sensing for Aquaculture	SEAFDEC/TD
8-9 December	Iloilo, Philippines	25 th Meeting of the Fisheries Consultative Group of the ASEAN-SEAFDEC Strategic Partnership (FCG/ASSP)	SEAFDEC Secretariat
12 December	Rome, Italy	6 th Meeting of the Global Record Working Group	FAO
13-14 December	Rome, Italy	3 rd Meeting of the PSMA Technical Working Group on Information Exchange	FAO

Southeast Asian Fisheries Development Center (SEAFDEC)

What is SEAFDEC?

SEAFDEC is an autonomous intergovernmental body established as a regional treaty organization in 1967 to promote sustainable fisheries development in Southeast Asia. SEAFDEC currently comprises 11 Member Countries: Brunei Darussalam, Cambodia, Indonesia, Japan, Lao PDR, Malaysia, Myanmar, Philippines, Singapore, Thailand, and Viet Nam.

Vision

Sustainable management and development of fisheries and aquaculture to contribute to food security, poverty alleviation and livelihood of people in the Southeast Asian region

Mission

To promote and facilitate concerted actions among the Member Countries to ensure the sustainability of fisheries and aquaculture in Southeast Asia through:

- i. Research and development in fisheries, aquaculture, post-harvest, processing, and marketing of fish and fisheries products, socio-economy and ecosystem to provide reliable scientific data and information.
- ii. Formulation and provision of policy guidelines based on the available scientific data and information, local knowledge, regional consultations and prevailing international measures.
- iii. Technology transfer and capacity building to enhance the capacity of Member Countries in the application of technologies, and implementation of fisheries policies and management tools for the sustainable utilization of fishery resources and aquaculture.
- iv. Monitoring and evaluation of the implementation of the regional fisheries policies and management frameworks adopted under the ASEAN-SEAFDEC collaborative mechanism, and the emerging international fisheries-related issues including their impacts on fisheries, food security and socio-economics of the region.



Secretariat



TD



MFRD



AQD



MFRDMD



IFRDMD

SEAFDEC Addresses

Secretariat

P.O. Box 1046
Kasetsart Post Office
Bangkok 10903
Thailand
Tel: (66-2) 940-6326
Fax: (66-2) 940-6336
E-mail: secretariat@seafdec.org
<http://www.seafdec.org>

Training Department (TD)

P.O. Box 97
Phrasamutchedi
Samut Prakan 10290
Thailand
Tel: (66-2) 425-6100
Fax: (66-2) 425-6110 to 11
E-mail: td@seafdec.org
<http://www.seafdec.or.th>

Marine Fisheries Research Department (MFRD)

52, Jurong Gateway Road,
#14-01, Singapore 608550
Tel: (65) 9046-4787
Fax: (65) 6334-1831
E-mail: Ong_Yihang@sfa.gov.sg
<http://www.seafdec.org>

Aquaculture Department (AQD)

Main Office:
5021 Tigbauan, Iloilo, Philippines
Tel: +63 33 330 7000
Fax: +63 33 330 7002

Manila Office:
Room 100-E, Ground Floor
Philippine Social Science Center (PSSC)
Commonwealth Avenue, Diliman
1101 Quezon City, Philippines
Tel & Fax: +63 2 8927 7825
E-mail: aqdchief@seafdec.org.ph
<http://www.seafdec.org.ph>

Marine Fishery Resources Development and Management Department (MFRDMD)

Taman Perikanan Chendering,
21080 Kuala Terengganu, Malaysia
Tel: (609) 617-5940
Fax: (609) 617-5136
E-mail: mfrdmd@seafdec.org.my
<http://www.seafdec.org.my>

Inland Fishery Resources Development and Management Department (IFRDMD)

Jl. Gub. HA. Bastari No.08
RT.29 RW.27 Kel. Silaberanti
Kec. Seberang Ulu I, Jakabaring, Palembang 30252
Sumatera Selatan, Indonesia
Tel: +627115649600; Fax: +627115649601
E-mail: ifrdmd@seafdec.id
<http://www.seafdec.id>



The third prize winner, *Maneerat Charoenphon*, from the national drawing contest in Thailand

National Drawing Contests were organized in all ASEAN-SEAFDEC Member Countries as part of the preparatory process for the ASEAN-SEAFDEC Conference on Sustainable Fisheries for Food Security Towards 2020 "Fish for the People 2020: Adaptation to a Changing Environment" held by ASEAN and SEAFDEC in June 2011 in Bangkok, Thailand, in order to create awareness on the importance of fisheries for food security and well-being of people in the region.