

# Revitalizing Boeung Tonle Chhmar in Tonle Sap Lake, Cambodia through ecosystem approach to fisheries management and co-management

JTF 6-2 Pillar III.  
Promotion of sustainable  
development of inland  
fisheries in Southeast Asia

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SEAFDEC/TD has long promoted the concepts of ecosystem approach to fisheries management (EAFM) and co-management, particularly for coastal small-scale fisheries, across the SEAFDEC Member Countries. These approaches aim to achieve sustainable development by balancing ecological well-being with human well-being and enhancing the governance framework through decision-making processes and stakeholders' participation. For inland fisheries, Tonle Sap Lake in Cambodia was selected as the pilot site for the first application of EAFM and co-management in inland fisheries due to its unique and dynamic ecosystem. Supporting one of the most productive freshwater fisheries, Tonle Sap Lake plays a significant role in the livelihoods of local communities. The lessons learned from applying inland EAFM and co-management will contribute to developing scalable and replicable models for inland fisheries management in other areas.

Regarding the Resolution and Plan of Action on Sustainable Fisheries for Food Security for the ASEAN Region Towards 2030 (RES&POA-2030) on Resolution No. 6, POA No. 14 and 15 emphasize implementing effective management and promoting co-management to improve social and economic benefits to all stakeholders. Also, POA No. 70 recommends strengthening best practices that enhance fish processing, handling, and marketing in small-scale fisheries. In this regard, SEAFDEC/TD implemented the project "Small-scale Fisheries Management for Better Livelihood and Fisheries Resources" to strengthen human capability in support of the implementation of the FAO Voluntary Guidelines for Securing Sustainable Small-scale Fisheries in the Context of Food Security and Poverty Eradication or SSF Guidelines by promoting EAFM and co-management to improve livelihood and well-being of small-scale fishers. The Project was supported by the Japanese Trust Fund 6-2 and implemented in 2020-2024.

Inland fisheries in Cambodia, particularly in the Tonle Sap, are vital to the country's food security, livelihoods, and economy. Tonle Sap is the largest lake in Southeast Asia with a surface area of around 11,000 km<sup>2</sup> in the wet season and 2,500 km<sup>2</sup> in the dry season and the water depth is from 1 m to 10 m varying between dry and wet seasons (Keskinen, 2003). The lake's unique hydrology, with its seasonal flood-pulse system, creates a rich and diverse ecosystem that supports a wide variety of fish species (MRC, 2010). During the rainy season, the Tonle Sap River reverses its flow, expanding the lake and flooding surrounding areas, which becomes a breeding ground for fish. This seasonal flood cycle is crucial for maintaining fish populations and providing a bountiful catch for local communities. It is one of the most productive inland fisheries in the world producing more than 500,000 t of fish annually (Masha, 2023).

Fishing in Tonle Sap is a way of life for many Cambodians with an estimated 1.5 million people wherein about 900,000 live in the floating villages in Tonle Sap rely on their income and daily consumption on the fishery resources (Johnstone *et al.*, 2013). Keskinen (2003) indicated that 20 % of households in Tonle Sap do fishing while 29 % are engaged in related fishing activities such as culture, selling, and processing (Johnstone *et al.*, 2013). The main fish species in the Tonle Sap Lake are categorized into black fish (residents), white fish (migrants), and grey fish (opportunists). Black fish include Channidae (snakeheads), Clariidae, and Bagridae (*Mystus* spp.) which can survive in low-oxygen environments. White fish species are composed of pangasiids, notoedris, and cyprinids. For grey fish, *trey riel* is the most common species which is mainly used for making fish paste and fish sauce as well as feed for aquaculture (Meynell, 2019).

However, the fishery in Tonle Sap Lake faces challenges including the decline in water levels or drought during the dry season. Other threats include upstream rice farming in, increase of outsider fishers, illegal fishing methods, water hyacinth proliferation, and extreme weather such as heavy rainfall causing flash floods (Meynell, 2019).

Inland fishery management is complex and differs significantly from marine fisheries due to the unique characteristics of inland water bodies, such as shallow waters and drought. Additionally, inland fisheries are directly impacted by pesticide use, pollution, and various human activities on land which are beyond the responsibility and authority of the fisheries sector. Therefore, effective management requires the involvement of a broad range of stakeholders, including those outside the fisheries sector. For example, the irrigation department plays a crucial role in managing water resources, which directly affects fish habitats. Similarly, land and water development sectors influence the quality and availability of water in inland areas. These stakeholders can/ help address issues such as water allocation, pollution control, and habitat conservation, which are essential for sustaining inland fisheries.

## Application of EAFM and co-management in inland fisheries

The ecosystem approach to fisheries management (EAFM) is a concept that adopts a holistic perspective, considering not only the catch of targeted species but also the broader ecosystem dynamics and impacts. Furthermore, EAFM also balances human well-being with ecological well-being which aims to promote sustainable fisheries, conserve biodiversity, support livelihoods, conserve the health of ecosystems, and good governance for present and future generations. The EAFM concept has been successfully applied in several Southeast Asian countries. In Thailand, the EAFM was introduced to Ban Nai Nang community in 2017 involving key stakeholders to develop the EAFM plan and share responsibility in implementing the plan. The EAFM plan focused on restoring marine resources, improving livelihoods, and promoting sustainable fisheries. After the implementation of EAFM in 2019, mangroves and seagrass beds were restored, the abundance of aquatic animals increased, community participation was enhanced, and economic benefits were derived from alternative livelihoods and ecotourism. The key factors contributing to this success were strong community leadership, dedicated efforts, and stakeholder involvement (Department of Fisheries Thailand, 2024). Moreover, Philippines recently developed its National Plan of Action for Small-scale Fisheries (NPOA-SSF) for 2024–2035 which considered the concept of EAFM and aims to sustain and provide equitable access to small-scale fisheries by involving government and non-government agencies engaging six fisher leaders of each region in the consultation workshops empowering fishers to be resilient and dignified (Bureau of Fisheries and Aquatic Resources, 2024).

Concurrently, co-management is a partnership approach where government and resource users share the responsibility and authority in managing a fishery or area which has been practiced for several years in many countries. SEAFDEC/TD promoted co-management in SEAFDEC Member Countries including in Nam Xouang Reservoir in Lao PDR where cooperation was fostered among fishery officers and fishers and their wives to conserve and monitor the resources in the reservoir. Since the promotion of co-management in 2017, the well-being of fishers improved by building their capacity in fish processing which helped them gain additional income (Rattana *et al.*, 2023).

Although the EAFM concept was originally created for coastal and marine fisheries, applying the EAFM concept with co-management was deemed to be an effective management approach for inland fisheries. The EAFM together with co-management seeks to foster inclusive governance structures that empower communities to participate in the management and conservation of their fishery resources by engaging local communities, government authorities, and key stakeholders in collaborative decision-making processes.

In 2016, SEAFDEC/TD introduced the EAFM concept in Cambodia by conducting the Essential EAFM (E-EAFM) Training Course as well as Training of Trainers for EAFM for the fishery officers in Cambodia. After the series of trainings, the EAFM core team in Cambodia was established. From then on, the Fisheries Administration (FiA) of Cambodia applied the EAFM concept with co-management to enhance the capacity of the local officers and communities for sustainable fishery management and to improve local livelihood in inland fishing communities.

With technical support from SEAFDEC/TD, FiA Cambodia performed the EAFM process based on the three phases of adaptive management, namely: plan, do, and check and improve. The startup step is carried out before commencing the plan phase, which is preparing the ground and engaging stakeholders. The plan phase aims to define and scope the fisheries management unit (FMU), identify and prioritize the goals, and develop an EAFM plan with goals, objectives, indicators, and management actions. Next, the do phase focuses on formalizing the EAFM plan by engaging several stakeholders to implement the EAFM plan. The check and improve phase involves the monitoring and evaluation of the indicators and management actions.

- **Startup**

For the startup, the key stakeholders and fisheries management unit (FMU) were identified. In 2021, several meetings were conducted with the officials from FiA Cambodia, the EAFM core team in Cambodia, and key stakeholders including the FAO, UNESCO, and SEAFDEC/TD to select the FMU. FMU is a defined area of the ecosystem and fisheries managed under the EAFM plan including ecological and geographic boundaries, stakeholders, and management objectives. The FMU should be multispecies, multigear (if catching the same species and/or conflicts between them occur), and multijurisdictional (if different jurisdictions involved). The FMU and geographic area chosen for the EAFM plan should be considered in four dimensions including ecological, socioeconomic, political/governance, and temporal. Finally, FMU should be scoped and profiled to consolidate relevant background information to be the baseline for EAFM planning and future monitoring and evaluation (SEAFDEC, 2019).

The 208.53 km<sup>2</sup> area of Boeung Tonle Chhmar (BTC) was selected to be the FMU, which is a wetland area in Kampong Thom Province (**Figure 1**). BTC serves one of the three areas in the Tonle Sap Biosphere Reserve, a vital habitat for various fish species, birds, mammals, and other wildlife contributing to the rich biodiversity of Tonle Sap Lake (Meynell, 2019). The livelihood of the local community, particularly fishers, depend heavily on this ecosystem. Therefore, effective management of BTC is important to enhance environmental sustainability, biodiversity conservation, and the livelihoods of the local people.

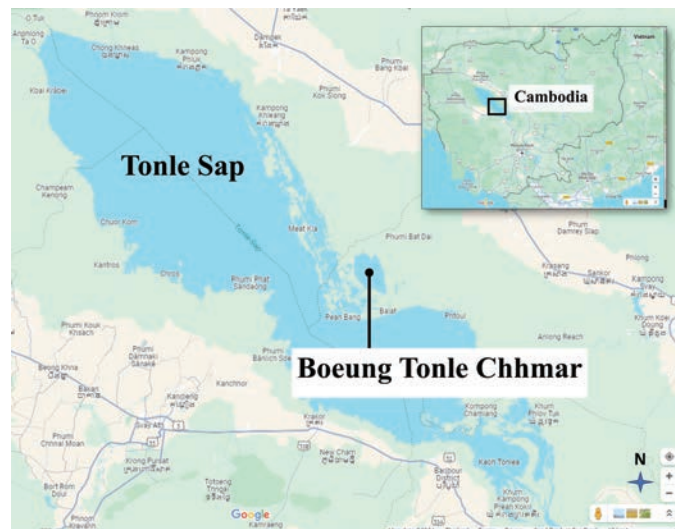


Figure 1. Boeung Tonle Chhmar is one of the three areas in the Tonle Sap Biosphere Reserve



Inland fishing community in Boeung Tonle Chhmar in Tonle Sap, Cambodia

- **Plan phase**

In the plan phase, SEAFDEC/TD organized the first meeting in November 2021 to define and scope the FMU. The meeting was attended by the EAFM core team and key stakeholders. The key stakeholders comprised the members

of the community fisheries; fishers; government officers from Kampong Thom Provincial Department of Environment and Kampong Thom Provincial Department of Agriculture, Forestry and Fisheries; IUCN; UNESCO; Akphivath Neary Khmer Organization (ANKO), Fisheries Action Coalition Team (FACT), and BTC Committee. The BTC Committee was established by the Provincial Governor of Kampong Thom which was composed of the District Governors and Commune Chiefs from the three villages around BTC. The stakeholders agreed that the coverage of the FMU shall include the entire area of BTC as well as the areas of the Community Fisheries (Cfi) of Pov Veuy Community Fisheries, Doun Sdeung Community Fisheries, and Peam Bang Community Fisheries, as well as the Protected Area managed by the Balot Village (**Figure 2**).

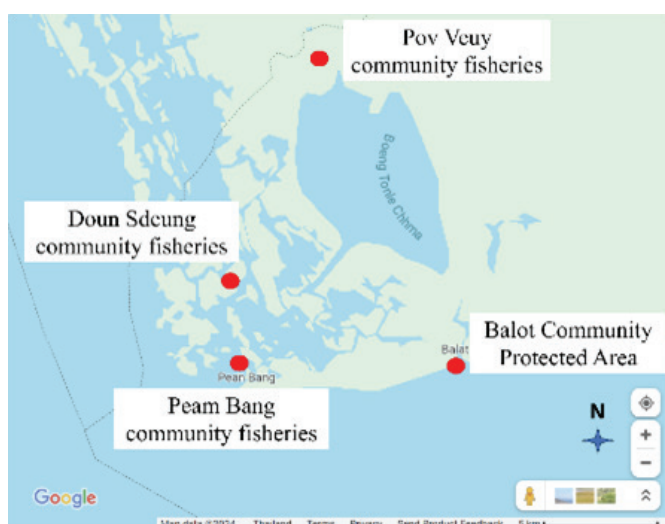


Figure 2. The FMU in Boeung Tonle Chhmar, Tonle Sap Lake in Cambodia

The problems and issues of BTC were identified and categorized into ecological, governance, and human dimensions. For ecological well-being, the issues were degrading habitats as well as shallow water and draught. Regarding governance, the issues were illegal fishing, limited understanding of local people of the importance of the ecosystem, and limited cooperation among relevant stakeholders. Besides, the conflict between the locals and outsiders also needed to be addressed. In terms of human well-being, the issues included low household income and lack of clean water. Subsequently, SEAFDEC/TD organized two meetings in December 2021 to draft the EAFM plan by setting the goals, objectives, indicators, benchmarks, and management actions. Then, a workshop was conducted in July 2022 to revisit and improve the draft EAFM plan. The final meeting was conducted in November 2022 to finalize the EAFM Plan. The summary of the EAFM plan for BTC is shown in **Table 1**.



Field visit of key stakeholders to Tonle Sap to define and scope the fisheries management unit



Table 1. EAFM plan for Boeung Tonle Chhmar

Ecological well-being			
Goal	Boeung Tonle Chhmar restored and protected		
Problems	Degradation of fish habitat such as shallow water and drought	Declining population of fish broodstock	
Objectives	Improve and protect the core fish habitat	Protect fish broodstock	
Indicators	<ol style="list-style-type: none"> <li>1. Size (ha) of flooded forest</li> <li>2. Number of cases of forest fire per year</li> <li>3. Survival rate of flooded forest replanted trees</li> </ol>	<ol style="list-style-type: none"> <li>1. Number of areas with fish broodstock</li> <li>2. Size of each area with fish broodstock</li> <li>3. Survival rate of fish broodstock during the dry season</li> </ol>	
Management actions	<ol style="list-style-type: none"> <li>1. Prevent flooded forest fires and encroachment through awareness-raising activities</li> <li>2. Replant flooded forest trees and protect the replanted trees</li> </ol>	<ol style="list-style-type: none"> <li>1. Deepen the water pools to maintain broodstock during the dry season</li> <li>2. Install marking poles to identify the water level of deep pools</li> <li>3. Organize consultations between fishers and farmers to balance water use for fisheries and agriculture</li> </ol>	
Governance			
Goal	Sustainable management of fishery resources		
Problems	Illegal fishing gear and other illegal activities and weak law enforcement	Limited understanding of the importance of a healthy ecosystem among the local people and authorities	Limited cooperation among relevant stakeholders
Objectives	Reduce the use of illegal fishing gear and the occurrence of illegal activities and strengthen the law enforcement	Increase the awareness of the importance of a healthy ecosystem among the local people and authorities	Establish a local coordination committee
Indicators	Number of illegal cases detected during patrolling	Number of community members participating in the protection, conservation, and rehabilitation of BTC	<ol style="list-style-type: none"> <li>1. Number of meetings conducted by the local management and coordination committee</li> <li>2. Number of meetings conducted with the Commune</li> <li>3. Number of active members of the local coordination committee</li> <li>4. One integrated management plan with proposed/joint local activities in BTC</li> </ol>
Management actions	<ol style="list-style-type: none"> <li>1. Formulate a joint patrolling schedule for the integrated members of CPA, CFI, Fisheries Inspectors, and rangers</li> <li>2. Install demarcation boundary poles in conservation areas of CFI and CPA</li> </ol>	Enhance the communication dissemination on the importance of healthy ecosystems by through signboards, posters, videos, radio, TV, etc.	<ol style="list-style-type: none"> <li>1. Identify key stakeholders and coordinators and form a sub-group for the management of BTC which will be chaired by the Vice Governor of Kampong Thom</li> <li>2. Identify key activities to be supported by the sub-group members</li> </ol>
Human well-being			
Goal	Improved well-being of people		
Problems	Low income among local households	Lack of clean drinking water	
Objectives	Increase income by identifying alternative sources of income and providing relevant technical support and/or capacity-building	Ensure the availability of clean drinking water	
Indicators	Level of annual household income	Percentage of local households with access to clean drinking water	
Management actions	<ol style="list-style-type: none"> <li>1. Introduce alternative livelihoods such as aquaculture, floating vegetable plantation, and value-added products</li> <li>2. Provide technical support to build the capacity of the local households such as improving post-harvest processing to produce good quality and safe products to meet market demands</li> <li>3. Improve market access</li> </ol>	Provide additional water purification centers	

- **Do phase**

Starting in 2023, the EAFM plan has been implemented mainly by FiA of Cambodia in cooperation with relevant agencies. For ecological well-being, the FiA supported the rehabilitation of critical fish habitats and the prevention of forest fires by replanting trees in BTC. CI provided some budget support for replanting trees and has been working closely with the local community and patrolling using mobile phones. Besides, the installation of artificial reefs, repair of poles, and removal of overgrown water hyacinth in the FMU were carried out by fishery officers with the local people. Moreover, the local community recorded the daily fish catch to monitor the status of their fishing ground.

For governance, the CPA Balot cooperated with the local officers and Cfi for the monitoring, control, and surveillance (MCS) of illegal activities such as the destruction of the FMU, catching birds, and illegal fishing as well as prevention of forest fire. MCS collectively ensure compliance with fishery management measures by gathering and measuring fishing data (monitoring), establishing regulatory conditions for resource exploitation (control), and overseeing adherence to these regulations (surveillance). Furthermore, BirdLife provided budget support for the fuel for seven days per month while the FiA provided the gasoline for patrolling illegal fishing 12 times per month and patrolling facilities such as safety jackets, sleeping swings, flashlights, and conservation signboards.

For human well-being, SEAFDEC/TD cooperated with FiA, CI, and FAO to conduct the capacity building for the local communities in producing processed fish products such as smoked fish, fish paste, etc. and learning the techniques to improve post-harvest processing to meet market demands for by producing good quality and safe food products. Moreover, the ANKO also supported the patrolling, capacity building, and training on fish processing in the communities. The CI supported the establishment of the savings group for the local community to build financial security and access to low-interest loans to reduce dependence on external sources of loans. The FAO committed to support capacity building as requested by Cambodia through the Provincial Fisheries Support Specialist (PFSS). The distribution of drinking water sanitation equipment has been initiated with the target of full distribution to all households in 2028.

## Conclusion and recommendations

Some challenges were encountered during the implementation of the EAFM plan. The FMU is located in a remote area, hence, it is difficult to communicate, provide support, and follow up on the activities. Furthermore, water levels in many areas became shallow in conservation areas in Tonle Sap in 2024 due to climate change. The EAFM core team requested the government to dig the areas to deepen the water pools to



Building the capacity of the local community to implement the EAFM and co-manage Boeung Tonle Chhmar as the fisheries management unit

sustain aquatic species. There is also a need for cooperation among other sectors to maintain the availability of water in the area. Therefore, coordination is crucial among the key stakeholders to follow up on the activities with CFI. Nonetheless, it is essential to regularly check and monitor the management actions during the implementation phase using the indicators outlined in the EAFM plan. If necessary, adjustments or adaptations can be made to ensure that the objectives are achieved.

Nevertheless, the BTC was demarcated, improved, and protected. Signboards and around 1,000 poles were installed with the application of EAFM with co-management by the EAFM core team with various key stakeholders. The forest fires were prevented and people were more aware and participated. Seeds of trees were nursed and replanted to cover the empty area for more than 10 ha. Moreover, the savings

group fund supported livelihood needs and management activities. For the women processing group, the fish processing technique and food hygiene were improved and gained marketing partners that made their income increase. The CFi became more active and participated in patrolling which resulted in reduced occurrence of illegal fishing. Furthermore, the total production of inland capture fisheries in Tonle Sap including bag net fisheries in Tonle Sap, family fisheries, and small-scale rice field fisheries increased from 349,700 t in 2022 to 426,750 in 2023 (FiA, 2023).

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