

Assessing the Resilience of Small-scale Fisheries (SSF) at Ban Toh Balew Community, Koh Lanta, Thailand Through Socio-Ecological Perspectives and Community Adaptation

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Small-scale fisheries (SSF) are essential for livelihoods, food security, and cultural identity in coastal communities, yet they are increasingly threatened by climate change, declining marine resources, and socio-economic changes. This study examines the resilience and adaptive capacity of the Urak Lawoi indigenous fishing community in the Ban Toh Balew community using the Social-Ecological Systems (SES) framework. Data were collected through focus group discussions and field observations with five purposively selected key informants, and qualitative data were analyzed using thematic content analysis based on SES resilience dimensions. The findings reveal that the community is affected by declining fishery resources, coral bleaching, seagrass degradation, coastal erosion, tourism-related pollution, and restricted access to fishing grounds.

Despite these pressures, the community demonstrates strong adaptive capacity through indigenous knowledge, social cohesion, livelihood diversification, and gender-based roles. Women contribute significantly through seafood processing, household financial management, and alternative livelihoods, while men provide traditional fishing knowledge and marine resource management. Community resilience is further strengthened through cooperation with external agencies and the preservation of cultural identity. However, challenges such as resource depletion, limited market access, and reduced participation in formal governance continue to constrain resilience. The study recommends strengthening co-management, supporting marine habitat restoration, promoting gender-inclusive adaptation strategies, and enhancing community-based livelihood development to improve resilience in small-scale fisheries.

Introduction

Ban Toh Balew (**Figure 1**) is a small coastal fishing community located in Sala Dan Subdistrict, Ko Lanta District, Krabi Province, Thailand. The community is home to the Urak Lawoi, an indigenous sea nomadic ethnic group that has traditionally depended on small-scale fisheries and marine resources for their livelihoods and cultural identity. The community consists of approximately 100 households with a population of around 297 people. Fishing remains the primary occupation, although some households are also involved in tourism-related services, agriculture, and wage labor.



Figure 1. Ban Toh Balew Community, Ko Lanta District, Krabi Province, Thailand

The Urak Lawoi fishers conduct fishing activities around Koh Ha, Koh Rok, Koh Kradan, Koh Ngai, Koh Phi Phi, Koh Ma, and Koh Jum, including nearby mangrove areas and artificial reefs. Fishers own small fishing boats and use various traditional fishing gear such as fish traps (*sai pla*), squid traps, crab and shrimp gillnets, fish gillnets, spears, cast nets, and hook-and-line gear. The fish trap is considered an important part of the cultural identity of the Urak Lawoi people and has been used for generations. Fishing gear is rotated according to the season and target species, particularly during the monsoon season between June and November.

Ban Toh Balew was selected as a study site because it represents a highly vulnerable small-scale fisheries community that strongly depends on coastal and marine ecosystems. The community possesses unique traditional ecological knowledge and cultural practices while facing increasing pressures from climate change, tourism expansion, and resource degradation. The community also actively participates in fisheries and conservation activities, making it suitable for fisheries resilience and community-based management studies.

The community faces several ecological, social, cultural, and governance issues. Environmental challenges include coral bleaching, declining seagrass beds, marine pollution, and decreasing fishery resources. Socioeconomic issues include unstable livelihoods, limited income opportunities,

and restricted access to fishing grounds due to conservation zones and tourism activities. In addition, traditional fishing systems, cultural ceremonies, and the Urak Lawoi language are gradually disappearing. The community also faces challenges related to legal rights, ethnic discrimination, access to justice, and encroachment into sacred and residential areas. These issues highlight the importance of integrated fisheries resilience approaches that combine sustainable fisheries management, cultural preservation, livelihood diversification, ecosystem restoration, and inclusive governance.

Data Collection and Analysis

This study uses the Socio-Ecological Systems (SES) framework to assess resilience across ecological, governance, cultural, and socioeconomic dimensions. Insights are derived from group discussions, community narratives, and secondary sources, with a particular emphasis on local perspectives regarding challenges, strengths, and pathways for adaptation.

The SES framework (**Figure 2**) provides a holistic lens for assessing the resilience of small-scale fisheries (SSF) by recognizing the dynamic interconnections between people and the ecosystems on which they depend (Berkes *et al.*, 2003; Folke, 2006). In the case of the Ban Toh Balew community, Koh Lanta, the SES approach allows for the integration of ecological factors such as fish stocks, coral reefs, and mangroves with social dimensions, including cultural practices, local knowledge, governance structures, and livelihood strategies. By treating humans and nature as one adaptive system with feedback loops, SES helps to evaluate how communities absorb shocks, reorganize, and adapt to changing environmental and socio-economic conditions (Walker *et al.*, 2004; Ostrom, 2009). This framework is particularly useful for understanding community adaptation in SSF, as it highlights both ecological vulnerabilities and the capacity of fishers and households to innovate, diversify, and strengthen governance in the face of challenges such as climate change, resource depletion, and policy pressures (Folke *et al.*, 2010; FAO, 2015).

Rapid Rural Appraisal (RRA) was applied in this survey in the Ban Toh Balew community using a Focus Group Discussion (FGD) approach with five purposively selected key informants. The informants included the village leader, community group leaders, youth representatives, and the *Toh Mo*, the traditional spiritual leader of the Urak Lawoi community. They were selected based on their knowledge, experience, and roles in representing community leadership, traditional knowledge, fisheries livelihoods, and perspectives on climate change and community adaptation.



Figure 2. Socio-Ecological Systems (SES)
Adapted from the Social-Ecological Systems (SES) framework
(Berkes & Folke, 1998; Folke, 2006)

The study was conducted by SEAFDEC/TD in collaboration with the U.S. Department of the Interior during the training on fisheries resilience and climate adaptation held on 21–25 June 2024. The discussion framework focused on three main topics: (1) the history of the community, (2) changes affecting local livelihoods and ways of life, and (3) support from external organizations and the community's adaptive responses.

Qualitative data obtained from the FGDs (**Figure 3**) were analyzed using thematic content analysis based on the Social-Ecological Systems (SES) resilience framework. The information was categorized into key resilience dimensions, including socioeconomic conditions, environmental changes, governance, cultural adaptation, vulnerabilities, and adaptive capacities. The findings were then interpreted descriptively to explain how climate change and other stressors affect the community and how local knowledge, gender roles, and community networks contribute to resilience and adaptation.



Figure 3. Group discussion with five key informants

Survey Results of Group Discussions in Ban Toh Balew Community, Koh Lanta, Krabi Province

Historical Background of the Village

Historically, the Ban Toh Balew community originally lived in the Laem Tueng area of Ban Sala Dan before gradually relocating several times to the present settlement area. During earlier periods, community members worked in logging and charcoal production in the Bo Nae area (Khlong Lat Bo Nae). After the logging concession ended, the community permanently settled in the current location. At the same time, the sacred shrine known as San Chao Toh Balew was relocated from Bo Nae to the village to preserve the spiritual and cultural center of the community and maintain its identity as a cultural space for the Urak Lawoi people.

An important community leader is *Mr. Madee-en Chang Nam*, locally known as the *Toh Mo* (spiritual leader), who has lived in the area for more than 60 years and serves as the leader of the traditional ceremonies and spiritual practices of the sea nomad community. The Urak Lawoi community continues to maintain close cultural and spiritual connections with the sea through traditional beliefs, fishing knowledge, and local wisdom, such as weather prediction based on observing the sky, stars, wind, and sea conditions.

Cultural Changes: Lost and Remaining Traditions

The survey found that several traditional cultural practices in Ban Toh Balew (**Figure 4**) have gradually disappeared due to modernization, tourism expansion, changing livelihoods, and external influences. Lost traditions include *Wian Koh* (island rotation practice) and *Pui Ya Le* ceremonies. Traditional practices such as “rotational sea use” and “beach sleeping ceremonies” have also declined following the establishment of conservation zones and national parks that restricted access to traditional activity areas. In addition, the sharing culture and mutual support among community members have weakened due to the increasing influence of outside groups and commercialization.

However, some cultural practices remain important within the community, including *Duean Sib* ceremonies, sea spiritual beliefs, and traditional ecological knowledge, such as “reading the sky, stars, water, and wind” to predict weather and fishing conditions. The community still maintains strong spiritual ties with the sea and continues to preserve some traditional fishing practices and rituals.



Figure 4. Ban Toh Balew Community, Ko Lanta District, Krabi Province, Thailand

Fishing Activities and Fish Marketing

Fishing remains the main livelihood activity in Ban Toh Balew (**Box 1**). Fishers operate mainly during the high fishing season from November to April, while tourism and wage labor become more important during the low fishing season between May and October. The community uses various traditional fishing gears such as fish traps, squid traps, crab nets, shrimp nets, fish gillnets, spears, cast nets, and hook-and-line gear. Major economically important species include grouper, squid, shrimp, and crab.

Fish products are mainly sold through middlemen, local fish traders, and fish landing platforms such as Pae Nayok and Le Lanta. Community members expressed a strong need to establish a community fish landing center and cooperative to improve bargaining power, income distribution, and direct seafood marketing. However, they reported lacking technical knowledge and organizational capacity to establish such systems.

Box 1. Fishing gear and methods used in the Toh Balew community	
Fish Traps	Used year-round, fish traps are set near underwater rock piles or coral reefs, around 5-10 meters from the reef. The traps are left for approximately 15 days before retrieval, with each fishing boat deploying about 20 traps.
Squid Traps (Figure 5)	Squid traps are also used throughout the year. Fishers set the traps at around 2:00 PM and retrieve them in the afternoon (around 2:30 PM) to bring them back to shore, preventing damage from other fishing activities. This method is locally known as “Sai Yok.”
Crab Nets	Used seasonally from May to October, crab nets are set in the sea and retrieved the following morning. Fishing is typically conducted during slack tide (from the 5 th to the 11 th lunar day).
Shrimp Nets	Used from May to October, shrimp nets are set early in the morning. If shrimp are plentiful, fishers return in the evening; otherwise, they return around noon. Shrimp fishing is most successful during high tides (from the 12 th to the 6 th lunar day).
Cuttlefish Nets	Employed from November to February, cuttlefish nets are used early in the morning, with fishers returning in the afternoon or evening, depending on the catch. This method is most effective during high tides (from the 12 th to the 5 th lunar day).
Dry Season Fish Nets	Used from October to May, this method involves nighttime fishing. If the catch is abundant, fishers return to shore by 11:00 PM; otherwise, they stay until the next morning.
Krill Scooping	Conducted from October to December, fishers use fine-mesh nets to scoop krill along the shore. Fishing is carried out daily, depending on krill availability.
Line Fishing	Practiced from October to May, this method involves fishing near underwater rock piles or coral reefs.
Spotted Clam Harvesting	From November to March, fishers dive in deeper waters to collect spotted clams, which are abundant during this period.
Squid Jigging	Squid is caught from December to January using artificial shrimp bait while drifting in squid fishing areas.
Spearfishing	Conducted from December to March, fishers dive underwater to selectively target fish using harpoons, typically during slack tide (from the 7 th to the 11 th lunar day) when water clarity is optimal.
Hand-Harpooning	This traditional method, practiced during high tides (from the 14 th to the 5 th lunar day), focuses on subsistence fishing, leaving surplus for sale.
Tib Clam Collection	Practiced during high tides (from the 14 th to the 5 th lunar day), this method involves subsistence harvesting, with excess clams sold for income.
Cast Nets	This method can be practiced year-round and involves the use of throw nets to catch fish.

The community’s fishing methods reflect a balance between traditional practices and sustainable resource use, ensuring the long-term availability of marine resources for their livelihoods.



Figure 5. Squid trap used as an example of fishing gear documented during the survey

Ecological and Socioeconomic Changes

The community has experienced significant ecological changes, including coral bleaching, declining seagrass beds, marine pollution, and declining fishery resources. Species such as Indian mackerel, short-bodied mackerel, and hardtail scads have become increasingly scarce. Dugongs and sea turtles are also observed less frequently because of seagrass degradation and tourism impacts. Community members identified climate change, tourism expansion, wastewater discharge, marine debris, and restrictions from marine protected areas as major drivers of environmental degradation.

At the same time, socioeconomic changes include increased dependence on tourism-related employment, declining fisheries income, and livelihood uncertainty. Although tourism has created additional income opportunities, it has also increased the cost of living and reduced access to traditional fishing grounds. The establishment of Marine National Park zones limited fishing areas and traditional cultural activities. However, after the 2004 tsunami, the community gained greater visibility and received increased support from government agencies, NGOs, and academic institutions.

Community Needs

The community identified several important needs, including:

- Establishment of a community fish landing center and cooperative
- Support for seafood preservation and processing technologies
- Training in value-added seafood products and packaging
- Stronger participation in fisheries and coastal resource management
- Support for indigenous rights and culturally appropriate management policies
- Documentation and preservation of Urak Lawoi traditional knowledge and culture

Social Dimensions of Resilience in Toh Balew

Table 1 outlines the operationalization of the social dimensions of resilience in the Toh Balew (Urak Lawoi) socio-ecological system based on the six adaptive capacity domains proposed by Cinner and Barnes (2019): assets,

flexibility, social organization, learning, socio-cognitive constructs, and agency. Box 2 shows the results of the group discussions of the community’s strengths, opportunities, limitations, and external drivers.

Using the social dimensions framework, resilience in the Toh Balew socio-ecological system is supported by access to ecological and technological assets, flexible livelihood strategies that combine fishing and tourism, strong cultural and organizational structures, and learning processes that integrate traditional knowledge with modern tools. Socio-cognitive dimensions, including cultural identity and conservation attitudes, further enable adaptive responses, while agency is expressed through community engagement in governance and market systems. However, resilience is constrained by weak tenure security, erosion of intergenerational knowledge, limited infrastructure, occupational attachment to fishing, and reduced bargaining power in tourism and seafood markets. Strengthening resilience, therefore requires not only ecological management but also investments in social assets, learning institutions, governance recognition, and community empowerment.

Table 1. Social dimensions of resilience in the Toh Balew socio-ecological system

Resilience Domain	Information from Toh Balew SES	Contribution to Resilience	Key Constraints
Assets	Reefs and seagrass fisheries, GPS, weather apps, education, healthcare, market access	Supports livelihoods, safety, and market connections	Limited fish landing, cold storage, and processing facilities
Flexibility	Mixed traditional and modern fishing practices, tourism jobs, willingness to relocate if culture respected	Enhance adaptation and income diversification	Dependence on fishing and restricted fishing zones
Social organization	Fisher groups, health volunteers, support from government, NGOs, academia, Toh Mo leadership	Strengthens cooperation and resource management	Weak indigenous tenure recognition
Learning	Traditional ecological knowledge combined with scientific information and conservation awareness	Improves adaptive capacity and environmental understanding	Loss of traditional knowledge among younger generations
Socio-cognitive constructs	Strong sea-based cultural identity, Loi Ruea ritual, and positive conservation attitudes	Encourages stewardship and community cooperation	Discrimination and limited livelihood alternatives
Agency	Engagement with external organizations, demand for fish landing and processing facilities	Supports participation and proactive adaptation	Dependence on middle buyers and limited market power

Box 2. Group discussion results: strengths, opportunities, limitations, and external drivers

Strengths: • Deep traditional ecological knowledge and sustainable practices • Flexible and adaptive mindset, including openness to rules and external collaboration • Strong local leadership with extensive networks	Opportunities: • Post-tsunami recognition has enhanced access to support and resources. • Eco-tourism offers potential for cultural preservation and economic diversification. • Community solidarity remains a strong foundation for collective action.
Limitations: • Ecological restoration capacity is weak, leaving fisheries highly vulnerable to decline. • Cultural knowledge transfer is diminishing, threatening long-term identity. • Economic dependency on fisheries creates exposure to stock fluctuations and market volatility.	External drivers: • Climate change remains the most pressing factor, manifesting in stronger storms, rising sea levels, and coral bleaching. • Tourism expansion contributes both income and ecological stress, requiring regulation and sustainable planning. • National Park policies highlight the tension between biodiversity conservation and indigenous livelihood rights, emphasizing the need for co-management frameworks.

Conclusion

This study, based on qualitative discussions with selected key informants, provides valuable insights into the resilience, vulnerabilities, and adaptive capacities of the Urak Lawoi indigenous community in Ban Toh Balew Community. The results show that the community remains deeply connected to small-scale fisheries, coastal ecosystems, and traditional cultural practices, which together form the foundation of their livelihoods, identity, and social cohesion. The findings also reveal important resilience attributes, including strong traditional ecological knowledge, flexible livelihood strategies, close social networks, cultural values, and a willingness to adapt to changing environmental and socioeconomic conditions. These characteristics have enabled the community to cope with climate variability, declining fisheries resources, and rapid coastal development.

At the same time, the study highlights how multiple stressors are increasingly threatening the sustainability of both the marine ecosystem and the community's cultural identity. Climate change, coral bleaching, seagrass degradation, tourism expansion, pollution, and restricted access to traditional fishing grounds are not only affecting fishery productivity but also transforming traditional ways of life and weakening intergenerational knowledge transmission. The gradual erosion of cultural practices and indigenous knowledge systems suggests that resilience in coastal communities is closely linked not only to ecological conditions but also to cultural continuity, social inclusion,

and equitable governance. The findings further demonstrate that resilience in small-scale fisheries should be understood as a dynamic socio-ecological process rather than simply the ability to recover from environmental shocks. In the case of Ban Toh Balew, resilience is strengthened through the interaction of local knowledge, community cooperation, livelihood diversification, and external support from government agencies, academic institutions, and civil society organizations.

Women's contributions to seafood processing, household adaptation, and community networks, together with men's fishing knowledge and resource-use practices, highlight the importance of gender roles in sustaining adaptive capacity and community well-being. This study provides broader implications for fisheries management and climate adaptation in coastal and indigenous communities across Southeast Asia. It underscores the need for integrated and culturally sensitive approaches that combine sustainable fisheries management, habitat restoration, livelihood support, gender inclusion, and protection of indigenous cultural heritage. Policies that overlook local knowledge systems and customary resource-use practices may inadvertently weaken community resilience and increase vulnerability.

Therefore, participatory governance and co-management approaches that actively involve indigenous and small-scale fishing communities are essential for achieving long-term sustainability. The study also contributes to the broader discourse on social-ecological resilience by demonstrating how indigenous coastal communities can serve as important sources of local knowledge and adaptive practices in responding to environmental change. The experiences of the Ban Toh Balew community provide practical lessons for policymakers, researchers, and development practitioners seeking to strengthen resilience in small-scale fisheries under increasing climate and socioeconomic pressures. Supporting community participation, improving market opportunities and seafood value addition, preserving indigenous knowledge, and promoting equitable and culturally appropriate policies will be critical for enhancing both resilience and long-term well-being of coastal fishing communities.



Locals assist each other in cleaning mussels in Toh Balew

Recommendations for Enhancing the Resilience of the Toh Balew Fishing Community

Enhancing resilience in Ban Toh Balew requires integrated approaches that strengthen ecological sustainability, community livelihoods, cultural preservation, and participatory governance. The study results show that the Urak Lawoi community possesses strong adaptive capacity through traditional ecological knowledge, flexible attitudes, and strong community networks. However, the community continues to face challenges from climate change, declining fishery resources, tourism impacts, and restricted access to traditional fishing grounds. Therefore, resilience can be enhanced through habitat restoration, sustainable fisheries management, support for community fish landing and seafood processing facilities, promotion of eco-cultural tourism, and strengthening the participation of the community in coastal resource management and policy development. Preserving indigenous knowledge and cultural practices, while improving livelihood opportunities and collaboration with government agencies and external organizations, will support the community's long-term sustainability and well-being.

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