Implementing the Strategic Action Programme for the South China Sea and Gulf of Thailand (SCS SAP Project)

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GOOD PRACTICES ON HABITAT AND LAND-BASED POLUTION MANAGEMENT IN PARTICIPATING COUNTRIES OF THE UNEP/GEF SCS SAP PROJECT

RECENT GOOD PRACTICES ON HABITAT AND LAND-BASED POLUTION MANAGEMENT IN PARTICIPATIG COUNTRIES OF THE UNEP/GEF SCS SAP PROJECT

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Thailand 1. Integrated Marine Spatial Planning for the Chonburi Island Cluster (Koh Lan, Koh Krok, Koh Sak & Koh Sichang)

1. Context and challenges in LbP and habitat management

Until the early-2020s the four tourist islands off Chonburi Province were governed by a patchwork of sectoral statutes. Conflicting mandates between the Act on the Promotion of Marine and Coastal Resources Management **B.E. 2558 (2015)**, the Fisheries Ordinance and local tourism by-laws left coral-reef zones un-demarcated; wastewater standards varied by municipality and proved unenforceable offshore. Rapid tourism growth—**700–900 Sea-Walker visitors day-¹ at Koh Lan alone**—combined with untreated grey water and plastic leakage pushed fecal-coliform counts and turbidity beyond Class-III thresholds, while **coral cover at Koh Lan fell to 30 % in some bays** during 2020-2022.

Moreover, the provincial budget covered barely **60 patrol-days a year** and lacked funds for systematic monitoring. Without a harmonised spatial plan, resorts expanded onto vegetated headlands, and speed-boat lanes crossed over living reefs, aggravating anchor damage and sediment re-suspension. The situation underscored the need for an integrated Marine Spatial Planning (MSP) regime with stable financing and clear legal authority.

2. Policies, regulations and/or supporting financial mechanism reformed

2.1 MSP concept and Thailand's policy framework

Marine Spatial Planning (MSP) is defined by UNESCO-IOC as "a public process of analysing and allocating the spatial and temporal distribution of human activities in marine areas to achieve ecological, economic and social objectives that are usually specified through a political process." In the Thai context, MSP functions as **"blue zoning"**—the ocean-side analogue of town planning—co-ordinating fisheries, tourism, navigation, conservation and pollution control through a single, legally-binding map.

Thailand's authority for MSP stems from **Section 22 of the Marine & Coastal Resources Management Promotion Act B.E. 2558 (2015)**, which mandates provincial governors, with ONEP and DMCR support, to draft marine spatial plans for their coastal waters. A **Cabinet Resolution (25 December 2018)** endorsed a National Policy on Sea-Use Allocation, followed by the **Marine Spatial Planning Master Plan 2021-2030** approved in June 2021. National targets include: protecting **≥ 20 % of coral reefs and seagrass beds** as no-take zones, ensuring commercial navigation lanes avoid critical habitats, and embedding user-pay instruments (tourist conservation fees, pollution levies) in provincial finances.

DMCR's **Guideline MAR/MPSP-22-01 (2022)** codifies a seven-step MSP cycle—scoping, baseline diagnostics, stakeholder visioning, spatial optimisation, legal integration, financing architecture and adaptive management—mirroring UNESCO-IOC practice and fully consistent with the SCS SAP Results Framework. The Chonburi Island Cluster MSP is the first provincial plan to complete all seven steps, thus providing a "test-bench" for roll-out to the Andaman coast and Gulf provinces.

2.2 From concept to enforceable plan—how the MSP cycle unfolded

To translate SCS SAP principles into practice, Chonburi followed a **seven-step MSP cycle** drawn from UNESCO-IOC guidelines and refined by Thailand's Marine and Coastal Resources Department (DMCR):

Scoping & legal mandate. Cabinet Resolution 19/2566 (2023) authorized Chonburi to prepare a provincial MSP under Section 22 of the Marine & Coastal Resources Act. A Terms-of-Reference matrix clarified responsibilities among DMCR, ONEP, Department of Fisheries and the provincial governor.

Baseline data & diagnostics. Using SCS SAP funds, survey teams fused high-resolution LiDAR bathymetry with the CR1 and CR2 coral-reef datasets and 14 months of AIS vessel tracks. All layers were uploaded to a participatory GIS (PGIS) platform for live display during community meetings.

Stakeholder visioning & trade-off mapping. Six multilingual workshops used the SeaSketch crowdsourcing tool to let fishers, resort operators and village councils draw "no-go", "must-have" and "flex" areas directly on a large touch-screen. The exercise logged 312 geotagged comments, building social legitimacy around zoning proposals.

Spatial analysis & scenario testing. Technical staff ran Marxan optimisation to test biodiversity targets (15 %, 20 %, 25 % reef no-take) against tourism revenue and fishing effort. The compromise 25 % no-take scenario delivered the conservation objective while retaining 87 % of baseline fishing income.

Legal integration & institutionalisation. The preferred zoning map was annexed verbatim (GIS coordinates) to a Ministerial Notification and mirrored in identical municipal by-laws, ensuring any enforcement officer could act under the same map. The dormant Chonburi Provincial Marine & Coastal Resources Committee was restructured—now legally recognised as the MSP authority and meeting quarterly.

Financing architecture. A ring-fenced Coastal Conservation & MSP Fund (Provincial Order 282/2566) draws revenue from a THB 40 e-conservation fee embedded in every ferry e-ticket (PromptPay gateway), a 5 % eco-levy on Marine Park entry tickets and 50 % of pollution fines. By Q2 2025 the Fund held THB 43.7 million, financing 90 % of patrol and monitoring costs.

Monitoring, evaluation & adaptive management. Patrol teams log incidents with the SMART Mobile app; data stream to a public MSP Geo-Portal (ESRI ArcGIS Online) hosted by MCRO Zone 2. Quarterly "reef-health scorecards" combine coral cover, turbidity and fee-revenue metrics, triggering adaptive actions such as re-marking boat lanes before peak tourism.

3. Impacts of reforms to management effectiveness

Ecological condition has stabilized or improved. Monitoring in 2024-25 shows ≥ 70 % coral cover categorised as 'good' across 70 ha at Koh Lan and Koh Krok, while Koh Sichang's reefs shifted from 'moderate' (43 % live cover) to 'good' (50 % live cover) within 18 months.

Pollution reduction. Average in-situ turbidity at main snorkelling sites dropped from 6.1 NTU (2023) to 3.5 NTU (2025); fecal coliforms declined 48 % following mandatory MBR adoption and grey-water inspections.

Compliance & enforcement. Unified by-laws enabled joint patrols (marine police + DMCR + volunteer guardians) totalling 312 patrol-days in 2024, a five-fold increase over 2022; 27 cases of illegal dredging and unlicensed gear progressed to prosecution with a 74 % conviction rate.

Financial sustainability. The MSP Fund's fee-collection system achieved a 94 % payment rate among tourists; interest earnings alone financed replacement of 22 reef-safe moorings, eliminating anchor damage in two bays.

Livelihood diversification. Eco-tourism operators recorded a 22 % increase in revenue from guided reef trails, while women's groups secured small grants to market low-impact night-kayak tours tied to MSP zones.

4. Lessons learnt

Nested legislation matters. Embedding MSP zones in both ministerial notification and municipal by-laws closed long-standing jurisdiction gaps and empowered on-the-ground enforcement.

Ring-fenced, multi-source funds build resilience. Combining tourist fees, levies and fine-sharing insulated core MSP operations from annual budget cycles.

Open data drives accountability. The real-time MSP Geo-Portal spurred public reporting; complaints logged via the portal fell 35 % after patrol heat maps were published.

Gender & youth mainstreaming enhance uptake. Women-led SMEs and school reef-ambassador programmes anchored conservation benefits in local livelihoods.

Adaptive co-management. Quarterly committee reviews used monitoring data to adjust boat-lane markers before the holiday peak, preventing reef collisions.

6. Sources & contact information

CR2 – Report on coral-reef management effectiveness, Koh Lan – Koh Krok – Koh Sak (DMCR 2024)

CR1 – Report on coral-reef management effectiveness, Koh Sichang (DMCR 2024)

Chonburi Provincial Order 282/2566 on Coastal Conservation Fund (2024)

MSP Geo-Portal dashboard analytics (MCRO Zone 2, accessed June 2025)

Contact: Marine & Coastal Resources Office 2 – Chonburi (mcro2@dmcr.go.th)

7. Pictures:

https://www.flickr.com/photos/200594494@N02/

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Thailand 2: Scaling-Up Locally Managed Marine Areas (LMMAs) in Thailand: National Policy Framework and Community Empowerment

1. Context and challenges

Before 2023, Thailand's coastal governance relied on sectoral laws that lacked explicit community co-management provisions. The Marine & Coastal Resources Act B.E. 2558 (2015), Fisheries Act, Forestry Act and Local Administration Act assigned overlapping mandates, resulting in:

Regulatory fragmentation: Multiple agencies enforcing incompatible regulations led to confusion over jurisdiction and inconsistent penalties.

Low community participation: Villages had no formal legal channel to influence marine resource management or secure enforcement support.

Funding constraints: Provincial budgets covered only minimal patrols and reactive interventions; no user-fee or community-based financing mechanisms existed.

Data scarcity: Absence of coordinated baseline surveys for mangroves, seagrass and coral reefs hampered evidence-based decision making.

These gaps hindered effective control of land-based pollution—from aquaculture effluent to plastic waste—and undermined sustainable habitat use.

2. Policies, regulations and supporting financial mechanisms reformed

Between 2023 and 2025, Thailand moved decisively to institutionalize LMMAs through legislative activation, operational guidelines, financing instruments and spatial planning alignment:

2.1 Activation of Sections 16–18, Marine & Coastal Resources Act (2023)

Section 16 – Coastal Stewardship Framework. Established a national mandate for co-management agreements between DMCR, provincial governors, local administrations and community groups. Pilots in Rayong and Chonburi provinces demonstrated the model, with Ban Don Bay formalizing its first Memorandum of Understanding (MoU) on 12 March 2024, defining shared roles in patrols, monitoring and dispute resolution.

Section 17 – Community By-Laws. Empowered communities to draft enforceable regulations on resource use, gear restrictions and pollution controls. Three coastal municipalities (Phang-nga, Trat and Surat Thani) enacted harmonized by-laws by late 2023, specifying no-take zones, water-quality standards and waste-management protocols; Ban Don sub-district passed its by-law on 25 November 2023, restricting shellfish racks in mapped seagrass meadows.

Section 18 – Legal Registration of LMMAs. Provided a formal registration process at DMCR headquarters. By Q1 2025, 15 communities had lodged registration dossiers, with 10 approved to date, including Ban Don Bay (registered 8 February 2025) and Koh Yao Noi (approved 22 April 2025).

2.2 National LMMA Guideline MAR-LMMA-01 (2023)

Standardized establishment protocols. The guideline delineates eight steps—from stakeholder mapping and resource assessment to MoU drafting and by-law enactment—complete with timelines and responsibilities. Chon Buri and Pattani provinces used the templates to fast-track LMMA set-up, reducing planning time from 9 to 4 months.

Model documentation. Includes ready-to-use Memorandum of Agreement, community by-law drafts and user-fee charters. The Trat Provincial Office reported a 40 % decline in drafting errors when using the model templates versus previous ad-hoc formats.

Monitoring & reporting templates. Prescribes SMART indicators—patrol-days, infractions logged, habitat-health metrics—that feed into the national LMMA dashboard. By June 2025, 22 sites submitted quarterly reports through the standard format, enabling comparative analysis across sites.

2.3. Financial Mechanism: Coastal Conservation Fund Expansion (2024)

Ring-fenced LMMA funding. Each coastal province instructed to create a dedicated fund, seeded with an initial tranche from the provincial Environment Fund (THB 10–20 million). Chonburi led the way, allocating THB 25 million in June 2024; Trat followed with THB 12 million in September 2024.

User-fee integration. Visitor fees (THB 20 per head in Trat, THB 40 in Chonburi) and vessel levies (THB 50–100 per boat) were embedded into municipal tourism billing systems. Ban Don Bay piloted a THB 20 conservation fee at Don Sak Pier, generating THB 1.2 million in its first 10 months.

Revenue-sharing agreements. Policy mandates that 70 % of fund inflows support LMMA patrols and restoration, 20 % for community training and 10 % for operational overhead. Provinces report on fund disbursement quarterly to DMCR, ensuring transparency and trust.

2.4. Integration into National MSP Master Plan (2021–2030)

LMMA as a formal management category. Amendment proposals in early 2025 incorporated LMMAs alongside Marine Protected Areas and Marine Economic Zones, clarifying their legal status within the spatial planning hierarchy.

Zoning alignment. Provincial MSP maps for Chonburi, Rayong and Satun now overlay LMMA boundaries to prevent conflicting uses (e.g., aquaculture, tourism) and streamline enforcement by a single integrated authority.

Data interoperability. LMMA boundaries and monitoring data were layered into the MSP Geo-Portal by Q2 2025, allowing thematic queries (e.g., pollution incidents within 500 m of an LMMA) and cross-sectoral planning.

3. Impacts of reforms to management effectiveness

By Q2 2025, national uptake and measurable outcomes include:

Rapid adoption: 27 LMMAs registered across six coastal provinces, covering > 9,000 ha of mangroves, seagrass and coral habitats.

Enhanced enforcement: Co-managed patrols logged 1,240 patrol-days in 2024, up from < 300 in 2022; prosecution rates for illegal clearance and discharge improved from 12 % to 68 %.

Community engagement: Over 4,500 Marine Conservation Volunteers (MCVs) trained; 92 % retention rate and high satisfaction scores (> 4.3/5).

Ecological recovery: LMMA pilot sites reported average canopy cover gains of 10 % in mangroves and 25 % increases in seagrass shoot density within one year.

Sustainable financing: Coastal Conservation Funds collectively hold THB 85 million across provinces, covering 75 % of annual LMMA operational costs.

4. Lessons learnt

Legal clarity drives uptake: Clear statutory provisions in Sections 16–18 reduced ambiguity and accelerated community registration.

Standardized guidelines ensure consistency: National MAR-LMMA-01 templates facilitated comparable LMMA frameworks across provinces.

Community financing builds ownership: Ring-fenced funds and transparent fee mechanisms strengthened local investment in enforcement and restoration.

MSP integration prevents overlap: Embedding LMMAs in the MSP plan minimized conflicts with marine park zones and navigation corridors.

Continuous capacity building is vital: Ongoing training and peer-learning networks maintained high volunteer engagement.

5. Sources & contacts

Marine & Coastal Resources Promotion Act B.E. 2558 (2015), Sections 16–18.

DMCR Guideline MAR-LMMA-01: Establishment and Management of LMMAs (2023).

SCS SAP PCA Progress Report Q2 2025 – Thailand.

Global Compact Thailand news: 30×30 commitment and OECM policy advances

Contact: DMCR Community Management Division – community@dmcr.go.th

Compiled by Suwimol Sereepaowong, NC-SCS SAP Thailand

China 1: Established a multi-stakeholder marine litter governance system that involves fishing vessels into litter collection efforts in Hainan Province, China

1. Context and challenges:

Marine plastic pollution is a severe challenge that the world faces. The entities responsible for marine litter management remain relatively limited, and the methods and strategies of marine litter governance are still inadequate. This is particularly evident in the lack of effective collection for marine litter. Hainan has been actively exploring and implementing a marine plastic waste cleanup mechanism. By engaging fishermen and other social groups, efforts have been made to remove plastic waste of marine environment. Consequently, a multi-stakeholder governance system for marine litter has been established, characterized by fishermen as the primary actors, with active support from local communities, fishery port management and sanitation authorities, and robust promotion by the media.

2. Multi-stakeholder marine litter governance mechanism reformed:

First, conducting comprehensive surveys to identify pilot fishing ports. Visting all fishing ports in Hainan to observe and study the operational methods of major fishing port docks, the current status of litter management, and the willingness of fishermen to engage in cleaning the sea, so as to evaluate the feasibility of project implementation. Aa a result, the first batch of demonstration fishing ports for the "fishing vessels collecting litter" pilot program are identified.

Second, coordinating key working nodes and establishing a operational working chain. Selecting influential local fishermen as the first batch volunteers for the "fishing vessel collecting litter " programme. Engaging sanitation workers familiar with fishermen's production and lifestyle to handle plastic waste brought ashore by fishermen, clearly defining storage locations and transferring procedures. After fishermen collect and sort marine plastic waste, sanitation workers weigh and record the collected waste. And then, the recyclable portion is processed for recycling and reuse by local recycling entities, while the non-recyclable portion is managed and disposed through the sanitation system. The tools utilized for collecting and storing marine plastic waste are returned to fishermen for reuse. Thereby, forming an operational working chain that includes fishermen - fishing vessels - fishing ports - plastic recycling and utilization.

Third, establishing an incentive mechanism to ensure the long-term sustainability of the "fishing vessels collecting litter" initiative. The pilot project of "fishing vessels collecting litter" has established an incentive mechanism aimed at enhancing fishermen's enthusiasm and recognition of the program. A points-based system has been introduced to evaluate fishermen's participation levels and the quantity of marine plastic waste collected. Points accumulated regularly can be redeemed for essential daily necessities and production supplies, so as to motivate fishermen's active involvement through tangible material incentives. In, addition, by training fishermen on marine liiter management and releasing achievement of the "fishing vessels collecting litter" initiative in public media, the sense of accomplishment of fishermen as key participants is significantly strengthened.

3. Impacts of reforms to management effectiveness:

Since the initiation of the pilot project at Changhua Fishing Port over a year ago, an increasing number of fishermen have actively joined the "fishing vessels collecting litter" initiative. The number of participating fishing vessels has grown from just one to 53, involving more than 200 individual fishermen. Approximately 30 communities, government departments, and various social organizations have directly engaged in the marine litter cleanup campaign**.**

4. Lessons learnt:

The pilot project of "fishing vessels collecting litter" has effectively boosted the enthusiasm and recognition of fishermen to participate in the initiative through mechanisms such as exchanging points for goods, inviting fishermen to engage in activities related to marine environment protection, and publicizing the efforts of fishing vessels in litter collection. By integrating fishermen, who play a pivotal role in reducing marine litter, into the broader social governance framework, the project has facilitated the development of an efficient and sustainable model for marine litter management.

5. Sources:

Ministry of Ecology and Environment of China:

https://www.mee.gov.cn/ywgz/zcghtjdd/sthjzc/202212/t20221215_1007998.shtml.

China 2: The provincial regulation concerning the prohibition of single use plastic products in Hannan Province, China

1. Context and challenges:

Plastic pollution has emerged as a critical environmental issue of global concern. Single-use plastic products, characterized by their lightweight nature, are difficult to recycle and degrade. These products not only lead to resource wastage but also present a significant risk of environmental leakage, while causing environmental pollution and potentially endangering human health. To address the pollution caused by single-use non-degradable plastic products and to protect marine environment, the Hainan Provincial Government has promulgated and implemented the "Regulations on Prohibiting Single-use Non-degradable Plastic Products in the Hainan Special Economic Zone."

2. Policies and regulations reformed:

Firstly, the promulgation and implementation of local regulations. The "Regulations on Prohibiting Single-Use Non-degradable Plastic Products in the Hainan Special Economic Zone," has been promulgated and implemented. The regulaton encompasses several key aspects, such as management of the banned plastic product list, product technical standards, traceability systems, recycling and utilization mechanisms, as well as monitoring and enforcement. Furthermore, a responsibility mechanism has been established to involve all stakeholders across the five critical sectors of plastic production, sales, transportation, storage, and usage.

Second, establishment of local standardization systems to improve product quality. Developing the local standard "General Technical Requirements for Fully Biodegradable Plastic Products," which specifies the biodegradability, hygiene, and ecological safety of fully biodegradable plastic products. For the timeliness requirements for supervision and evidence collection, formulating two additional local standards concerning rapid detecting of plastic products.

Third, development of a negative list to facilitate the dynamic management of banned plastic products. Two batches of the "Negative List of Plastic Products Prohibited from Production, Sale, and Use in Hainan Province," along with supplementary directories, were successively formulated and released. These documents clearly delineated the prohibited scope using a negative list approach and implemented dynamic adjustment mechanisms for managing the list.

Fourth, innovation of the regulatory system to cultivate the new materials industrial chain. Developing and establishing the Hainan Province Plastic Product Ban Management Information System, leveraging internet technology to create product electronic supervision codes, consequently forming a robust product information traceability system. The action plan was developed, which establishing a joint enforcement mechanism involving "government + association + enterprise + volunteer + media" to implement regular market supervision. With development of effectiveness assessment frameworks, implementing the regulatory responsibilities of each city and county. The "Hainan Province Fully Biodegradable Plastic Industry Development Plan (2020-2025)"was developed to strategically plan the upstream, midstream, and downstream industrial bases for biodegradable materials to establish an innovative development hub for the biodegradable materials industry.

Fifth, Raising public awareness on prohibition of single use plastic product. By launching a pilot program on phasing out single-use non-degradable plastic products in main organizations/ key places such as government agencies, state-owned enterprises, schools, tourist attractions, big supermarkets and hospitals, public awareness of environmental protection has been strengthened, so as to ensure the smooth enforcement of the regulation on single ues plastic banning. In addition, a range of publicity campaigns have been conducted through the effective utilization of diverse media platforms, including newspapers, television, the Internet, and social media channels like Weibo.

3. Impacts of reforms to management effectiveness:

Two upstream raw material projects have been established in the province, and 15 downstream product enterprises have commenced operations, so as to ensure a stable supply of alternative for the plastic product in Hainan. The biodegradable materials industry has begun to take shape. As of July 2024, the average market penetration rate of alternative products in nine key industry sectors across the province exceeded 80%. Government agencies, canteens, sanitation systems, public hospitals, and schools have largely ceased using disposable non-biodegradable plastic products. Over 55 A-level and higher scenic spots have achieved near-complete compliance with the regulation on banning single use plastic. According to social surveys, the rate of public awareness of the plastic banning policy has surpassed 90%.

4. Lessons learnt:

To effectively implement the single use plastic banning, Hainan has developed a comprehensive set of plastic pollution control solutions with characteristics that are replicable and promotable. These solutions encompass local regulations, local standards, a negative list of prohibited plastic products, a product supervision system, and an alternative product supply chain. Two local standards for rapid detection methods of fully biodegradable plastic products have been endorsed by the National Standardization Committee.

5. Sources**:**

Ministry of Ecology and Environment of China:

https://www.mee.gov.cn/ywgz/zcghtjdd/sthjzc/202212/t20221216_1008092.shtml

Cambodia 1. Establishment of Marine Fisheries Refugia in Cambodia

1. Background, context and challenges

Cambodia's initiative to establish marine fisheries refugia is a compelling example of best practices in sustainable marine resource management. This effort, part of a broader regional project funded by the Global Environment Facility (GEF) and implemented by the United Nations Environment Programme (UNEP), aimed to protect critical marine habitats while ensuring the sustainability of fish stocks in the South China Sea and Gulf of Thailand.

The project, which began in 2017, sought to identify and manage critical habitats linked to priority fisheries, such as spawning and nursery grounds, which are essential for the life cycles of key fish species. The primary objective was to operate and expand a network of fisheries refugia, integrating these areas into national and regional management frameworks to achieve long-term sustainability goals for fisheries in the region.

2. Policy & regulation reforms;

Site Selection and Stakeholder Engagement:

Three sites in Cambodia were prioritized for the establishment of fisheries refugia: Kampot for juvenile grouper, Kep for blue swimming crab, and Koh Kong for Indo-Pacific mackerel. The selection was based on scientific assessments that identified these areas as critical for the protection of specific fish species. From the outset, the project emphasized the importance of stakeholder engagement. Local communities, fishers, provincial authorities, and other stakeholders were actively involved in the planning and establishment process. This inclusive approach helped build local support and ensured that the refugia would meet both conservation and livelihood needs.

Legal and Policy Frameworks:

The project also focused on developing robust legal and policy frameworks to support the establishment and management of the refugia. This involved the creation of clear guidelines for demarcating boundaries, enforcing fishing restrictions, and protecting critical habitats. For example, fishing closure seasons were established for the blue swimming crab in Kep and the short mackerel in Koh Kong, with all fishing gears targeting these species prohibited during the closure periods. These regulations were backed by national proclamations issued by the Ministry of Agriculture, Forestry, and Fisheries (MAFF), providing a strong legal basis for enforcement.

Challenges and Adaptation:

The implementation of the project was not without challenges. One significant issue was the overlap between the proposed refugia boundaries and coastal development projects in Kampot, which delayed the formal adoption of the refugia by local authorities. Additionally, the COVID-19 pandemic disrupted stakeholder consultations and site management activities. Despite these challenges, the project adapted by extending its timeline and continuing efforts to resolve conflicts and engage stakeholders effectively.

Management and Monitoring:

To ensure the ongoing effectiveness of the refugia, the project implemented continuous monitoring and adaptive management practices. Provincial management committees and technical working groups were established to coordinate activities and address issues at the

refugia sites. At the local level, patrolling teams were formed to monitor and enforce regulations, particularly during the fishing closure seasons. These efforts were complemented by awareness-raising campaigns and the installation of mooring buoys and concrete poles to demarcate refugia boundaries.

Integration into National Policy:

Recognizing the success of the fisheries refugia concept, the Cambodian government, through the Fisheries Administration (FiA) and MAFF, integrated this approach into national fisheries management policies. The concept was incorporated into the draft law on fisheries and the 10-year strategic plan for marine fisheries conservation and management (2019-2029). This integration underscores the government's commitment to sustainable fisheries management and the protection of marine biodiversity.

3. Outcomes and Lessons Learned:

The establishment of fisheries refugia in Cambodia has yielded positive outcomes, including increased fish stocks and the return of endangered species such as dolphins, dugongs, and sea turtles to the protected areas. The project also highlighted the importance of considering both fisheries and environmental factors in conservation efforts, as well as the need for collaboration between different sectors. Gender mainstreaming was another key aspect, with nearly 25% of women participating in the management and operation of the refugia, demonstrating the project's inclusive approach.

Cambodia's successful establishment of marine fisheries refugia serves as a model for other countries seeking to balance marine conservation with sustainable fisheries management. By integrating scientific research, stakeholder engagement, robust legal frameworks, and adaptive management, Cambodia has made significant progress in protecting critical marine habitats while supporting local livelihoods. The lessons learned from this project emphasize the importance of a holistic and inclusive approach to marine resource management, ensuring the long-term sustainability and resilience of both ecosystems and communities.

Compiled by Sopheak Thav. National Coordinator of Cambodia

Philippines 1. National Coral Reef Policy Reforms and Ecosystem-Based Management in the Philippines

1. Background, Context, and Challenges

The Philippines hosts approximately 26,000 square kilometers of coral reefs, making it the second-largest reef system in Southeast Asia and a key component of the Coral Triangle—the global epicenter of marine biodiversity (Licuanan et al., 2019; Veron et al., 2009; Allen, 2008; Carpenter & Springer, 2005). These reefs, which support over 500 species of hard corals and a wide variety of reef-dependent organisms, play a crucial role in coastal protection, food security, and local livelihoods through fisheries and ecotourism (Burke et al., 2002).

Marine Protected Areas (MPAs) were introduced as a key management tool to reduce human pressures and promote reef recovery. While the establishment of MPAs rapidly expanded in the early 1990s—driven by community-based efforts, NGO interventions, and academic partnerships (Campos & Aliño, 2008)—these early initiatives fell short of delivering widespread improvements in reef condition and fisheries productivity. Long-term monitoring revealed continued declines in fish catches, coral cover, and species diversity across many reef areas (Licuanan et al., 2017; Nañola et al., 2011; Arceo et al., 2001). These trends pointed to critical limitations, including inadequate enforcement, narrow ecological representation of MPAs, and poor institutional coordination.

Widespread destructive practices such as blast and cyanide fishing persisted, compounding the effects of unregulated coastal development, sedimentation from upland deforestation, and nutrient pollution from untreated wastewater. The rising impacts of climate change—particularly coral bleaching and stronger, more frequent typhoons—further accelerated coral decline. Before meaningful policy reforms were introduced, national efforts were fragmented and largely reactive. Weak enforcement mechanisms, overlapping agency mandates, limited financial resources, and inconsistent ecological monitoring constrained the country's ability to manage its reef ecosystems effectively (Bobiles et al., 2016).

Public awareness of coral reef conservation was generally low, and although local communities increasingly engaged in protection efforts, their participation was often informal and unsupported by long-term governance structures. The lack of system-wide coordination and legal integration meant that the early expansion of MPAs did not result in large-scale ecological resilience or recovery.

This context underscored the urgent need for comprehensive national reforms—anchored in science-based planning, integrated ecosystem management, stronger legal frameworks, and community empowerment—to reverse reef degradation and sustain the ecological and economic services provided by coral reefs.

2. Policy and Regulation Reforms

Over the past two decades, the Philippines has implemented significant national-level reforms to address coral reef degradation and strengthen marine ecosystem governance. These reforms

span spatial and temporal scales—from local MPAs to nationwide ecosystem-based management—and are grounded in updated legal frameworks and enforcement mechanisms.

Expansion and Institutionalization of Marine Protected Areas (MPAs)

The first locally managed Marine Protected Area (MPA) in the Philippines was established in 1974 at Sumilon Island Marine Sanctuary by local fishing communities with technical support from Dr. Angel Alcala and Silliman University. This initiative was later endorsed by the local government of Oslob, Cebu (Aliño et al., 2019). The success of this model inspired the creation of the Apo Island Marine Reserve in Dauin, Negros Oriental in 1982, which also demonstrated the ecological and socioeconomic benefits of community-based reef protection.

At the national level, the government established the Tubbataha Reefs Natural Park (TRNP) in 1988 through Presidential Proclamation No. 306, marking one of the earliest large-scale, no-take MPAs in the country. TRNP was recognized as a UNESCO World Heritage Site in 1993, and has since gained additional international designations, including as a Ramsar Wetland of International Importance, an ASEAN Heritage Park, and a Particularly Sensitive Sea Area (PSSA) by the International Maritime Organization. These recognitions highlight the Philippines' commitment to conserving globally significant marine biodiversity. TRNP is now governed by Republic Act No. 10067 (Tubbataha Reefs Natural Park Act of 2009), which institutionalized zoning, strict protection protocols, and a multi-agency enforcement system—establishing it as a national benchmark in marine conservation governance.

While the establishment of MPAs gained attention and expanded rapidly in the 1990s—largely due to the rise of community-based management and support from NGOs and academic partners (Campos & Aliño, 2008)—many of these early MPAs were considered "paper parks". This term refers to protected areas that exist legally but lack effective enforcement, ecological monitoring, or management implementation (Aliño et al., 2019).

Between 2000 and 2020, the total number of MPAs in the Philippines grew to around 1,800, covering a wide range of reef habitats across the archipelago (Aliño et al., 2019). In more recent years, many MPAs have adopted spatial zoning schemes that define core no-take zones, buffer areas, and multiple-use zones. These are commonly backed by municipal ordinances and managed through community-based enforcement units, such as Bantay Dagat volunteer groups, signifying a shift toward more structured and locally integrated governance models;

Ecosystem-Based and Climate-Resilient Coastal Management

To address the intensifying impacts of climate change on coastal ecosystems, the Philippines has implemented long-term, spatially integrated strategies since the early 2010s. Among these is the Department of Environment and Natural Resources (DENR)'s Climate Resilient Coastal Cities project, which focuses on urban coastal areas vulnerable to sea-level rise and extreme weather events (DENR, 2021). Complementing this, the DENR-Biodiversity Management Bureau (BMB) adopted the Ridge-to-Reef (R2R) approach, promoting integrated management across terrestrial and marine ecosystems—linking upland forests, river systems, mangroves, seagrasses, and coral reefs—to enhance ecological connectivity and system-wide resilience (DENR-BMB, 2020).

Policy and legal frameworks have been refined to support these initiatives, including the mainstreaming of climate adaptation and ecosystem-based management in local development

planning through the Enhanced Local Climate Change Action Plans (ELCCAPs), guided by the Climate Change Act of 2009 (Republic Act No. 9729). These frameworks are supported by improved enforcement mechanisms under the Clean Water Act (Republic Act No. 9275), and strengthened guidelines for coastal habitat and fisheries management under the amended Fisheries Code (Republic Act No. 10654).

Local governments and stakeholders—including coastal communities, civil society organizations, and private industries—are now actively involved in the co-management of marine protected areas (MPAs), adoption of localized wastewater treatment systems, and enforcement of zoning ordinances to minimize sedimentation and land-based pollution impacts on coral reefs (BFAR, 2020; CCC, 2023). These coordinated efforts collectively aim to ensure that coral reef ecosystems remain productive and resilient in the face of climate-related stressors.

Strengthening of National Legislation and Enforcement Mechanisms:

Since the late 1990s, the Philippines has undertaken major legal reforms to strengthen the protection of marine ecosystems, including coral reefs, across spatial and temporal scales. A landmark policy shift began with the enactment of the Philippine Fisheries Code of 1998 (Republic Act No. 8550), which was significantly amended by Republic Act No. 10654 in 2015. The revised law mandates ecosystem-based and precautionary approaches to fisheries management and introduces stricter sanctions for illegal, unreported, and unregulated (IUU) fishing activities, with enhanced enforcement capacities at both national and local levels. It also institutionalizes co-management arrangements between government agencies and fisherfolk communities, promoting localized stewardship of coastal and marine habitats (BFAR, 2020).

In parallel, the Expanded National Integrated Protected Areas System (E-NIPAS) Act of 2018 (RA 11038) marked a spatial expansion in the country's conservation agenda, formally designating over 90 additional protected areas, many of which include critical coral reef habitats. This act streamlines management responsibilities, ensures state funding for protected area management boards (PAMBs), and legally recognizes Indigenous Community Conserved Areas (ICCAs), incorporating customary conservation practices into the formal legal framework (DENR-BMB, 2019).

To address land-based sources of pollution (LbSPs) that impact coastal and marine ecosystems, the implementation of the Ecological Solid Waste Management Act of 2000 (RA 9003) and the Clean Water Act of 2004 (RA 9275) has established mechanisms for wastewater treatment, solid waste segregation and reduction, and effluent discharge regulation. These laws are particularly enforced in urbanizing coastal areas, where unregulated waste inflow threatens nearshore coral reef systems. Moreover, these legislative tools have increasingly emphasized the role of local governments, industries, and communities in managing pollution sources through decentralized enforcement, local ordinances, and public-private partnerships (CCC, 2023; EMB, 2021).

Collectively, these national laws have reinforced institutional accountability and enabled adaptive governance approaches to marine and coastal management, laying the legal groundwork for long-term resilience of coral reef ecosystems across multiple spatial scales.

Promotion of Sustainable Anchoring and Tourism Management Practices

The Green Fins initiative, developed by The Reef-World Foundation in partnership with the UN Environment Programme, has expanded globally as a model for promoting environmental best practices in the marine tourism sector. In the Philippines, Green Fins has been active since the mid-2010s, with early implementation in Mabini, Batangas—a popular dive destination within the Verde Island Passage, one of the most biodiverse marine corridors in the world (Green Fins, 2018). The initiative has focused on fostering environmentally responsible diving through educational outreach, reducing anchor damage, and promoting stakeholder collaboration.

To address reef degradation from mechanical anchoring and unregulated tourism, sustainable mooring systems consistent with Green Fins protocols have been gradually adopted. In 2023, a notable local initiative "Buoyanihan" led to the installation of mooring buoys in key dive sites in Mabini, supported by LGUs, the Department of Environment and Natural Resources (DENR), local dive operators, and non-government partners such as Metro Pacific Investments Foundation through its Shore It Up program (MPIC, 2023; Inquirer, 2024).

As of this writing, over 80 buoys are being installed along the nearshore dive sites of Mabini, Batangas situated along the Verde Island Passage and one of the coral reef sites of the SCS SAP Project activities. The buoys are color-coded indicating their intended use, i.e., green buoys for mooring of local dive boats; yellow buoys for free divers; and red buoys to mark the legal boundaries of MPAs. These buoys use the Helix system which minimizes the footprint and damage to corals and other marine organisms caused by previous systems such as huge cement blocks.

Complementing the physical infrastructure is a comprehensive policy-based financing mechanism: the diver conservation fee system established under Municipal Ordinance No. 02-2003. Implemented in partnership with WWF-Philippines, the system requires scuba divers to pay PHP 50 (USD 0.90) per day, or purchase annual passes (PHP 1,000 for regular divers, PHP 700 for professionals), under the slogan "Pay Before You Play" (WWF-Philippines, 2003). A willingness-to-pay survey conducted by WWF prior to implementation confirmed diver support for the initiative, with projections indicating it could generate PHP 2–3 million annually (USD 36,000–54,000).

Eighty-five percent of the collected revenue is deposited into a special conservation account, which supports Bantay Dagat (sea patrol) units, reef monitoring, mooring buoy maintenance, and other coastal resource management (CRM) activities. Fund management is overseen by a multi-sectoral CRM Board composed of dive shop owners, fisherfolk, resort operators, NGOs, and LGU representatives, ensuring transparency, community participation, and alignment with the Mabini Integrated Coastal Management Code of 2024.

Together, these anchoring and tourism management reforms demonstrate how policy, infrastructure, and inclusive governance can be integrated to protect reef ecosystems while sustaining tourism livelihoods. Mabini's model of anchoring regulation and user-fee financing presents a scalable and replicable strategy for other coastal tourism areas in the Philippines and across the Coral Triangle.

3. Impacts of Policy Reforms

Biodiversity Conservation:

National and local policy reforms have significantly improved the ecological performance of well-managed marine protected areas (MPAs). In the Tubbataha Reefs Natural Park (TRNP), long-term monitoring data indicate that live coral cover followed an overall increasing trend following its declaration as a marine park in 1988. Coral cover peaked in 1997, marking the highest recorded level since its protection began. However, a severe El Niño event in 1997-1998 led to coral bleaching and a substantial decline, with the lowest cover recorded in 1999. Recovery began shortly thereafter, and by 2005, coral cover had nearly returned to 1997 levels, demonstrating the reef's resilience under effective protection and management (WWF, 2005).

In addition, a monitoring study conducted by the Tubbataha Management Office (TMO) reported that fish biomass within the park reached 137 metric tons per square kilometer (MT/km²) in 2014, a 43% increase compared to 2008, when fish biomass was recorded at 96 MT/km² (TMO, 2015)

Economic Gains:

Policy reforms in marine resource governance have yielded tangible economic benefits by enhancing the productivity of marine ecosystems and enabling sustainable, community-driven tourism revenue models. Well-enforced Marine Protected Areas (MPAs) have demonstrated their capacity to significantly increase fish biomass, support small-scale fisheries, and provide steady income through ecotourism and conservation financing mechanisms.

In Cagayancillo, Palawan, monitoring data from the Tubbataha Management Office (TMO) revealed a 43% increase in fish biomass, rising from 96 metric tons per square kilometer (MT/km²) in 2008 to 137 MT/km² in 2014 (TMO, 2014). This rebound is largely attributed to effective enforcement of no-take policies within MPAs, leading to spillover effects that benefit adjacent fishing grounds. Artisanal fishers in neighboring barangays have reported increased catch per unit effort, directly contributing to improved food security and livelihoods.

In Mabini, Batangas, the local government implemented a diver conservation fee system under Municipal Ordinance No. 02-2003, with technical support from WWF-Philippines. The ordinance mandates a PHP 50 (USD 0.90) fee per diver per day, along with optional annual passes for recreational and professional divers. Initial implementation raised PHP 170,000 (USD 3,000), and projections indicated that full compliance could generate PHP 2–3 million annually (USD 36,000–54,000) (WWF-Philippines, 2003). As of 2018, even prior to the full rollout of the sustainable mooring system, Mabini was generating an estimated PHP 11–14 million annually (USD 190,000 – 250,000) in dive tourism-related user fees. The municipality was also proposing an additional PHP 50 fee to support the installation and maintenance of mooring buoys, aimed at preventing anchor damage in key reef areas (Philippine Daily Inquirer, 2018).

Revenues from the conservation fees are deposited into a municipal trust fund and reinvested annually into reef monitoring, Bantay Dagat enforcement patrols, mooring buoy maintenance, stakeholder consultations, and community training programs. Fund management is overseen by a multi-sectoral Coastal Resource Management (CRM) Board, which includes representatives from dive operators, fisherfolk associations, NGOs, and the local government, ensuring transparency and accountability.

This model demonstrates how user-pays systems, when integrated with national legal frameworks such as the Fisheries Code (RA 10654) and the Ecological Solid Waste Management Act (RA 9003), can create sustainable financing pathways that both incentivize conservation and deliver direct economic returns to local communities. Mabini's experience offers a replicable framework for other coastal municipalities seeking to align tourism management with biodiversity protection and inclusive governance.

Community Participation:

At the national scale, policy reforms in the Philippines have systematically integrated community participation into marine and coastal resource governance. Legal frameworks such as the Fisheries Code of 1998 (RA 8550, as amended by RA 10654) and the Expanded National Integrated Protected Areas System (E-NIPAS) Act of 2018 (RA 11038) provide legal mandates for co-management, recognizing the essential role of local stakeholders—including fisherfolk, Indigenous Peoples, women's groups, and civil society organizations—in the planning, management, and enforcement of marine conservation policies.

Under these laws, over 1,800 locally managed Marine Protected Areas (MPAs) have been established across the country, with most supported by community-based management bodies, such as Bantay Dagat volunteer enforcement groups and multi-sectoral MPA Management Councils. These groups are typically composed of representatives from local government units (LGUs), people's organizations, NGOs, academic institutions, and the private sector, and are responsible for implementing site-specific management plans, conducting ecological monitoring, and coordinating enforcement activities.

To support and institutionalize these efforts, the Department of Environment and Natural Resources – Biodiversity Management Bureau (DENR-BMB) and the Bureau of Fisheries and Aquatic Resources (BFAR) have developed national guidelines for community engagement, MPA evaluation (e.g., MPA Management Effectiveness Assessment Tool - MEAT), and capacity building for local governments and stakeholders.

These reforms and support mechanisms reflect a shift toward inclusive, decentralized, and adaptive marine governance, where local communities are not only beneficiaries but also active decision-makers and stewards of marine ecosystems. The Philippine experience illustrates that community participation—when backed by legal frameworks, technical support, and sustainable financing—leads to greater compliance, ecological effectiveness, and long-term social equity in marine conservation.

4. Lessons learnt

Strengthening Institutional Coordination and Mandate Clarity

Challenge: Before reforms, institutional fragmentation and overlapping mandates among agencies (e.g., DENR, BFAR, LGUs) led to duplication of efforts, poor policy coherence, and inefficient enforcement.

Response: National legislation such as the Expanded NIPAS Act of 2018 (RA 11038) and the Amended Fisheries Code (RA 10654) clarified institutional roles and encouraged inter-agency coordination through mechanisms like Protected Area Management Boards (PAMBs) and FARMCs. National-level technical guidance also aligned marine policies across agencies.

Lesson Learned: Integrated governance frameworks must be legally established to streamline mandates, align programs, and enhance coordination across agencies and levels of government.

Bridging Policy and Practice in Marine Protected Areas (MPAs)
Challenge: Early MPAs were often "paper parks" lacking implementation, enforcement, and monitoring—leading to minimal ecological impact despite widespread legal designation.
Response: National guidelines and tools such as the MPA Management Effectiveness Assessment Tool (MEAT) helped standardize performance evaluation. Community-based enforcement units (e.g., Bantay Dagat) were supported through national programs, and local MPAs were integrated into broader seascape-level planning efforts.
Lesson Learned: Policy reforms must be operationalized through capacity-building, clear evaluation metrics, and community-based implementation mechanisms.

Scaling Ecosystem-Based and Climate-Responsive Approaches
Challenge: Previous coral reef policies focused narrowly on site-based protection, often ignoring land-based pollution, catchment degradation, and climate impacts.
Response: National programs mainstreamed ecosystem-based management (EBM) and ridge-to-reef (R2R) planning, as seen in the Climate Resilient Coastal Cities Project and Enhanced Local Climate Change Action Plans (ELCCAPs). These integrated watershed and reef management linked coastal and upland policy, and addressed climate adaptation.
Lesson Learned: Holistic planning frameworks that integrate terrestrial, coastal, and marine ecosystems are essential for long-term reef resilience.

Enhancing Community Participation through Legal Empowerment
Challenge: Despite community enthusiasm, many early marine initiatives failed due to the lack of formal recognition, long-term support, and decision-making power for local stakeholders.
Response: Reforms such as RA 10654 and RA 11038 mandated co-management and institutionalized community roles in marine governance. The proliferation of community-led MPAs, ICCAs, and LGU-led CRM Codes showed how legal empowerment translated into effective local stewardship.
Lesson Learned: Formalizing and funding community roles is vital for equitable, sustainable, and effective marine conservation.

Leveraging Sustainable Financing for Long-Term Implementation
Challenge: Dependence on external project funds made many marine programs unsustainable after donor support ended.
Response: Conservation finance innovations—such as user-pays systems (e.g., Mabini's diver fee), municipal trust funds, and public-private partnerships—created self-sustaining mechanisms. These were embedded in municipal ordinances and linked to national policies to ensure legal and financial continuity.
Lesson Learned: Financing reforms must be embedded in policy, and locally adapted funding strategies are critical to sustaining conservation outcomes.

Ensuring Data-Driven and Adaptive Governance
Challenge: Coral reef policy lacked sufficient long-term monitoring data, limiting the capacity to evaluate interventions and adapt to new threats like climate change.
Response: National agencies (DENR-BMB, BFAR) collaborated with academic institutions (e.g., UP-MSI, Silliman University) to generate standardized monitoring data. Tools like MEAT and ecosystem health indicators informed management. Recent reforms emphasized adaptive management—the ability to change course based on ecological feedback.
Lesson Learned: Science-based, data-driven decision-making is fundamental to successful policy reform and must be integrated into marine governance systems.

Promoting Scalable Best Practices through Demonstration Sites
Challenge: National policies struggled to scale successful local initiatives without systematic support or templates.
Response: Sites like Tubbataha, Apo Island, and Mabini became national models through consistent protection, financing mechanisms, and community participation. Their success stories were documented, collected in national policy, and adapted in other provinces.
Lesson Learned: Flagship reef sites and pilot programs can serve as replicable models—provided there is documentation, policy integration, and support for scaling up.

Overall, the Philippines' coral reef policy reforms demonstrate that national legislation alone is not enough—success depends on the combination of strong laws, institutional capacity, sustainable financing, community engagement, science-based planning, and continuous learning. By integrating these lessons, the country is better equipped to address the escalating threats of climate change, overfishing, and coastal degradation while sustaining biodiversity and local livelihoods.

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6. Contact Information

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Philippines 2. Wetland (Estuaries) Conservation in the Philippines

1. Context and challenges in habitat management:

Wetlands in the Philippines, particularly estuaries, are vital ecosystems that play a foundational role in the country's ecological and economic stability. They serve as sanctuaries for biodiversity, including migratory birds and aquatic species, while also acting as natural barriers against coastal erosion and storm surges. Beyond their ecological functions, these areas provide livelihoods for local communities, from fishing to ecotourism.

In spite of their importance, wetlands face escalating threats. Urbanization, industrialization, and agriculture often encroach upon these fragile ecosystems, leading to habitat loss and degradation. The destruction of mangroves and coral reefs, coupled with pollution from improper waste management, has further strained these ecosystems. Compounding these issues is the looming threat of climate change, which exacerbates flooding and disrupts the delicate balance of these habitats.

2. Policies, regulation and/or supporting financial mechanism reformed:

- **National Wetlands Action Plan (NWAP):** Recognizing the urgent need to safeguard wetlands, the DENR launched the NWAP in 2013. This plan aims to enhance the management of wetland areas by strengthening institutional frameworks, fostering community participation, and raising public awareness. By addressing both conservation and sustainable use, the NWAP provides a blueprint for preserving wetlands for future generation.
- **National Integrated Protected Areas System (NIPAS) Act:** Enacted in 1992, this law established a legal framework to designate and protect ecologically significant areas. Wetlands like the Olango Island Wildlife Sanctuary in Cebu benefit from this legislation, which ensures their conservation as critical habitats for migratory birds and other wildlife.
- **Ecological Solid Waste Management (ESWM) Act of 2000:** Pollution is one of the most pervasive threats to wetlands, and the ESWM Act directly addresses this issue. By mandating local governments to implement waste segregation, recycling, and composting, the law has significantly mitigated pollution, protecting wetlands from harmful solid waste.
- **Integration of Indigenous Knowledge Systems and Practices (IKSP):** Indigenous communities possess centuries-old knowledge about sustainable living and conservation. The integration of IKSP into wetland management recognizes the value of this wisdom. This approach not only respects cultural heritage but also improves the effectiveness of conservation efforts.

3. Impacts of reforms to management effectiveness:

- **Increased Habitat Protection:** Protected wetlands under NIPAS, like Olango Island, have seen measurable improvements in biodiversity. The populations of migratory birds and marine species have stabilized or increased, highlighting the success of legal protections.
- **Reduction in Pollution:** The implementation of the ESWM Act has visibly reduced solid waste in coastal and wetland areas. Cleaner environments have improved water quality, enhancing the resilience of wetland ecosystems.

- **Community Involvement:** Including IKSP in conservation plans has empowered local communities to become active stewards of their environment. Their participation has not only led to better resource management but also strengthened community ties and cultural pride.

4. Lessons learnt:

Policy development plays a major role in the conservation of wetlands and other habitats. Without the legal support of policy, conservation of wetlands would be a challenge to accomplish, encountering legal barriers that only policy statements could overcome. Every issuance of policy is a victory for conservation given the political and procedural system of government.

A strategy in addressing the challenge of red tape of political and procedural systems of government is to identify a political champion for the cause of conservation. A champion can facilitate the passing of a policy in Congress.

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Ecological Solid Waste Management (ESWM) Act of 2000

Philippines 3. Monitoring Mangrove Forests in the Philippines using Remote Sensing

1. Context and challenges

The mangrove forests of the Philippines represent one of the country's most valuable coastal ecosystems, playing a critical role in coastal protection, biodiversity conservation, fisheries support, and carbon sequestration. As of 2020, the total mangrove extent was estimated at approximately 264,818 hectares. These ecosystems are widely distributed across the Philippine archipelago.

Between 2000 and 2020, mangrove cover in the Philippines exhibited both losses and gains. Losses were primarily due to land conversion, degradation, and exposure to environmental stressors, while gains were observed as expansions near existing mangrove stands, suggesting areas of natural regeneration or restoration efforts. Analysis of vegetation change revealed correlations with various environmental variables such as sea surface temperature (SST), sea surface height (SSH), rainfall patterns, and typhoon frequency. Anthropogenic influences, including land cover changes associated with aquaculture, urban expansion, and agriculture, also significantly affected mangrove dynamics during this period.

Despite some positive trends, Philippine mangroves face numerous threats. Climate-related challenges such as increased typhoon intensity, sea level rise, and altered sedimentation patterns pose serious risks to the health and distribution of mangrove forests. Human-induced pressures remain a major concern, with continued conversion of mangroves to aquaculture ponds, residential areas, and infrastructure developments. Pollution and poor land use practices in adjacent upland areas further exacerbate mangrove degradation. Additionally, weak enforcement of environmental regulations and limited localized monitoring hinder effective management and protection, particularly in remote or underserved regions. Addressing the issues facing mangroves requires not only strong policy implementation, inter-agency cooperation, and active community engagement but also a sustained technological innovation to ensure long-term conservation and resilience.

2. Policies, regulations and/or supporting financial mechanism reformed

Republic Act No. 11363 (Philippine Space Act of 2019): This act established the Philippine Space Agency (PhilSA) as the primary government entity responsible for space policy, planning, and development. Under this mandate, PhilSA supports mangrove management through the development and deployment of space-based technologies, particularly remote sensing (RS), for environmental monitoring, disaster risk reduction, and natural resource management.

3. Impacts of reforms to management effectiveness

Improved Monitoring Capabilities: By developing and applying the Mangrove Vegetation Index (MVI) using Sentinel-2 satellite data, the study enables rapid, accurate, and cost-effective nationwide monitoring of mangrove forests. This addresses a longstanding challenge in mangrove conservation—monitoring vast and often remote coastal areas in a timely manner.

Data-Driven Decision Making: The study provides detailed spatial and temporal information on mangrove cover changes over two decades (2000–2020), which is essential for evidence-based policy formulation, planning, and prioritization of conservation interventions.

Early Detection and Rapid Assessment: The use of remote sensing tools allows for quick post-disaster damage assessments, such as those conducted after Typhoon Rai. This supports timely responses and targeted restoration in affected areas, helping minimize long-term ecological and socio-economic impacts.

Support for Climate Action and Blue Carbon Initiatives: The inclusion of aboveground biomass and carbon stock estimation contributes to the national and international blue carbon agenda. It positions mangroves as vital assets in climate change mitigation through carbon sequestration, and supports the Philippines' commitments under global environmental agreements.

Integration of Environmental and Anthropogenic Drivers: By correlating mangrove changes with environmental (e.g., SST, typhoons) and human (e.g., land conversion) variables, the study helps managers understand not just what changes are occurring, but why. This supports the development of targeted, adaptive management strategies.

Scalability and Operationalization: The methodologies introduced, such as the MVI, are scalable and can be operationalized through institutional networks like the PhilSA Integrated Network. This ensures continuity and broad implementation of mangrove monitoring across regions.

Capacity Building and Public Engagement: The study emphasizes the role of citizen science and app-based data collection, fostering local stakeholder involvement in mangrove conservation. This democratizes data collection and enhances public awareness and accountability.

4. Lessons Learnt

Remote sensing is crucial for continuous and efficient monitoring, particularly in archipelagic settings like the Philippines where in-situ surveys are logistically difficult.

Inter-institutional collaboration enhances data mobilization and application, bridging scientific innovation and policymaking.

Environmental and anthropogenic factors must be monitored concurrently to effectively assess changes in mangrove extent.

Citizen science and mobile applications (e.g., for volunteered geographic information) can complement technical approaches and engage communities in conservation efforts.

Establishing **biomass and soil organic carbon (SOC) models** for the entire country can strengthen the Philippines' positioning in **global climate and carbon mitigation dialogues**.

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Philippines 4. Integrated Coastal Management in Northwestern Philippines

1. Context and challenges in Mangrove management of Northwestern Philippines

The northwestern Philippines, encompassing the coastal provinces of Ilocos Norte, Ilocos Sur, La Union, Pangasinan, Zambales, Bataan, Bulacan, and the Subic Bay Freeport Zone, forms part of the West Philippine Sea biogeographic region. This area features a highly diverse range of coastal ecosystems and contributes significantly, over 20%, to national fisheries production. Despite its ecological and economic importance, the region's mangrove forests remain limited in extent, fragmented, and under increasing pressure from both human and natural disturbances.

As of the latest assessments, mangrove cover in the region varies widely by province, with many areas dominated by secondary growth and plantations, and very few retaining substantial old-growth stands. Key mangrove biodiversity hotspots like Pangasinan and Zambales host over 20 true mangrove species, while others like Ilocos Norte and Cagayan have lower species richness and more degraded sites.

The most significant threats to mangrove forests in northwestern Philippines include: conversion to aquaculture and residential use, Industrial pollution and household waste discharge, reclamation and infrastructure development, unregulated harvesting for firewood and construction, ineffective rehabilitation due to wrong species-site matching, and climate change impacts, including sea level rise, typhoons, and sedimentation.

These pressures have led to declining fisheries productivity, habitat loss, and increased vulnerability of coastal communities to storm surges and flooding. While localized successes in rehabilitation and protection have emerged especially in areas like Bani (Pangasinan) and Masinloc (Zambales) mangrove conservation in the region still faces challenges in policy coherence, enforcement, community engagement, and scientific monitoring.

The mangroves of northwestern Philippines are ecologically vital yet highly threatened. A more coordinated, science-based, and community-inclusive management approach is essential to restore and sustain these coastal forests for biodiversity conservation, climate resilience, and human well-being.

2. Policies, regulations and/or supporting financial mechanism reformed

- Integrated Coastal Management Program
- Municipal Fisheries Ordinance
- Masinloc Barangay Ordinance No. 02-2011
- Bulakan Mangrove Eco-Park.

3. Impacts of reforms to management effectiveness

- In Pangasinan. at least 283 ha of mangrove old stand was protected; **nearly** 451,070 seedlings produced (2008–2013) across 51.05 ha coastal and 86.75 km riverbank, and there were an increased in fish catch in Bani, Pangasinan.
- In Zambales, at least 204.5 ha mangrove areas were planted (64 ha rehabilitated, 139.5 ha reforested and the Panglit MPA was established and expanded.
- In Bataan, at least 120.2 ha mangrove areas were planted.
- In Bulacan, at least 24.64 ha mangrove areas were planted and the Bulakan Mangrove Eco-Park was established.
- In Ilocos, at least 133.49 ha mangrove areas were planted with survival rate of 90% and about 5 ha mangroves were protected in Cabugao, Ilocos Sur.
- Tourism and ecotourism were enhanced in Panglit and San Salvador and there was a total of 21 mangrove species recorded in Northwestern Philippines.
- Biodiversity was enhanced. High regeneration rates, of *Avicennia marina* (63,588 seedlings/ha).

4. Lesson learnt

- Long-term management and strong institutional support are vital.
- Community engagement via fisherfolk organizations is effective; Stakeholder synergy (LGU + NGO + private) improves outcomes.
- MPAs strengthen ecosystem function and biodiversity.
- Local ordinances are crucial for site-specific protection.
- Recognition programs boost manager motivation; Effective IEC campaigns and regular monitoring are critical.
- Integrated waste management and aquaculture regulation are essential; Urbanization and fishpond expansion
- Site-specific assessments needed before rehabilitation; Ineffective rehabilitation due to wrong species/site matching.
- Overlapping mandates across agencies (DENR, LGUs, BFAR); Lack of national coordinating body (e.g., defunct NMC).

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Philippines 5. Strategic Environmental Plan (SEP) and ECAN in Palawan, Philippines

1. Context and challenges in Palawan's Mangrove Management

Palawan is the largest province in the Philippines by land area, located in the **MIMAROPA region**. Often referred to as the country's **"Last Ecological Frontier",** Palawan is renowned for its **exceptional biodiversity, rich natural resources**, and **stunning landscapes and seascapes**. The province holds the **largest remaining forest cover in the Philippines,** including **extensive mangrove ecosystems** (approx. 689,161 ha total forest area; 59,421 ha mangrove forest as of 2015). However, between 2010 and 2015, a notable 4% decline in mangrove cover (loss of 4,111 ha) was recorded due to land conversion for built-up areas, driven by urbanization, commercial development, and tourism expansion in the province.

2. Policies, regulations and/or supporting financial mechanism reformed

2.1. SEP Law (RA 7611)- Enacted in 1992 as a framework for sustainable development, tailored specifically for Palawan. Anchors its ecosystem management strategy on zoning and environmental regulation.

2.2. Environmentally Critical Areas Network (ECAN)- Operationalizes the SEP through a zoned management system: Core Zones – Strict protection for biodiversity (e.g., mangrove forests in key areas), Buffer Zones – Controlled use and minimal impact activities allowed, and Multiple Use Zones – Sustainable economic activities permitted under regulations. Applies both to terrestrial and marine ecosystems, creating a ridge-to-reef management model. Ensures protection, development control, and community-based management of critical habitats, including mangroves.

3. Impacts of reforms to management effectiveness

Institutionalization of PCSD (Palawan Council for Sustainable Development) as the central authority overseeing environmental management and enforcement.

Integration into local planning – ECAN zoning is embedded into comprehensive land use and forest land use plans of municipalities in Palawan

International recognition – Palawan was acknowledged by UNESCO in 2017 for effectively fulfilling conservation, development, and logistic functions as a Biosphere Reserve.

Water quality monitoring in mangrove-adjacent rivers has improved; some upstream river sites retain **Class A quality**, indicating low anthropogenic pressure (e.g., Calategas Dam, Cabayugan River).

Ecotourism and environmental education efforts, especially around mangrove and marine biodiversity, contribute to conservation and local awareness.

Zonation-based resource management (core, buffer, transition zones) adapted to both land and sea.

Science-informed monitoring via Environmental Monitoring and Evaluation System (EMES).

Collaborative governance involving LGUs, NGOs, IPs, and academic institutions.

Public engagement and CEPA programs (Communication, Education, and Public Awareness) to build grassroots conservation values.

Sustainable tourism integration that supports mangrove conservation (e.g., firefly watching in mangrove habitats).

4. Lessons learnt

Land use pressure from real estate and commercial development is a major threat; needs stricter ECAN enforcement.

Effective mangrove protection requires simultaneous land and sea management; upland deforestation impacts downstream mangrove health.

Zoning works best when communities are engaged and their livelihoods are aligned with conservation goals.

Monitoring data is essential – regular updates on land cover and water quality guide adaptive management.

Institutional capacity needs to be strengthened, particularly for enforcement and inter-agency coordination.

5. Sources and Contact Information

PCSD (2020). *State of the Environment: Palawan (UNESCO Biosphere Reserve), Philippines - 2020 Updates*. [PCSD Publication]

Philippines 6. Policy reforms for land-based pollution management in the Philippines

1. Background, Context, and Challenges

The Philippines, an archipelago with extensive coastlines, is vulnerable to the impacts of land-based pollution on coastal habitats. Marine ecosystems in provincial regions like Zambales, Batangas, and Palawan, situated along the West Philippine Sea (WPS), illustrate the breadth of these challenges. These areas rely heavily on tourism, fisheries, and other industries at or near these coastal areas, making effective pollution management crucial for environmental sustainability and economic growth. For example, the Batangas Bay Region, designated as one of three critical pollution hotspots in the Philippines, exemplifies the complex interplay between economic development and environmental protection needs [1].

The country's rapid urbanization and industrial development could have intensified these challenges, with only about 10% of the population having access to proper sewerage systems. Industrial pollution is particularly concerning, with manufacturing facilities, the power sector or mining operations, and industrial zones contributing significant loads of heavy metals, toxic chemicals, and untreated wastewater to waterways and water bodies. According to the Environmental Management Bureau's monitoring data, in 2022, about 50% of monitored industrial firms fully complied with water quality standards, indicating substantial room for improvement in wastewater management [2].

Moreover, the most recent and alarming concern is the Philippines' status as one of the most significant contributors to global marine plastic pollution [3]. Single-use plastics and other packaging materials and weak waste management systems exacerbate marine litter issues. This highlights the urgent need for more effective waste management strategies. This challenge is compounded by limited wastewater treatment infrastructure, widespread use of poorly maintained septic systems, and agricultural runoff containing pesticides and fertilizers that impact coastal waters.

2. Policy & Regulation Reforms

The Philippines has implemented comprehensive policy reforms to address these challenges through three major environmental laws and their supporting regulations and initiatives [1,2]:

The Clean Water Act (Republic Act 9275, 2004) established an integrated water quality management framework. Its implementation has led to the designation of 40 Water Quality Management Areas nationwide as of 2023, with governing boards comprising local government units, national agencies, NGOs, and private sector representatives. This watershed-level approach ensures integrated planning, data collection, and management, with local stakeholders actively involved. The 2016 revision of water quality guidelines (DENR Administrative Order 2016-08) introduced more stringent effluent standards and monitoring requirements for several parameters, including biochemical oxygen demand (BOD), total suspended solids (TSS), and nutrient loads. The Clean Water Act also mandates connection to available sewerage systems for households and establishments.

The Toxic Substances and Hazardous and Nuclear Waste Management Act (RA 6969, 1990) provides regulations on managing and controlling toxic chemicals and hazardous wastes. The law establishes a comprehensive framework for chemical management that includes import restrictions, registration requirements, and permitting systems. Under this law, industries handling hazardous materials must register with the EMB and obtain necessary permits. In 2023, EMB data shows an 80% compliance rate among monitored firms, reflecting improved industrial chemical and hazardous waste management practices.

The Ecological Solid Waste Management Act (RA 9003, 2000) has driven significant improvements in municipal waste management. As of December 2023, 85% of local government units had approved 10-year solid waste management plans, representing a substantial increase from 50% in 2015.

Most recently, the Extended Producer Responsibility (EPR) Act of 2022 (RA 11898) introduced groundbreaking requirements for large enterprises to take responsibility for their plastic packaging throughout the product lifecycle. The law sets progressive targets for plastic waste recovery and diversion, starting at 20% by the end of 2023 and increasing to 80% by 2028 [4].

3. Impacts of Reformed Policies on Management Effectiveness

Building on lessons learned from the UNEP/GEF South China Sea Project "Reversing Environmental Degradation Trends in the South China Sea and Gulf of Thailand" [5], the implementation of these innovative approaches and reforms has yielded measurable improvements in environmental management:

1. Cross-Sectoral Coordination and Institutional Capacity. The Philippines has established an effective institutional framework through:

- The creation of 40 Water Quality Management Areas (WQMAs) nationwide as of 2023, with governing boards comprising local government units, national agencies, NGOs, and private sector representatives [2].
- The DENR's Environmental Management Bureau's strengthened role as the central coordinating body, aligning with lessons learned from successful demonstration sites in other countries about the importance of clear institutional arrangements. Online permitting and monitoring systems have also enhanced regulatory oversight and data management capabilities.

2. Community-Based Enforcement. Drawing from best practices in building local enforcement capacity, the Philippines has, for example, implemented:

- The Adopt-an-Estero Waterbody Program emphasizes community involvement in cleanup, implementation, and sustainable planning. Estero refers to a coastal inlet, tidal channel, or small riverine estuary where seawater and freshwater mix. In 2023 alone, this program mobilized 25,969 individuals from various sectors and recovered over 228,000 kilograms of waste [2].
- Enhanced monitoring capabilities through EMB Regional Offices, conducting over 200,000 sample determinations in 2023 [2].

3. Industry Participation and Compliance. Building on successful models of private sector engagement from the region, the Philippines has:

- Implemented the Extended Producer Responsibility (EPR) Act of 2022, engaging 947 companies in plastic waste management programs and achieving the recovery and diversion of approximately 163,000 metric tons of post-consumer plastic packaging waste in 2023[6].
- Though the implementation of environmental regulations has shown varying compliance rates across different sectors, the DENR reported significant improvements in industrial compliance, with hazardous waste management compliance reaching 80% in 2023 [2].

4. Water Quality Management. The Philippines has demonstrated measurable improvements in water quality monitoring:

- Manila Bay has seen a 66% decrease in fecal coliform levels from 10,306 MPN/100ml in 2018 to 3,481 MPN/100ml in 2023 [2].

- This also includes enhanced monitoring through standardized protocols across 15 coastal monitoring stations in critical areas like Batangas Bay [1].

4. Future Directions:

Based on the 2021 National Implementation Report on Land-Based Pollution, priority actions would include [1]:

The development of a comprehensive National Research Framework for marine litter monitoring, strengthening environmental laboratory services, and implementing improved data management systems. The government has also published a Roadmap for Plastic Waste Management (2023-2040) that outlines strategies to achieve zero plastic waste pollution by 2040 [7].

These initiatives demonstrate the Philippines' commitment to addressing land-based pollution in the West Philippine Sea through integrated approaches combining policy reform, institutional strengthening, and stakeholder engagement. These include expanding stakeholder engagement and public-private partnerships. However, continued effort is needed to address remaining challenges, particularly in enforcement capacity at the local level and in expanding wastewater treatment infrastructure.

5. Sources:

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[2] Department of Environment and Natural Resources. (2023). Environmental Management Bureau 2023 Annual Report (https://emb.gov.ph/wp-content/uploads/2024/06/FINAL_EMB-ANNUAL-REPORT-2023.pdf)

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[5] Vo, S. T., Pernetta, J. C., & Paterson, C. J. (2013). Lessons learned in coastal habitat and land-based pollution management in the South China Sea. *Ocean & coastal management*, *85*, 230-243. (http://dx.doi.org/10.1016/j.ocecoaman.2013.02.005)

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For more information: https://emb.gov.ph

Indonesia 1. Policy reforms and technique innovation for restoring Indonesia's coral reefs: 30 Years of Restoration Projects (1990–2020)

1. Context and challenges in LbP and/or habitat management at the locality:

Indonesia has 39,538 km² of coral reefs (16% of the world's total), but more than 95% of these are threatened by overfishing, destructive fishing, pollution, and mass bleaching. The long-standing practice of blast fishing has created rubble fields that are difficult to recover naturally. Restoration is one solution, but it is often uncoordinated, lacks standards, and is rarely supported by long-term monitoring.

2. Policy and regulation reforms, and technique development

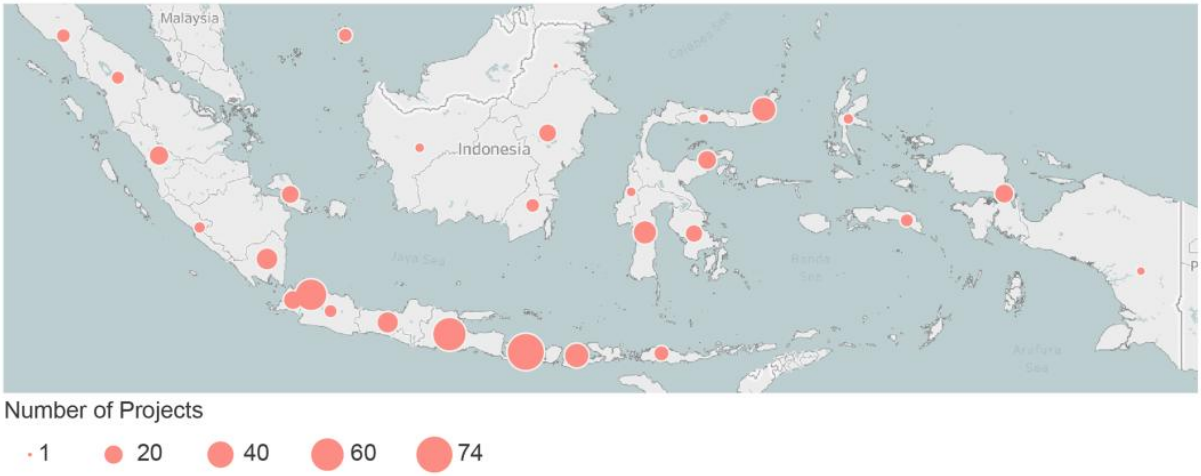
- Policies and regulations: 17 regulations related to coral restoration (4 laws, 3 government regulations, 2 presidential regulations, 8 ministerial regulations). All emphasize community participation and decentralization of permits.
- Restoration projects: 533 documented projects in 29 provinces, implemented by the government (38%), the private sector (15%), universities (14%), and NGOs (13%).
- Restoration techniques and materials:
  - Artificial reefs (66%): concrete (46%), steel (24%), used tires (popular in the 1990s, but disappeared post-2009).
  - Coral transplantation (53,640 units, nearly 1 million fragments planted).
- New methods: Mars Reef Stars (South Sulawesi, post-2013), EcoReefs, Reef Balls.
- Major program: Indonesia Coral Reef Garden (ICRG, 2020) planted nearly 96,000 structural units across 74.3 ha in Bali, involving 10,000 workers as part of the post-COVID-19 economic recovery.

Examples of coral reef restoration techniques used in Indonesia:

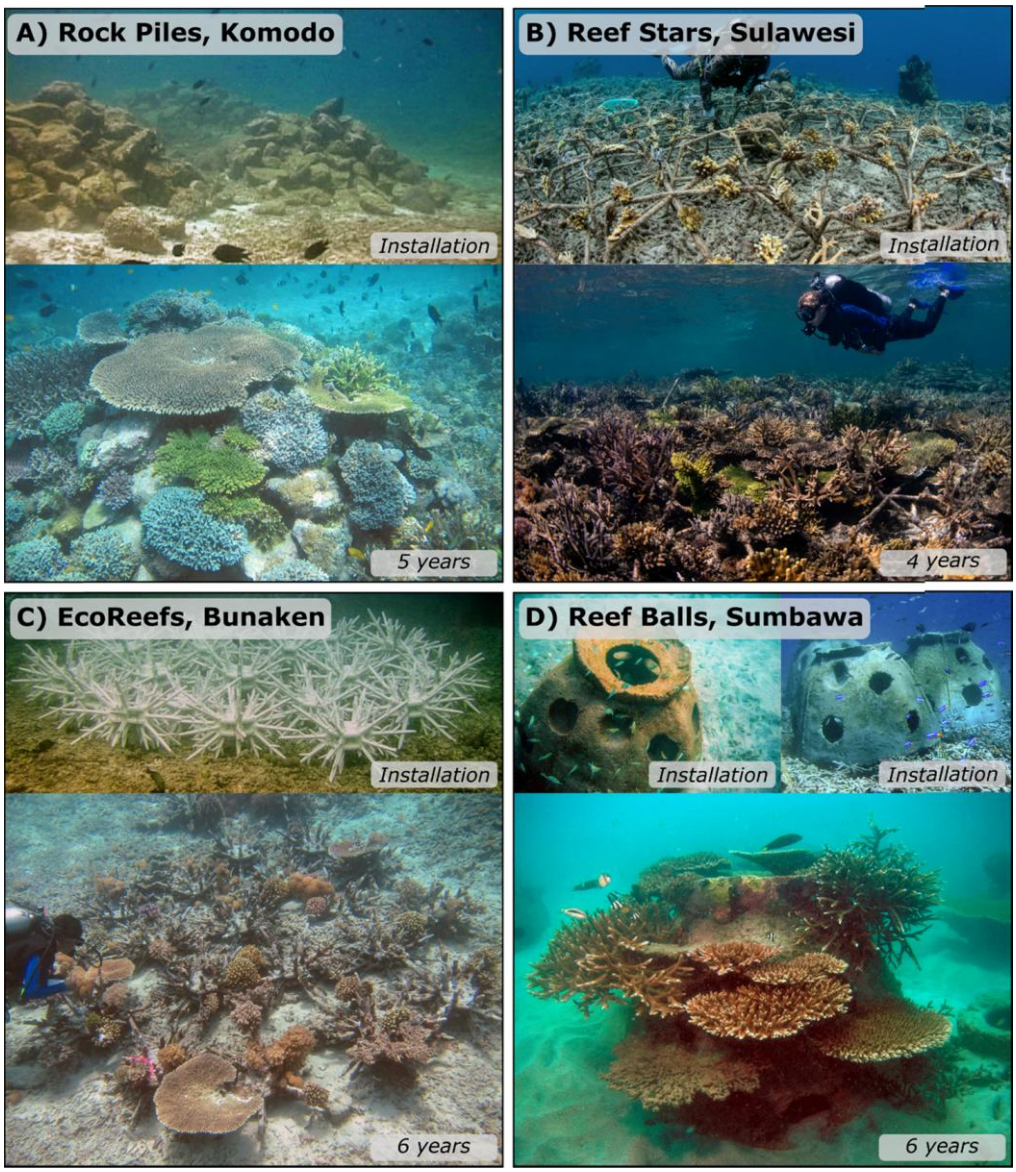
- Rock piles at Komodo National Park, East Nusa Tenggara
- Mars Reef Stars at South Sulawesi
- EcoReefs at Bunaken National Park, North Sulawesi
- Reef Balls at Sumbawa, West Nusa Tenggara

3. Impacts of reforms

- Large scale: Indonesia is now the country with the largest number of planted coral fragments in the world (>965,000).
- Practitioner diversity: Restoration is carried out across sectors (government, private sector, communities, universities).
- Method innovation: From simple artificial reefs (tires, concrete) to modern modular methods (Mars Reef Stars, EcoReefs).
- Regulatory strengthening: Ministerial Regulations No. 26/2021 & No. 28/2021 require permits and local stakeholder participation in restoration.
- Public awareness enhancement: 42% of project records are published online, demonstrating strong public communication.



Indonesia's coral reef restoration projects (1990–2020), aggregated by province. Circles are positioned at the geometric centre of each province; their size is proportional to the number of restoration projects in that province.



Examples of coral reef restoration techniques used in Indonesia (Razak et al. 2022).

4. Challenges and lessons learnt:

Challenges Faced in Coral Reef Restoration in Indonesia (1990–2020) include:

Lack of monitoring and evaluation: Only 16% of projects conducted post-installation monitoring. Most only conducted a single survey after installation, without long-term monitoring. As a result, it is difficult to assess ecological success (e.g., increased coral cover or fish community recovery).

Lack of standardization and clear targets: Indonesian regulations encourage broad participation, but do not establish standard methods or indicators of restoration success. Many projects focused on the number of fragments planted, rather than on ecological success or ecosystem sustainability.

Artificial reefs risk failure: 66% of projects were artificial reefs, but some were not planted with corals. If placed in inappropriate locations, the structures simply become "underwater debris" with no real ecological benefits.

Data fragmentation and reporting: Of the 533 projects, 42% were documented only in online news reports, not in scientific or official reports. This makes it difficult to verify data and share knowledge at the national and global levels.

Limitations of international knowledge exchange: 84% of records are only available in Indonesian. As a result, Indonesia's experience is underrepresented in the global literature (only 5% are included in the ICRI global restoration database).

Decentralized permits vs. national coordination: Regulations (e.g., Law 27/2007, Presidential Regulation 121/2012, Ministerial Regulation 26/2021) emphasize community participation and regional permits. This is positive for local involvement but leads to varying standards and weak coordination between regions.

External environmental pressures: Destructive fishing (dynamite and cyanide fishing) remains rampant. Mass bleaching has become frequent due to rising sea temperatures. Coastal population growth caused in pollution, habitat conversion, and excessive fishing pressure.

Lessons learnt include:

- Minimal monitoring: Only 16% of projects have post-installation monitoring. Most only conduct one-off surveys, rarely long-term.
- Artificial reef risks: Many structures are not planted with coral and have the potential to become "underwater trash."
- Knowledge sharing gap: 84% of documents are in Indonesian–less accessible to the global scientific community.
- Discontinuity of goals: Many projects focus more on the number of planted fragments, rather than on long-term ecological success.
- Significant opportunity: With 30 years of experience and the largest number of projects, Indonesia has the potential to become a global leader in coral restoration if monitoring and knowledge sharing are strengthened.

5. Sources:

Razak, T. B., Boström-Einarsson, L., Alisa, C. A. G., Vida, R. T., & Lamont, T. A. C. (2022). Coral reef restoration in Indonesia: A review of policies and projects. Marine Policy, 137, 104940.

B. Good practices at the local level on "Management measures and technologies for sustainable use of SCS coastal habitats and land-based pollution management"

China 1: The Shenzhen Bay Mangrove Wetland Restoration Project in Shenzhen city, China

1. Context and challenges:

In the past few years, the mangrove wetland in the Shenzhen Bay faced the Challenge as follows: the rapid expansion of urban construction led to the reduction of mangrove area; the direct discharge of industrial wastewater and residential urban sewage caused degradation of water quality and natural purification functions in mangrove wetlands; the man made waterway by hardening destroyed the structure and function of the coastal river ecosystem; the degradation of enclosure fish ponds resulted in reduction of migratory birds habitats; Mikania micrantha, Leucaena leucocephala and other alien invasive plants had a large distribution area, which occupied the niche of native biological species and made the wetland biological community structure single and vulnerable.

To protect the mangrove wetland ecosystem effectively to serve bird habitats and sustainable urban development, the Shenzhen municipal government took a series of coastal mangrove wetland restoration actions in the Shenzhen Bay such as mangrove sustainable management and replanting mangroves. As a result, the degradation and lose of mangrove ecosystem was reversed and the total area of mangroves increases gradually.

2. Actions done

River rehabilitation. The Fengtang River is the most important river running through Futian Mangrove Wetland. The main problem of the Fengtang River was that the harden face of this river bed and bank Led to vegetation free in the river with only water pipe function. This caused loses of the biological habitats and degradation of natural purification functions of the mangrove wetland. To solve the issue of Fengtang River, firstly, it is to change the surface structure of the channel from hardening to softening in the Fengtang River, and to reduce the elevation of the channel and lay a certain thickness of humus layer on the slope. This led to restoring the soil environment of the river channel to facilitate the growth of plants. Secondly, it is to restore riparian vegetation, and establish a "mangrove-semi-mangrove-shore based plant" ecosystem based on the habitat characteristics of the area.

Restoration of Fishponds for bird habitats. Enclosure fishponds provide high-tide level habitats for birds and have a positive effect on birds protection. The enclosure fish ponds in Futian Mangrove Reserve covered an area of about 66.67 hectares, accounting for 18% of the total area. However, the water is too deep so that it cannot meet the habitat needs of different birds. By learning from the fish pond management experience in the Hong Kong Mai Po Reserve, the Guangdong Neilingding Futian National Nature Reserve Management Bureau cooperated with the Mangrove Foundation (MCF) to take actions to meet the needs of different water bird habitats. The part of fish ponds was remedied, turning the artificially farmed fish

pond into a habitat for birds. The fishpond eco restoration area formed a mosaic pattern of deep water, shallow water and middle island. And reed communities were planted on the embankment to meet the needs of different water birds. In addition, to further create a suitable habitat for water birds, in summer, the water level of the middle island is controlled to be above 0.3 meters, and the middle island is completely submerged to prevent the growth of plants on the gentle slope; in winter, the water level of the middle island is controlled at 0.0 to 0.1 meters, forming the middle island and tidal flat for water bird.

Mangrove planting and intertidal zone reconstruction. The implementation scope of mangrove ecological restoration project (including mangrove planting and tidalflat reconstruction) is about 220 hectares. In the Shahekou estuaryof the west of Shenzhen Bay, the restoration of native mangroves is the main way to build a inhabit for birds, which provides a resting place for short footed waders; About 30.2 hectares of mangroves were planted in Shahekou of Shenzhen Bay and Fengtang estuary of Futian National Mangrove Nature Reserve. The Sonneratia apetala is used as the pioneer tree species for afforestation, and Sonneratia apetala forest is built on the non-forest land. As a result, the afforestation environment of the **intertidal zone** in the middle and low tidal zone is significantly improved to meet the growth requirements of native mangrove plants and provide a favorable habitat for native mangrove plants for afforestation on the non-forest land. After 2 to 3 years of planting Sonneratia apetala forest, they were removed manually for planting native mangrove species on the land. Finally, the native mangrove forest had a good growth without Sonneratia apetala.

Nature education. The Mangrove Foundation (MCF) cooperates with the Futian District Education Bureau, the Futian District Science and Technology Association, and the Protected Area Administration to carry out the "Futian District Primary and Secondary School Students' Mangrove Science Education Activity Project", which is open to reservations for schools in Futian District every month. In the Futian Mangrove Ecological Park, activities such as "Shenzhen Bay's Little Key", and "Thursday Fixed-point Bird Watching" are carried out, and "Visit Bird Paradise" and "Explore Tide" are carried out in the Mangrove Reserve. These promote awareness of coastal wetland protection, and develop a group of supporters for coastal wetland protection. Thousands of activities have been held to directly serve more than 200,000 people, including primary and secondary school students.

3. Achievements

Biodiversity increase. The function of mangrove wetlands in the area has been restored, and the biodiversity has been continuously improved. The abundance of plants such as Kandelia obovata、Bruguiera gymnorhiza、Aegiceras corniculatum、AcanthusIlicifolius increased, and the vegetation coverage rate reached more than 95%. The diversity of animals in the area is also more abundant, especially after the restoration of fish ponds, which have become the habitat of waterfowl at high tide level, and the species and numbers have increased significantly. After the implementation of a series of restoration measures, it has played a very important role in maintaining the ecological function of Shenzhen Bay on the migratory route of migratory birds, especially in the steady increase in the number of endangered and the Platalea minor. The number of the Platalea minor in Shenzhen Bay increased from 135 in 2000 to 361 in 2020.

Sustainable development. with the restoration of mangrove ecosystem, the natural connection between sea and city, birds and human beings were established to improve the integrated function of mangrove wetland ecosystem and the environment quality of the area. Shenzhen Bay coastal mangrove wetland has become a demonstration base for urban ecological

civilization construction. It is a resort for leisure and tourism for citizens and tourists at home and abroad. It provides mangrove protection education services.

4**. Lessons learnt:**

Firstly, land - based pollution control is integrated into mangrove restoration and protection. The new sewage treatment plants were built, and the rain and sewage pipe network systems were improved to strictly controls land-based pollution and raise water quality of the wetland.

Secondly, the structure and function of Shenzhen Bay coastal mangrove wetland ecosystem are systematically improved through taking measures such as comprehensive rehabilitation of river channels entering the Bay, functional restoration of fish ponds and waterfowl habitat, prevention and control of alien species, and replanting mangroves.

5**. Sources:**

Excerpt from The Project of Shenzhen Bay Mangrove Wetland Restoration of Chinese Best Practice cases issued by Ministry of Nature Resources in 2021

China 2: Effective management of ecological conservation and sustainable development using innovative and integrated approach at Dapeng Bay, China

1. Background

Dapeng Bay, facing the South China Sea, is located on the Dapeng Peninsula in the eastern part of Shenzhen. It is situated at the core area of the Guangdong-Hong Kong-Macao Greater Bay Area. The bay covers an area of 174 square kilometers, with 31 beaches and a coastline stretching 69 kilometers. It houses typical marine ecosystems such as coral reefs and seaweed beds, as well as seafront resorts and tourist destinations. Dapeng Bay is integral to Shenzhen's ambition to become a world-class coastal eco-tourism resort area and a global oceanic hub city. In 2022, it was selected as one of China's first 8 "Beautiful Bays" exemplary cases. In recent years, Shenzhen has implemented a variety of ecological and environmental management measures, the water quality of the offshore marine areas of Dapeng Bay has come up to the state's first-class standard, the ecological environment and biodiversity protection have achieved remarkable results, and the value of ecological products has been fully realized.

2. Actions done

Establishing a Marine Ecological Environment Protection Mechanism. Fistly, the establishment of a comprehensive and long-term management mechanism. Shenzhen programmed and implemented the "Shenzhen Marine Environmental Protection Plan (2018-2035)", following the concept of connectivity from watershed to estuary to marine areas. This plan introduces a comprehensive marine environmental management mechanism that includes total amount of pollutants discharged into the ocean, outfalls, and marine litter. A rotational co-chair meeting system for marine and land coordination was established by multiple departments to hold regular consultations, and clarify the key tasks for each stage. **Secondly, the improvement of an all-element smart supervision system.** China's first district-level all-element ecological environment dynamic monitoring system has been built. This model ensures that ecological environment elements such as surface water, nearshore sea areas, environmental emergencies, and biological resources are visible, measurable, and controllable, supporting the intensive efforts in preventing and controlling land-based pollution in the bay, as well as the habitat protection and restoration.

Intensifying Efforts in bay catchment Pollution Control. Firstly, strengthening the source tracing and remediation of land-based pollution. The improvement of the bay area's drainage system with rain and sewage diversion, restoration of municipal drainage networks, and community drainage network connections has been carried out. There has been a push to advance dual increase of the water volume and concentration entering sewage treatment plants, with Dapeng Bay achieving a sewage collection rate of nearly 100%. The control of the total amount of pollutants discharged into the sea is also enhanced. The implementation of a management list for coastal outfalls has established a "check, measure, trace, treat, manage" closed-loop management mechanism, ensuring that all coastal outfalls within the bay meet the water quality standards. **Secondly, Intensifying the cleanup and prevention of marine litter.** The "Coastline and Marine Litter Comprehensive Management Implementation Plan of Dapeng New District" and the "Marine Litter Cleanup and Prevention Work Plan of Yantian District" were issued, achieving a "patrol-notify-remedy-feedback" closed-loop management system.

The efforts have promoted seamless connection of marine litter collection, transportation, and disposal, and a special cleanup operation in Dapeng Bay has cumulatively cleared about 523 tons of marine litter.

Habitat Protection and Restoration. Firstly, restoring the ecological environment along the coastline. Spatial control measures have been implemented for the coastal zone, dividing it into several sections and prioritizing the implementation of ecological protection, development and utilization as per ecological control guidelines. Efforts have been made to promote regular coastline restoration for beaches such as Guanhu and to expand and enhance the quality of key beaches like Dameisha and Xiaomeisha. Dapeng Bay provides the world with a Natural-Based solution, which adopts a triple coastal defense strategy and carries out ecological seawall construction with high standards in the eastern section of Moon Bay, Shayuchong, and the eastern section of Guanhu, creating Shenzhen's most beautiful coastal leisure landscape corridor. **Secondly, conserving typical marine habitats.** Shenzhen established China's first national-level marine ranch demonstration area which focused on coral conservation—the Dapeng Bay National Marine Ranch Demonstration Area—with the deployment of about 27,600 cubic meters of artificial fish reef structures (comprising 688 individual structures). China's first Coral Conservation Center was established in Dapeng, successfully breeding Shenzhen's first batch of sexually reproduced coral offspring. Active coral surveys have been conducted, with the launch of Guangdong Station of China Coral Survey in Dapeng.

3. Achievements

After years of efforts, the ecological environment of Dapeng Bay has significantly improved. The water quality of the offshore marine areas has reached the state’s first-class standard. All coastal outfalls into the bay area are up to standard, and comprehensive cleaning of beach litter has been achieved with no blind spots. The bathing beaches have reached the excellent standard in comprehensive evaluation. Notable results have been achieved in the biodiversity conservation in the bay area: there are over 190 species of fish, crustaceans, cephalopods, and mollusks; more than 130 species of phytoplankton such as algae; and nearly 100 species of corals, with a coral community coverage rate reaching 50% in key distribution areas. The value of ecological products has been fully realized: the area received over 30 million visitors annually, with the tourism revenue of Dapeng New District reaching 9.7 billion yuan in 2023.

4. Lessons learnt:

Multi-sectors Coordination, Establishing a New Mechanism for Integrated Terrestrial and Marine Ecological Environment Governance

Five departments, including ecological environment and marine affairs established joint working mechanism to promptly report and find solution in marine environmental pollution, ecological landscape damage, and sudden environmental accidents discovered through water quality monitoring and law enforcement inspections. This enhances the cross-departmental handling of problems, comprehensively improving the ecological environment supervision and synergy in Dapeng Bay.

Co-construction and Sharing, Creating a new pattern of multi-dimensional collaboration in Marine ecological protection.

A "Beautiful Bay" Co-construction and Sharing Platform has been built with "Government Leadership, Corporate Support, and Social Participation". Driven by the government and actively supported by donations from enterprises, several ecological environmental protection foundations have been established. 11 bay ecological environmental protection organizations have been cultivated and set up. Publicity activities for typical marine habitats conservation have been actively carried out. Underwater cameras have been set up to broadcast live footage of the seabed corals, spreading awareness about coral protection and planting effectiveness. Coastal community members jointly participate in underwater garbage cleaning. Diverse participation in marine ecological protection actions has been achieved.

Reform and Innovation, Promoting a New Path for Marine Ecological- Environment-Oriented Development

Shenzhen has issued China's first comprehensive local standard for Marine carbon sink Accounting Guidelines, carried out Marine Gross Ecosystem Product (GEP) accounting, formulated China's first district-level collaborative index for reducing pollution and carbon, and carried out pilot construction of near-zero carbon emission communities, creating a new model for low-carbon development in the Gulf. Taking the Xiaomeisha area as a pilot, the integrated implementation and development of ecological environmental governance and cultural tourism industry are promoted, which has been selected for China's Ecological and Environmental Protection Financial Support Project Reserve. Adhering to the development concept of "Ecology, tourism, and economy", the Greater Bay Area Dragon Boat Race was hosted at the bay, and several marine sports tourism brands were built, such as the Dameisha International Water Sports Center, the Jinshawan International Park, etc. In addition, publication of the most beautiful natural scenery spots in "Ecological Dapeng" makes people further promote the concept of sustainable development.

5. Sources:

Shenzhen Municipal Ecology and Environment Bureau, China

Contacting information: Huaming Luo, Deputy Director of the Department of Natural Ecology and Marine Ecological Environment, Ecology and Environment Bureau of Shenzhen Municipality.

China 3: Rehabilitation of Yintan beach by Nature-based solutions and supporting artificial measures and regulation reform in Beihai, China

1. **Context and challenges:**

Beihai City sits on the northeastern coast of the Beibu Gulf in southern Guangxi, boasting abundant natural resources and great cultural tourism attraction. The Beihai Silver Beach is a landmark of Beihai City — the west section is long and flat, known for its white sand, clean water, and gentle waves, while the east section features vast mangrove forests and flocks of birds. In the past few years, the Beihai Silver Beach was plagued by issues such as unstable quality of river water flowing into the sea, marine litter, and degradation of coastal wetland. In recent years, Beihai has given priority to ecological and green development towards a sustainable and beautiful bay. Beihai further enhanced land-sea pollution prevention and control, ecosystem conservation and restoration, and coastal environment improvement, striving to achieve harmonious coexistence between humanity and nature. The Fengjia River Rehabilitation was selected as top ten typical cases of ecological restoration and the typical case of natural-based solution. The Beihai Coastal Wetland was listed as a wetland of international importance. The key objectives were achieved at the bay, for instance, the proportion of the sea water with good-quality keeps at 100%, and the regional biodiversity increase. The Yintan Tourist Resort was upgraded to "National-level tourist resort" in 2023.

2**. Actions done**

Implementation of comprehensive pollution prevention and control measures to address marine pollution. Beihai have carried out targeted pollution prevention and control measures with a focus on the Fengjia River, which flows into the sea at the Beihai Silver Beach. Firstly, Beihai stepped up efforts to control the sources of pollution. To be more specific, Beihai removed 540,000 cubic meters of contaminated silt, laid 27.7 kilometers of sewage pipelines, constructed 19 sewage treatment facilities along the river, built 1 new urban sewage treatment plant, remedied 1.33 million square meters of areas affected by pollution from aquaculture and 24 farms in the watershed of the Fengjia River. In addition, Beihai built a new water reclamation plant, laid 18 kilometers of water replenishment pipelines, and used reclaimed water for ecological water replenishment. Secondly, Beihai implemented different measures for different areas. A total of 44.7 kilometers of river revetments and 545,000 square meters of aquaculture ponds along rivers have been remedied, while 83,000 square meters of mangrove forests have been conserved and restored. Thirdly, Beihai facilitated the establishment of the "marine litter cleanup system" and the issuance of the Assessment Method for Cleaning Litters on the Shore and Floating on Sea Surface (Trial) in Beihai City, strengthening supervision and assessment to manage litters on the shore and floating on sea surface.

Implementation of the Nature-based solution on ecosystem conservation and restoration. Firstly, Beihai formulated the Regulations on Mangrove Resources Protection in Guangxi Zhuang Autonomous Region, which is the first legislation for mangrove conservation in China. Secondly, Beihai enhanced the management of mangrove forests in Beihai City by dividing the forests into 22 grids and appointing 2 full-time rangers in coastal townships, ensuring grid-based regular mangrove forest management and patrol. Thirdly, Beihai carried out a specific action plan for mangrove protection and restoration. Since 2020, Beihai City has planted 3.389 million square meters of mangrove forests, including nearly 27,000 square meters at the Beihai

Silver Beach, and restored more than 10 million square meters of mangrove forests, including over 1.33 million square meters at the Beihai Silver Beach. Fourthly, Beihai released approximately 114 million units of various juvenile fish in Beihai City, including yellowfin seabreams, Kuruma prawns, Lutraria sieboldii, and blackhead seabreams, to stimulate the reproduction of aquatic life.

Enhancement of protection and restoration of the Beach. Firstly, Beihai strengthened beach protection through the issuance of related regulations. For example, the Regulations on the Protection of Coastal Beaches in Beihai City have been issued, specifying that reclamation projects encroaching on beaches and mangrove forests are prohibited within 300 meters from the coastline. Secondly, improved the quality of the beach environment. 3.3 kilometers beach shoreline were recovered to form 167,200 square meters beach areas, and 40,400 square meters of dykes and reclamation were returned to the sea. constructed public facilities along the coast to forge "Ten Miles coastal beach of Yintan" for further enhancement of the public's sense of happiness enjoying the sea landscape to promote tourism development.

3. Achievements

Ever since the "Beautiful Bay" initiative was launched, the Beihai Silver Beach has witnessed continuous improvement in ecological environment. With 100% high-quality water areas and a litter coverage of merely 0.106‰, the beach is very clean. Moreover, the regional biodiversity has been improved significantly, with a total of 19 species of mangrove plants, 206 species of birds, and 207 species of benthonic animals. The Fengjia River Water Environment Management Project has been selected as one of China's top ten exemplary cases for ecological restoration with Chinese characteristics and a typical case of natural-based solutions, and the Beihai Binhai National Wetland Park has been recognized as a wetland of international significance. In 2023, the Beihai Silver Beach was selected as an outstanding example of "Beautiful Bay" construction[3], and the Beihai Silver Beach Resort was honored as a "National Tourism Resort". In 2023, Yinhai District, where the Beihai Silver Beach is located, recorded 18.0986 million visits from tourists and a comprehensive tourism revenue of RMB 22.858 billion, up by 140.99% and 142.6% year-on-year respectively. Featuring clear water, clean beach, as well as diverse species of fish and birds, the Beihai Silver Beach is the epitome of harmonious coexistence between people and the sea.

4. Lessons learnt:

Establishing the Bay Environmental Protection Responsibility System for long-term conservation. The official of the Beihai Municipal People's Government was appointed as the chief of the bay management, responsible for comprehensive management of the land, sea, and river, took coordination among relevant departments of the city government. The performance assessment method for the System was formulated for effective implementation.

Advocating nature-based ecosystem solution. Adhering to the principle of respecting, conforming to, and protecting nature, taking nature-based shoreline restoration, mangrove protection and restoration, as well as ecosystem restoration along the Fengjia River, so as to preserve the original topography and geographic pattern, enhancing the self-purification and restoration capabilities of the coastal ecosystem, and improving the quality and functionality of the ecological environment in restoration areas.

Promoting ecological protection through legislation. Beihai is the first city in China to formulate and implement regional laws and regulations for ecological protection, including the Regulations on the Protection of Coastal Beaches in Beihai City and the Regulations on Mangrove Protection in Beihai City, designating the space within 300 meters from the coastline as the protection zone. This will provide a legal basis.

5. Sources:

Department of Ecology and Environment of Guangxi Zhuang Autonomous Region

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China 4: Restoring the Haikou Bay with Nature-based Solutions and Watershed Approaches in Haikou city, China

1**. Context and challenges:**

Haikou City, located in the northern part of Hainan Island, is a model city for ocean economy innovation and development. Haikou Bay is located in the center of Haikou City and borders Cape Tianwei to the west and the Nandu River estuary to the east. The bay's total area is 268.2 square kilometers, and its coastline is 59.4 kilometers long. The bay plays a critical role in Haikou's urban development. Haikou Bay is primarily composed of sandy beaches and is rich in tourist resources, such as Holiday Beach, Xixiu Beach, and other nationally renowned beaches. The bay plays an important role in strengthening the leading role of the Hainan Free Trade Port core area, and enhancing Haikou's ecosystem and the city's core competitiveness. Due to development activities, Haikou Bay once faced ecological and environmental issues such as inferior-quality river water discharging into the sea, serious coastal erosion, ecological function degradation, and inaccessible coastal areas for people . In recent years, Haikou has promoted the construction of an amazing bay and made Haikou Bay a blue ecological business card for city development. After years of careful work, Haikou Bay has achieved success in ecology, the economy, and society. It has become a scenic bay featuring "coconut fragrance, ocean scenery, and free communication between city and bay."

2**. Actions done**

Strengthening the comprehensive prevention and control of pollution across river basins. 1. Radical measures were taken to clean up black and polluted rivers, permanently improving the water environment; 2. Tailored measures were adopted to clean up each estuary, improving water quality; 3. Offshore cleanup systems were established to clean up all littoral rubbish; 4. Closed-loop management was promoted to collect, transfer and treat onboard water pollutants.

Improving the marine environment using ecological methods to create beautiful seascapes. An investment of 348,000,000 yuan was made in ecological restoration projects on the west coast of Haikou and in Haikou Bay. Sandy coastline conservation and restoration projects were also promoted, restoring 4,600 metres of coastline. Over the past three years, 33,250,000 fish and shrimp have been released to replenish the ocean's biological resources. An investment of 576 million yuan was used to rectify and restore the Wuyuan River wetland, transforming a smelly river into a national-level wetland park.

Making people have equal access to the coastal area. 1. An ecological corridor has been completed to create a seaside amusement park. With an investment of 1,871,000,000 yuan, the Haikou Bay Passage Engineering and West Coast Passage Construction and Renovation Projects were implemented, completing the comprehensive rectification and functional improvement of 32.7 km of coastline. The Huludao Island landfill project was removed and ecological restoration was completed to restore Haikou Bay's water circulation, coastline communication and ocean views.2. A tour economy was developed to create a charming bay. Leisure and entertainment sites such as the Yundong Library and Mid-Air Hills were built, as well as speciality ocean culture and tour events such as the Dragon Water Bath and the China Yachting Annual Ceremony.3. The cultural atmosphere was enhanced to create a cultural bay. Hainan University, a 'double world-class' university, is located in the heart of the Haikou Bay area. The university carries out research activities on tropical ocean resources, cultivates ocean-related talent, and is constructing a first-class oceanological research base.

Safeguarding the ocean by establishing new systems for bay conservation. Haikou City established a coordinated mechanism for jointly rectifying the six rivers. They also fortified the top-level design of bay protection planning systems. The “three-line one-list” zoned management was implemented. The 14th Five-Year Plan for the Marine Ecological and Environmental Protection of Haikou Municipality was released.

3**. Achievements**

Create a clean sea. The quality of offshore water has improved continuously, with 100% of offshore areas attaining Excellent and Good levels in 2021 and 2022.

Create a new ecology with a beautiful coastline and biodiversity. Restore and significantly improve natural coastlines and ecological functions. The populations of major ocean creatures and wetland rare wildlife are replenished. The bee-eater reserve on the Wuyuan River was selected as one of the world's top 100 biodiversity cases, and as an outstanding case of biodiversity protection in 2022.

Create a golden coastline for seaside leisure and entertainment. Access to the sea is fully improved, and oceanic culture is enriched and developed. The Yundong Library has attracted over 200,000 readers and visitors, while the Qilou App and WeChat account has seen a 1380% increase in followers. The two sessions of the China Yachting Annual Ceremony recorded over 160,000,000 views on sports.sina.com.cn.
Create a new model for bay rectification. Coordinated systems for the prevention, control and enforcement of ocean pollution have been established to implement a new approach to coordinated land-sea and river-sea rectification.

5. Lessons learnt:

Coordinate land and sea rectification to continuously improve the quality of the coastal water. We implemented the joint rectification of the six rivers. Getting rid of concrete riverbeds and riverbanks to eliminate waters below Class V completely. Rectify black and stinky rivers and maintain a high-quality water environment by controlling the source of emissions, stopping the emission of pollutants, carrying out internal source rectification and conducting biological restoration.
Create an ecological corridor to form the most beautiful 'city parlor'. Thoroughly integrate the city's history, culture and landscape with the construction of the amazing bay to realise water circulation, coastal communication and an unobstructed ocean view. Following the rectification of the bay, the ecological landscape of Haikou Bay has been completely upgraded and the integration of ocean ecology, cultural industries and tourism has been achieved, as has the transformation of the blue ocean and silvery beach into valuable assets.

Systematically restore the area to create a model for urban river estuary rectification. In the ecological restoration of the Wuyuan River wetland, natural recovery plays a primary role and ecological restoration plays a secondary role. Comprehensive rectification in various forms, including reducing pollutant emissions by controlling sources, fighting flooding and removing waterlogging, improving the water environment, restoring water ecology and improving the water landscape, was adopted to create a healthy composite 'reservoir–river–seaside coast' ecosystem. This provides a practical example of how to rectify pollution and conserve biodiversity in small-scale urban estuary systems.
Improve a legal system to improve the long-term mechanism for conserving the ecological environment of the bay area. Local rules and regulations on the bay conservation have been promulgated. Haikou established a working mechanism for the coordinated rectification of six

rivers. A complete offshore cleanup system has been established for the regular removal of rubbish from beaches and the sea.

Sources:

Department of Ecology and Environment of Hainan Province, China

China 5.: Watershed Treatment and Coastal Wetland Restoration at Maoweihai, Guangxi, China

1. **Context and challenges:**

Maoweihai is a semi-closed bay in Beibu Gulf Area, part of Guangxi zhuang autonomous region. It is one of the demonstration sites of SCS SAP project in China. There are about 2371ha of mangroves and coastal salt marsh wetland distributed in Maoweihai. In recent years, the total amount of pollutants flowing into Maoweihai was continually increasing which led a negative impact on Maoweihai wetland habitat, and wetland ecosystem was in degradation. To solve problems above, Guangxi Department of Ecology and Environment developed the Maoweihai integrated environmental management plan in December 2022 and Guangxi government also took many measures about pollutant control and prevention and ecological protection and restoration.

2**. Actions done**

First, local government continually improves mangrove wetland protection regulations and strengthen the cooperation among departments to enhance the ability of mangrove wetland inspection and law enforcement. In addition, goals about Maoweihai integrated management are set by the plan. In the 14th Five-year plan for high-quality development of marine ecological and environmental protection in Guangxi zhuang autonomous[2], the goal about the marine water quality was made. Guangxi Department of Ecology and Environment developed the Maoweihai integrated environmental management plan, which set goals and measures about reducing pollutant concentration, protecting wetlands ecosystem and marine rare animals, etc.

Second, measures and projects about coastal wetland protection have been taken. Since 2019, about 37,950,800 yuan were invest to mangrove re-plantation projects like Qinnan district 2021 Beibu Gulf typical coastal wetland ecosystem protection and restoration project. Since 2020, municipal finance department made an overall arrangement on organizing relevant departments to clear illegal mariculture. By promoting a normalized mechanism for joint enforcement, more than 460 rafts, 30 seines and 18 pillars have been cleaned up till September 2023.

Third, major river comprehensive treatments have implemented and measures of controlling the total amount of pollutants flowing into Maoweihai have been taken. On the basis of field survey, water quality simulation and environmental capacity caculation, Guangxi Department of Ecology and Environment with Qinzhou government and Fangchenggang government set the goal about reduction quantity of pollutants to Maoweihai and assigning the pollution control tasks to related administrative districts. By implementing projects about rain and sewage diversion, ecological mariculture, livestock wastes disposal and application, riparian zone ecological restoration and tributary water quality improvement treatment, the water quality of major rivers flowing into Maoweihai is continually improved.

3**. Achievements**

First, mangrove wetland resources are effectively protected. In 2005, Guangxi Maoweihai mangrove autonomous region nature reserve and reserve management office was established. About 82.47% of mangrove in Qinzhou city are included in the nature reserve [3]. In 2011,

Maoweihai national marine park was established in Qinzhou, Guangxi, with an area of 3482.7ha [4]. Most areas of Maoweihai are declared within the ecological red line, and under the protection of related laws and regulations at national and local level, such as ecological red line control requirements and Guangxi zhuang autonomous region wetland protection regulations. In addition, by implementing related projects, more than 490.37ha mangrove are re-planted or restored in Maoweihai since 2019.

Second, marine environment has continued to improve, seawater quality and major pollutant concentrations have reached the target set by the government. Local government and related departments took measures like seagoing river management, sewage outfall management, ecological culture pilot project, ect., which promotes the effectiveness of Maoweihai integrated environmental management and improve the seawater quality. In 2022, the water quality indexes of Maoweihai reached the fourth category of GB3097-1997[5], and the concentration of inorganic nitrogen and reactive phosphate reduces 15% respectively [6].

Third, the public awareness about coastal wetland protection are significantly raised. For instance, festivals and special days like World Wetland Day, Ocean Day, World Earth Day, Wildlife Conservation Month, Bird-Loving Week and Arbor Day are regularly held, which significantly enhance public awareness of coastal wetland protection.

4. **Lessons learnt:**

First, the comprehensive treatment about pollution control and ecological restoration could promote the all-round protection and restoration of coastal wetlands, including improve the environmental quality of coastal wetland and protect the wetland habitat and biodiversity. Second, the institutional reform by specifying the responsibilities of related departments and developing dedicated department and staffs effectively contributes to wetland ecological protection and restoration. Third, the government-led approach could effectively solve key difficult problems, and promote the implementation of all tasks successfully.

5**. Sources:**

South China Institute of Environmental Sciences of MEE, China

Reference：

[1] Department of Ecology and Environment of Guangxi Zhuang Autonomous Region. 2022. Maoweihai Integrated Environmental Management Plan

[2] Department of Ecology and Environment of Guangxi Zhuang Autonomous Region. 2022.The 14th Five-year Plan for High-quality Development of Marine Ecological and Environmental Protection in Guangxi Zhuang Autonomous

[3] GUOPING YIN. List of Precious Species in Guangxi[J]. .Forestry of Guangxi, 2010(11):44-45

[4] Guangxi Zhuang Autonomous Region Oceanic Bureau. 2011. Qinzhou Newly Built National Marine Park[OL]. http://hyj.gxzf.gov.cn/gzdt/qnkb_66841/t3175150.shtml

[5] Department of Ecology and Environment of Guangxi Zhuang Autonomous Region. 2023. Reply of the Department of Ecology and Environment of Guangxi Zhuang Autonomous Region to Proposal No. 2023549 of the 14th National People's Congress of the Autonomous Region[Z]

[6] Department of Ecology and Environment of Guangxi Zhuang Autonomous Region. 2022. Notice from the Department of Ecology and Environment of the Autonomous Region on Issuing the 2022 Action Plan for Pollution Prevention and Control in Guangxi Coastal Waters[Z]

China 6: Coastal eco-restoration and comprehensive watershed improvement in Beihai, Guangxi, China

1. Context and challenges:

The Beihai City is Located in the south of Guangxi Zhuang Autonomous Region and the northeast coast of Beibu Gulf, with a flat and open terrain, surrounded on three sides by the sea. It is an important member of the Guangxi Beibu Gulf Economic Zone. The nearby sea areas are rich in biological resources with typical marine ecosystems, which are mangrove forest, sea grass bed and coral reef. Beihai National Wetland Park is a typical example of the complex wetland ecosystem with "reservoir-river-offshore" in southern China. The northern part of the park includes the Liyudi Reservoir and its surrounding buffer areas. The central part includes the Fengjiajiang River from the Liyudi Reservoir to the mouth of the river, and 50-200 meters wide buffer areas along both sides of the river. The southern part includes the Fengjiajiang River's estuary, and coastal mangrove forests (Jinhaiwan[1] Mangrove reserve included) and the shallow sea. In the Beihai National Wetland Park, there are 9 national protected mangrove species, 17 kinds of endangered animals and plants, 86 species listed in the migratory birds that China-Japan protect jointly and 38 species that China-Australia protect jointly.

With rapid development of urban construction, coastal industries, aquaculture and tourism, the Fengjiajiang River basin was seriously polluted, and the environmental quality of the Yintan Beach and adjacent sea areas was degraded, the structure and function of coastal wetland ecosystem were impaired and degraded, the coverage of mangrove forests and biodiversity decreased. In over past years, sewage in the Fengjiajiang River basin was directly discharged into the sea, leading to excessive fecal coliform of bathing water in the Yintan[2] Beach and surrounding waters. The silt content in many places of the Yintan Beach's areas was increased. The problems above had a serious impact on the water quality and environment of the Yintan Beach. Thus, Beihai city government took the Integrated Coastal Area and River Basin Management (ICARM) approach to implement comprehensive measures to curb pollution and promote coastal eco-restoration.

2. Actions done

Sponge city construction. While improving urban infrastructure such as the rainwater pipe network, Beihai city gives full play to the role of ecosystems such as greenbelt and water system in absorbing, storing and releasing rainwater, to effectively control rainwater runoff and realize natural accumulation, infiltration and purification. Firstly, the city gradually upgraded the rainwater pipe network and drainage pump stations during the urban reconstruction to establish functions of rainwater regulation and storage of the urban ecosystem, to reduce the flood water pressure on the downstream Fengjiajiang Wetland, which fundamentally solved the problem of urban waterlogging. Secondly, by taking the **e**ngineering measures including biological treatment(e.g. sinking greenbelts and rainwater storage and purification ponds) to make infiltration, storage, retention, application, purification, and drainage, the city promoted comprehensively the capacities in flood control, drainage and water supply, improved

[1] Jinhaiwan literally means golden bay

[2] Yintan literally means silver beach

the urban water ecological environment and built an urban water cycle system, Thirdly, the city made reservation of natural waters such as rivers and lakes, while establishing the connection among waters.

Ecosystem restoration based on pattern and function of the ecological landscape. First, Ecological restoration of the upstream Liyudi Reservoir. The existing ponds around the reservoir were reconstructed to create ecological islands that enrich habitat types. To improve water self-purification capacity, the ecological shorelines were extended with planting indigenous species such as *Bougainvillea speetabilis and Colocasia antiquorum schott* on the banks. **Second, Ecological restoration of the upstream open channels.** The illegal buildings on both sides of the two open channels in the upper reaches of the Fengjiajiang River were removed. Well-growing trees within the ecological red line were retained. The vegetation with filtering and reduction of nonpoint were replanted to build the areas into a vegetative filter strip. As a result, the ecological function along the river is restored. **Third, Ecological restoration of the fresh water in the middle and upper reaches of the Fengjiajiang River.** To restore natural ecological interface environment, the cemented slope protection around ponds was demolished and replaced with ecological material slope protection for seepage waterproofing. Ecological slope protection was designed to expand the interface between vegetation and water. In order to improve the purification efficiency and increase biological diversity, aquatic plants with purification functions such as *Pontederia cordata* were planted on the slope to transform the ponds into ecological wetlands, which function to intercept pollution and purify water. **Forth, Brackish water ecological environment restoration in the middle and lower reaches of the Fengjiajiang River.** In the middle and lower reaches of the Fengjiajiang River, the self-succession restoration method was adopted. the flinty slope protection work was demolished and replaced by semi-mangrove indigenous plants which help improve water quality, such as *Heritiera littoralis,* so as to form a stable mangrove ecological environment and provide a nesting and foraging place for birds. In the estuary area, salinity is high in the water, so is the salinity and alkalinity in soil. Also, it is a landing place of typhoon, where plants need to feature higher adaptability. In some nearby areas, it is suitable to plant native palms plants. They consume less fresh water, and form plant communities that are resistant to typhoon, high soil salinity and alkalinity and bacteria. **Fifth, mangrove forest conservation and restoration.** Mudflats in the mangrove forests area are closed restoration with implementing afforestation projects. Indigenous mangrove species (mainly *Avicennia marina and Kandelia obovata*) are extensively planted or replanted in suitable forest lands to restore biodiversity and stabilize the ecosystem in wetland mangrove forests. At present, 370 mu[3] of mangrove forests have been successfully restored, and 270 mu have been planted artificially. In some areas, the preservation rate of artificially planted mangrove forests has increased from less than 20% to more than 50%. Non-native mangrove species, such as *Sonneratia apetala,* are monitored to bring their distribution and growth under control. **Sixth, the Coastal Yintan Beach restoration.** The coastal beach has been purified through a few projects. A total of 7.44 hectares of beach and about 1,430 meters of shoreline have been restored in the comprehensive ecological remediation and restoration project along the central shoreline of the Yintan Beach.

[3] 1 mu=0.0667 hectares

3. Achievements

Water quality reaches the standard. Aquaculture pollution sources in the targeted area have been wiped out. 27.7 kilometers of sewage pipelines have been laid in the Fengjiajiang River basin, and 19 sewage facilities have been built. A total of 540,000 cubic meters of silt have been removed, while nearly 2,000 mu of the polluted aquaculture area was remedied. The water quality of the Fengjiajiang River remained inferior to Class V in the past years, but it now has reached and even exceeded the standard of surface water Class IV. The excellent and good water quality rate of bathing water of the Yintan Park in Beihai city has sharply increased from 20% in 2019 to 64.28% in 2020.

Biodiversity increase. According to incomplete statistics, 182 species of birds have been monitored along the coastal area in recent years, 46 more than in 2017. *Eurynorhynchus pygmeus* (Spoon sandpiper), a critically endangered bird around the world, and birds under State protection category II, such as *Elanus caeruleus* (Black-winged kite) and *Centropus sinensis* (Greater coucal), have been monitored for many times. Since coastal mudflats have fully been recovered, the number of benthic species, such as *Sipunculus nudus* (sandworms), has increased from 66 in 2017 to the existing 153. Rare marine animals such as *Tachypleus tridentatus* (Chinese horseshoe crab) and *Chelonia mydas* (green turtle) have been found around the estuary. The growing condition of 17 mangrove plants distributed in the basin has also seen obvious improvement.

Improved quality of community life, with community - based co-construction and co-management projects, Beihai National Wetland Park has improved the production conditions in rural communities, increased the income for people in the nearby communities and made them enjoy a higher living standard and quality of life. Also, the projects have inspired the residents to be more aware of environmental protection. As a result, people have been spontaneously carrying out environmental protection measures, which contributes to the harmony between people and nature.

4. Lessons learnt:

Nature-based solutions combined with appropriate artificial measures to promote urban ecological restoration. The measures fully respect the regional natural geographical pattern, the law of natural ecosystem succession, as well as the law of marine hydrodynamics. Taking the integrity and interaction of land and marine ecosystems into consideration, the projects were implemented for the coastal complex wetland ecosystem protection and restoration. In addition, due to the intensive human activities in cities, artificial measures should be taken to speed up the restoration process and improve the effect. The measures should be made according to the needs to control urban water pollution, improve living environment, promote ecological and leisure tourism towards sustainable development.

Construction of an urban ecological infrastructure network to ensure urban ecosystem services, on the base of the Liyudi Reservoir, the Fengjiajiang (river) corridor, the Beihai National Wetland Park and other green belts in the city's parks, Beihai city has built an ecological infrastructure network with connecting water system of rivers, lakes and reservoirs to form a complex wetland ecosystem. With the support of mangrove forests, mudflats and beaches, a complete and stable natural ecological barrier along the coast has been formed. The urban ecological infrastructure built by both natural and artificial means has provided Beihai city and its residents with clean

water, fresh air, leisure and entertainment facilities, and aesthetic and educational services.

Taking an ICARM approach, to implement comprehensive measures. The scope of restoration projects covered the estuaries, bays and coastal zones which are located in the land-sea interaction area. Being problem-oriented, **the "integrating land with sea" approach should be taken at implementation of the restoration projects** to protect and improve the environment of the river basin and the sea. On the one hand, the city implemented the watershed pollution prevention and control to improve the water quality of the river and estuary. On the other hand, the city spent great efforts in protecting and restoring coastal wetlands, mangrove forests, beaches and coastlines to form coastal ecological green belts.

5. Sources:

Excerpt from The Coastal eco-restoration and comprehensive watershed improvement in Beihai city of Chinese Best Practice cases issued by ministry of nature resources in 2021.

China 7: Integrated management of water quality of Qianshan River in Zhuhai, Guangdong, China

1. Context and challenges:

Qianshan River belongs to the Pearl River Delta System. It originates at the southeastern Wugui Mountain, Zhongshan City. It flows through Zhongshan and Zhuhai and into Wanzai Waterway through Shijiaozui Sluice Gate, facing Macao. The main river is 23 kilometers (Zhuhai section about 8 kilometers, Zhongshan section about 15 kilometers), with a total basin area of 328 square kilometers (114 square kilometers in Zhuhai City, 214 square kilometers in Zhongshan City).

Since the 1990s, with the rapid development of economy and society, urban population had grown greatly, and agricultural and industrial pollution load had increased continuously. It caused heavy environmental pressure on the city. In addition, urban pollution treatment infrastructure construction lagged behind. The city faced extreme environmental challenge. The water quality in the river basin was deteriorated. From 2017 to 2019, the section of Shijiaozui Sluice Gate was only Class IV. From 2018 to 2019, it was Class V and poor Class V for seven times. There are 44 channels in Qianshan River basin, and 30 of them were poor Class V water bodies in 2019, accounting for 68% of the total.

2. Actions done

First, implementing Integrated River Basin Management approach. In 2019, the Plan for Comprehensive Water Environment Improvement in the Qianshan River Basin was formulated and adopted, with a total investment of 7.3 billion yuan to improve the water environment in the Qianshan River Basin.

Second, implementing diversion of rainwater and sewage. From 2020 to 2022, the projects of rainwater and sewage diversion for more than 630 drainage units were completed, the pipe network was built for more than 740 kilometers to achieve the goal of "sewage into the waste water treatment plant and clean water into the river". At present, the sewage collection rate in the basin has reached 86%.

Third, ecological landscape was built. A riverside park, 10.1 kilometers of park greenway and 6.5 kilometers of green infrastructure were built. Qianshan Green infrastructure functions such as an ecological corridor, a recreational scenic road, a cultural corridor.

Forth, the transboundary water environmental cooperation mechanism between Zhuhai city and Zhongshan city was established. The two cities jointly organized and formulated the Plan for Transboundary Flood Control and Comprehensive Control of Water Pollution in Qianshan River Basin so as to jointly promote the treatment of transboundary water of Qianshan River system from the whole basin.

Fifth, promoting the public engagement. A number of large scale mass activities were held, such as fishing competition and "River Xiaoqing" volunteers patrolling and protecting the river. In addition, annual July 28 was set as "Qianshan and River Protection Day" to encourage the public to make joint efforts in water environmental protection.

3. Achievements

After comprehensive treatment, the water quality of Qianshan River has been significantly improved. Five black and smelly water bodies were eliminated, the water quality of Qianshan River Shijiaozui Sluice Gate section was upgraded from Class IV in 2019 to Class III in 2020. The average concentration of ammonia nitrogen in the national section of the Qianshan River Gate from January to November 2022 (0.48mg/L) decreased by 66.2% compared with that in 2019 (1.42mg/L). The species and number of benthic animals, insects and birds had increased significantly, and the beautiful scenery of abundant water grasses and egrets had been revived.

4. Lessons learnt:

First, the municipal governments made and implemented the plans, and pushed all relevant departments to carry out various tasks and take responsibilities in the integrated management of Qianshan River basin.

Second, implementing diversion of rainwater and sewage. Pollution in the water, the root on the shore, the core in the pipe network. Implementation of rain and pollution diversion throughout the whole basin is a key to fundamentally solve the problem of river water pollution

Third, Zhuhai is committed to establishing and improving the governance mechanism to make everyone a participant, supervisor and beneficiary in water pollution control and environmental protection.

5. Sources:

Translation and excerpt from the Plan for Comprehensive Water Environment Improvement in the Qianshan River Basin issued by Zhuhai in 2019.

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China 8: Comprehensive watershed improvement of Maozhou River in Shenzhen, Guangdong, China

1. Context and challenges:

The Maozhou River is located in the Pearl River Delta, originating in the northern of the Yangtai Mountains in Shenzhen, flowing through the cities of Shenzhen and Dongguan and eventually into the Lingdingying of the Pearl Rive mouth. Maozhou River basin has a total area of 388 square kilometers, of which 311 square kilometers in Shenzhen and 77 square kilometers in Dongguan. Maozhou River is a rain-source tidal river, with 33 first-level tributaries and a total length of 31.3 kilometers. The runoff is small, and the carrying capacity of water environment is limited.

Since the 1990s, the industrialization and urbanization of Maozhou River Basin had developed rapidly, and the economy and population had increased greatly. However, due to the long-term shortage of environmental protection infrastructure and relatively weak environmental management, the pollution load in Maozhou basin caused the most seriously polluted water in the Pearl River Delta region. The water quality of the whole basin was inferior to that of class V, and ammonia nitrogen and total phosphorus even exceeded the standard of class V by more than 10 times, which was big challenge for all sectors of society.

2. Actions done

In accordance with Integrated River Basin Management approach, strengthening the pollution control at sources, treating pollution along the river, eliminating black and odorless water bodies, and improving water quality for rehabilitation of water environment in Maozhou River basin.

Firstly, implementing diversion of rainwater and sewage. Maozhou River, a heavily polluted river with densely distributed industries and populations on both sides, cannot be fundamentally improved if the combined sewage system is not changed. Rainwater and sewage must be completely separated at source. Since 2016, the projects had been firmly implemented to achieve rain and sewage diversion throughout the basin. In every village, every community of the city, all the drainage point such as kitchen and toilet and balcony was surveyed. The sewage pipes were installed, and rainwater and sewage diversion were carried out. A total of 2,482 residential areas and villages within the city were reconstructed, basically covering every household. In the basin, another city, Dongguan, also actively promoted the diversion of rainwater and sewage at the source, and completed the drainage network reconstruction of 11,816 buildings.

Secondly, construction of sewage pipe network. With the goal of diversion of rainwater and sewage, Shenzhen city constructed a systematic and independent sewage collection pipe network system. Shenzhen has built 2,053 kilometers of sewage pipe network along the Maozhou River basin, and all sewage collection systems have been completed. In addition, Guangming District of Shenzhen also built initial rain interception pipes covering 1 trunk, 13 branches, 50 small micro units with a total length of 89 kilometers, built 9 regulating and storing ponds of 493,000 cubic meters, and initially built a set of initial rain interception system to effectively collect unclean rain within 15 mm of initial rainfall. Dongguan also promoted the

construction of sewage collection pipe network. The city conducted inspection and replacement of the old pipe network, and newly rebuilt about 359 kilometers of sewage pipe network.

Thirdly, controlling the sludge from wastewater treatment. One of reasons why the sewage becomes clear in the sewage treatment process is that some pollutants in the sewage are transferred from the water phase to the solid phase. If the sludge in the solid phase is not treated well or improperly disposed, it will release pollutants and pollute the environment again. Shenzhen innovatively adopted sludge treatment/disposal technologies such as "microwave conditioning and plate-frame pressure filtration", "plate-frame pressure filtration and rapid low temperature drying" and " plate-frame pressure filtration and low temperature condensation drying", and has built 18 sets of deep sludge dehydration facilities and 21 sets of mobile emergency treatment facilities. The total capacity of deep dehydrating sludge in the city is up to 6,135 tons/day. In cooperation with the Haifeng Power Plant, the city has built a coupled sludge and coal burning power generation facility that can process 2,000 tons of sludge per day, and basically incinerate all the sludge in the city. in addition, Dongguan city implemented the disposal of sludge drying and reduced by 1,710 tons/day.

Fourthly, implementing green growth policy. Taking the integrated improvement of Maozhou River as an opportunity, Maozhou River treatment was combined with industrial transformation and urban upgrading. In terms of industrial transformation, heavily pollution enterprises were eliminated. In terms of urban construction, the mainstream of Maozhou River and its route were rehabilitated with a healthy ecological corridor.

Fifthly, ecological restoration of the river system. The main measures included the in situ remediation of polluted sediment, artificial wetland restoration, aquatic plant restoration, ecological revetment for rehabilitation of the river ecosystem. Shenzhen completed comprehensive remediation of 49 rivers/channels, including Tantou River, Yutan River and Matan flood drainage channel, remediation of waterway of 167.8 kilometers and removing polluted sediment of 2.48 million cubic meters. Through the construction of a green channel on Maozhou River and making it to connect ecological nodes such as Yanluo Wetland Park and Wanfeng Lake Wetland Park, Shenzhen built an ecological corridor along the river. Dongguan city completed the renovation of 21 rivers, 45.1 kilometers of waterway, and dredged 580,000 cubic meters of silt. As a result, an ecological river system was created.

3. Achievements

After continuous comprehensive remediation, the water environmental quality of the whole Maozhou River basin has been steadily improved. 44 black and odorous water bodies and 304 small black and odorous water bodies in the basin had been completely eliminated until 2019. Compared with 2015, the comprehensive pollution index of the mainstream of Maozhou River in 2019 decreased by 78.5%, and the main pollution indicators of chemical oxygen demand, ammonia nitrogen and total phosphorus concentration decreased by 54.0%, 84.9% and 86.2% respectively. The local snails, blue-tailed shrimp, blackfish and colored dragonflies that had disappeared for many years returned to the Maozhou River. The national endangered plant wild floating fern was found for the first time. The aquatic biodiversity index of the basin was significantly improved.

4. Lessons learnt:

First, pollution sources were accurately identified. The measures below were taken: ecological environment monitoring, pollution source survey, public complaints, and other high-tech means such as big data analysis.

Second, systematic rehabilitation was implemented. considering the practical situation of the basin, based on past experiences and lessons, the old way of terminal sewage interception was abandoned, and a new mode of rain and sewage diversion was established.

Third, improving the legal system to provide a strong legal guarantee for innovative measures of water control. Firmly implementing policies in accordance with laws and regulations to promote the transformation and upgrading of industries within the river basin.

5. Sources:

Translation and excerpt from Maozhou River Governance from the Perspective of Ecological and Environmental Protection Supervision issued by Southern Daily in 2021.

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China 9: Whole chain control of plastic pollution in the Pearl River Estuary, China

1. Context and challenges:

The Pearl River Estuary (PRE) of Guangdong Province is one of the most economically dynamic and wealthiest areas in China, with a sea area of 15,500 km2, annual runoff of 349 billion m3 and population of about 86 million. In 2022, China's plastics industry output exceeded 7,700 billion, as Guangdong province contributed the largest share in this number. In the past few years, the marine plastic pollution control in PRE faced challenge as follows: (i) The lack of whole chain control from production to design and waste management led to the high production of plastic waste; (ii) The incomplete segmented interception led to the progressively increase of plastic waste inputs from land into the ocean; (iii) The wide variety of plastic materials with unique physical and chemical characteristic enhanced the difficulty on classification and disposition.

To strengthen marine environment protection and control marine plastic pollution, the Guangdong provincial government took a series of Activities in the PRE such as source pollution reduction, alternative product promotion, plastic waste reuse and recycling. The whole chain control of plastic pollution has been formed initially and some key innovations are achieved**.**

2. Actions done

Guangdong has formulated a 2022-2025 action plan to curb plastic waste, it will promote "green" plastic products, boost its plastic recycling and incineration capabilities, and take action against the overuse of plastic in packaging and agriculture, which include five activities as follow:

Source reduction. The green design of plastic products is promoted, a green design standard is hammered out and implemented to reduce the complexity of plastic components. The plastic-related production supervision is strengthened, a plastic ban has been enacted on the ultra-thin plastic shopping bags with a thickness of less than 0.025 mm and the polyethylene agricultural mulch with a thickness of less than 0.01 mm. The single-use plastics are reduced in commodity retail, e-commerce, catering and accommodation. The green governance for express packaging is strengthened, all postal express outlets will ban non-degradable plastic bags, disposable plastics fabric woven bag and plastic tape by the end of 2025. The green product certification system will be built and the public institutions are encouraged to Play a role.

Alternative products promotion. A sound standard system for alternative products is established, such as Bamboo and wood products, paper products, degradable plastic products, etc. The research and development of new technologies and products on recyclable and degradable alternative materials are strengthened in universities, scientific research institutions and enterprises. The biodegradable plastics industry is promoted to develop plastic alternatives orderly.

Standardized recycling and disposal. Layout the collection and transfer facilities reasonably; improve the standardized recycling level in the field of transportation; improve the standardized recycling level of plastic waste in emerging areas; support supply and marketing cooperatives to carry out vigorously the standardized recycling of plastic waste; establish and improve the

collection, transportation and disposal system of rural plastic waste; strengthen the resource utilization of plastic waste; and improve the harmless treatment level of plastic waste.

Special cleanup and rectification. Implement special cleanup for floating plastic waste in rivers, lakes and seas; implement agricultural film recycling and pesticide packaging waste treatment; deepen the plastic waste cleanup and rectification in tourist attractions; strengthen the plastic waste treatment along the road; and regulate the ship plastic waste receiving and transferring.

Public participation. strengthen policy publicity and education, guide the public to accurately understand the policy and good practices of plastic waste control; encourage public participation in plastic pollution governance, such as using cloth bags, grocery baskets and reducing the consumption of disposable plastic products; and strengthen green consumption incentives, encourage restaurants and hotels to provide reusable accommodation supplies and tableware.

3. Achievements

Reduce land-based plastic waste into the PRE. Based on the regular cleaning and special floating waste cleaning, about 60,000 kilometers and 6,700 square kilometers of rivers were cleaned, 5 million tons of floating waste was collected and disposed annually. The "Waste free" is basically achieved in the main rivers, lakes, reservoirs and bay areas.

Improve the long-term mechanism of plastic waste control. The construction of a "waste free" bay area is formed to deepen exchanges and cooperation among the Guangdong, Hong Kong and Macao on the prevention and control of solid waste pollution, jointly promote the solid waste source reduction, resource utilization and harmless disposal system, and establish a notification and early warning mechanism for floating waste.

4. Lessons learnt:

Strengthen source reduction. Implement the reduction of plastic production and use, promote the use of plastic alternative products, strengthen the design, production and circulation of plastic products to "lose weight", and reduce its production and use from the source.

Strengthen recycling. Based on the resource and environmental properties of plastic products, strengthen the efficient recycling of plastic waste , change "plastic waste" into "renewable resources", and achieve the maximum utilization of plastic waste resources and the reduction of plastic pollution in the whole chain.

Strengthen key governance. Based on the "white pollution" characteristics of small volume, light weight and easy leakage for plastic waste, strengthen the plastic pollution control in rivers, lakes and seas, agriculture and rural areas, tourist attractions, roads, ships and other fields, so that all kinds of plastic waste have no place to hide.

Strengthen public participation. The whole chain control of plastic pollution involves all aspects of plastic production, consumption and disposition. The nationwide action on plastic pollution control should be proposed to strengthen social co-governance and public participation, build a social consensus and encourage an extensive participation of government, enterprises and public.

5. Sources:

Translation and excerpt from Guangdong Province Plastic Pollution Control Action Plan (2022-2025) issued by Guangdong Provincial Development and Reform Commission, Guangdong Provincial Department of Ecology and Environment in 2022.

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China 10. Blue Carbon trading for the Futian Mangrove Forest in Shenzhen, Guangdong Province, China

1. Context and challenges:

The Futian Mangrove Nature Reserve in Shenzhen (referred to as the Reserve) is situated in the northeastern part of Shenzhen Bay. The total area of the Reserve spans 367.37 hectares, with the mangrove area covering 126.09 hectares. Shenzhen has taken mangrove carbon sinks within the Reserve as a starting point to explore the establishment of a comprehensive blue carbon trading mechanism that includes surveying and monitoring, ownership confirmation and registration, carbon sink quantification and verification, base price evaluation, market trading, and financial support, etc. The city is actively working to create a market-oriented and sustainable blue carbon trading model.

2. Actions done

First, conducting the natural resources survey and registering carbon sink products. Establishment of unified standards, methods, and approaches for the registration of natural resources; delineating the boundaries of protected areas; figuring out the quantity and quality of natural resources; and clarifying the ownership status and associated information of such resources; completing the rights registration for protected areas. Innovation of the registration approach for carbon sink products by incorporating the total carbon sink volume from the mangrove ecosystem and transaction records into the relevant information sheet of the natural resource registry.

Second, developing methodologies for carbon sink measurement and the blue carbon value evaluation of manrove forest. Issuing the "Carbon Sink Methodology for Mangrove Protection Projects (Trial Version)" to guide the quantification of carbon sinks generated by mangrove projects during the monitoring period. Based on land asset evaluation methods, establishing a comprehensive carbon sink asset evaluation framework that incorporates cost, benefit, market dynamics, and technical routes to assess the carbon sink value of the mangrove project within the reserve and determine the base price for carbon sink auctions of mangrove projects. Through expert deliberation, the base price for carbon sink auctions of the mangrove protection projects is set at 183 yuan per ton.

Third, formulating a trading workplan to achieve market-based allocation. The "Workplan for the Pilot Program of Mangrove Carbon Sink Trading in Futian Mangrove Reserve" was developed and issued, clearly defining entry criteria, trading platforms, and other trading rules for blue carbon transactions. Referring to Over-the Counter Trading Bilateral Agreements from the voluntary carbon market, blue carbon trading was conducted via public auctions. The initial transaction of the carbon sink was a one-year mangrove carbon sink volume of 3,875 tons. On September 26, 2023, the carbon sink of the mangroves within the reserve was publicly auctioned. Following the principle of "highest bidder winning," the successful bidder was determined after 92 rounds of intense competition among 17 enterprises. The public auction of 3,875 tons of mangrove ecosystem carbon sink was successfully completed at a price of 485 yuan per ton.

Fourth, actively exploring scenarios for blue carbon application. Exploring the establishment of an ecological compensation mechanism that reflects the economic value of carbon sinks of mangrove ecosystem, e.g. making the purchase of carbon sink as one of the measures to fulfill the liability for compensating for damage to natural resources assets. In addition, promote blue carbon pledge financing and loan financial services to enhance the green financial service system.

3. Achievements

First, establishing a comprehensive full-chain trading mechanism for mangrove carbon sinks and providing a replicable demonstration path for market-based transactions. Shenzhen conducted systematic surveys and monitoring of natural resources, confirmed the ownership and registration of blue carbon products, clarified the quantity and ownership of mangrove carbon sink products. The city standardized the verification process for carbon sink volumes in mangrove protection projects, and formulated methodologies for assessing the economic value of mangrove carbon sinks, and scientifically determined the base price for carbon sink auctions, meticulously designed a detailed trading workplan and adopted an open auction method to realize government-led auction and bidding transactions in the primary market for mangrove carbon sinks.

Second, filling the methodological gap and establishing a sustainable mechanism for carbon sink products. By developing a technical framework for blue carbon products, Shenzhen has actively explored domestic mangrove carbon sink measurement and monitoring, report preparation, and verification of carbon sequestration to address the methodological gap in relevant carbon sink projects in China. This has resolved the challenge of "difficulty in measurement" for blue carbon trading and provided replicable and scalable experiences and examples for the subsequent development and trading of similar carbon sink products.

Third, innovating the carbon sink property rights registration method to activate the natural resource carbon sink market. Shenzhen took the carbon sink trading of mangrove ecosystem as the key point, based on the market trading of carbon sink in the field of natural resources, innovatively implemented the ownership confirmation, transfer, and registration of blue carbon property rights in the natural resource sector, issued the first carbon sink certificate to the successful bidder, and registered the total carbon sink volume and the first transaction. It clearly defined the ownership of carbon sink property rights within the protected area, addressed the issue of "difficult trading" for blue carbon, and enriched the types of ecological products in the natural resource domain.

Fourth, exploring pathways for social capital participation of blue carbon trading After the successful auction of the nation's first mangrove carbon sink, all the income obtained will be fully remitted to the Shenzhen municipal government and allocated to support mangrove protection and restoration efforts. This has charted a new course for guiding social capital to participate in mangrove protection and restoration, providing a "Shenzhen model" for establishing a sustainable mechanism for realizing the value of blue carbon products.

4. Lessons learnt:

Taking the carbon sink of the mangrove forest in the Futian Mangrove Nature Reserve as the key point, the carbon sink trading project have been systematically implemented. Through the establishment of a mangrove carbon sink methodology and economic value assessment

technology tools and the proactive exploration of blue carbon application scenarios, the city has created a measurable, tradable, and achievable value realization path for mangorve carbon sinks. In addition, the city established a comprehensive full-chain trading mechanism for blue carbon, which included surveying and monitoring, ownership confirmation and registration, carbon sink quantification and verification, base price identification, market trading, and financial support, etc. The full-chain trading mechanism not only fosters a market-oriented and sustainable carbon sink resource trading market but also paves a new way for realizing the value of mangrove carbon sinks.

5. Sources:

Ministry of Natural Resources of China:

Notice from the Office of the Ministry of Natural Resources on Issuing the "Typical Cases of Ecological Product Value Realization" (the Fifth Batch).

China 11: High-quality Development of the Blue Economy in Shenzhen Daya Bay, China

1. Background

Daya Bay (Shenzhen section) is located in the eastern part of Dapeng New District, Shenzhen. It boasts exceptional natural ecological resources, with a sea area of 140 square kilometers and a coastline stretching 85.09 kilometers. There are 19 beaches in the area, and it possesses a mangrove ecosystem covering 23.05 hectares and 68 species of reef-building corals. The region includes Dapeng Peninsula National Geopark, Daya Bay Aquatic Resources Nature Reserve, and Dapeng Peninsula Municipal Nature Reserve. It is home to the world's most complete natural community of ancient Heritiera littoralis trees. In recent years, Shenzhen has thoroughly implemented Xi Jinping Thought on Eco-Civilization, establishing an integrated protection and management framework from the mountains to the sea, and promoting the construction of beautiful bays across the entire Dapeng Peninsula. The water quality of the offshore marine areas of Daya Bay has come up to the state's first-class standard, achieving both high-level ecological protection and high-quality economic development.

2. Actions done

Establishing a Marine Ecological Environmental Protection System. Firstly, improving the legal and regulatory framework: Shenzhen has fully utilized its legislative power as a special economic zone to add a dedicated chapter on marine ecological environment protection during the revision of regulations on ecological environment protection and marine pollution prevention. This strengthens comprehensive pollution prevention and control measures for land-based sources, marine-related projects, and ships, as well as emergency response to marine pollution incidents. Secondly, strengthening high-level overall planning: The Shenzhen Municipal Government has taken a series of measures, supporting Daya Bay in benchmarking against leading bay areas in terms of all environmental elements.

Deepen Systemic Governance of Land-Sea Coordination. On the land side: A patrol mechanism for ecological red lines and nature reserves has been established, precise control of non-point source pollution has been implemented, rainwater-sewage diversion as well as the upgrading of sewage treatment plants have been advanced, and comprehensive improvements have been made in domestic sewage treatment. **In river basins:** A comprehensive inventory management system for river (and marine) discharge outlets has been implemented, and the "river chief" system has been established to strengthen watershed pollution prevention and control. As a result, all 136 marine discharge outlets and 27 rivers entering the sea have achieved compliance. Through a regulatory mechanism combining "daily drone patrols and beach video surveillance," dynamic zeroing of beach and floating marine litter has been achieved. **In marine areas:** Over 400 recreational vessels have been brought under regulation, and 116 hectares of offshore fish farming rafts have been cleared. Joint cross-departmental law enforcement actions are carried out on a regular basis. Special inspections are also strengthened for marine outfalls, marine dumping, and marine-related projects.

Exploring Green Development Paths for the Bay. Creating coastal green spaces: By leveraging the region's natural endowments such as ancient Heritiera littoralis trees and coastal wetlands, a network of coastal parks with recreational and science education features has been developed. Restoration efforts include 14 hectares of coastal shelterbelt forests and 13.42

hectares of mangrove wetlands. Two ecological corridor bridges have been built, along with 12.7 kilometers of eco-friendly seawalls and 76.57 kilometers of greenways. Over 35% of the coastline is now accessible to the public.

Developing a premier coastal tourism destination: The area has established China's first and Asia's second International Dark-Sky Community, built the first International Cittaslow in a major Chinese city, and constructed the world's largest LEGOLAND Resort. It also hosts the largest "China Cup International Regatta" in the Asia-Pacific region, continuously enhancing the coastal recreation and tourism experience, and achieving development through conservation.

Fostering green marine industries: Key marine research and development platforms such as the Daya Bay Marine Biology Comprehensive Experimental Station have been established, and the core area of the Southern Marine Science City in Baguang is under development. Major "blue" initiatives include the construction of Shenzhen Ocean University, a Marine Museum, and the National Deep-Sea Scientific Research Center. These efforts have promoted the integrated development of the marine ecological industry chain, innovation chain, education chain, and talent chain.

3. Achievements

Through years of comprehensive management, the marine ecological environment of Daya Bay in Shenzhen has been significantly improved. Since 2021, seawater quality has consistently met the state's first-class standard, with precise control over marine discharge outlets and marine litter. The city's capacity for marine ecological environment management continues to strengthen. The distribution and coverage of mangroves have been continuously optimized, with the retention rate of natural coastline reaching 64.86%. Over the past three years, a total of 120 nationally protected plant and animal species have been recorded, including the discovery of a new species of water fern, "Baguang Water Fern," named after its place of discovery. The number of nationally protected flora and fauna in the bay has increased significantly, leading to a marked improvement in biodiversity. Adhering to the sustainable development approach of "ecology-tourism -economy," Dapeng New District has continuously unlocked ecological dividends and created harmonious green coastal spaces for people and nature. Over the past four years, the Gross Ecosystem Product (GEP) of Dapeng New District has achieved an average annual growth rate of 3%. In 2024, the district received 19 million tourists, an increase of 17.9%, with tourism revenue reaching RMB 11.8 billion, representing a 21.7% increase and setting a new historical record.

4. Lessons learnt:

Empowering Through Technology: Pioneering a New Drone-Based Nearshore Marine Environment Monitoring System. By establishing a 24-hour remote dispatch and automatic patrol system combining fixed-route patrols with targeted flight inspections, nearshore waters covering 8 kilometers and the entire 85-kilometer coastline are effectively monitored. Utilizing the "5+11" coordinated land-sea marine ecological protection joint work model involving relevant departments, a normalized, rapid, and efficient patrol system has been built, forming a closed-loop marine environment supervision framework capable of timely tracking and handling of emergencies.

Multi-Stakeholder Cooperation: Establishing a New Governance Mechanism among Government, Enterprises, and Society. A shared "government-enterprise-community" platform has been built, including the establishment of the Dapeng Peninsula Ecological Civilization Public Welfare Fund and the launch of mangrove conservation fundraising campaigns. Leveraging resources such as ancient Heritiera littoralis trees, typical ecosystems, and ecological environment monitoring, an open natural education platform encouraging public participation has been created, with over 3.1 million online and offline participants.

Reform and Innovation: Advancing New Practices in Gulf Ecological Civilization Construction. Efforts have been strengthened to synergistically reduce pollution and carbon emissions, establishing a near-zero carbon emission pilot zone at the Daya Bay Nuclear Power Base with an annual carbon reduction of up to 26,000 tons. The Longqiwang EOD project has been included in the national ecological and environmental finance support project library, enhancing industrial development value through ecological governance, and using industry profits to support ecological protection, thereby achieving a "win-win" of high-quality ecological environment and economic development.

5. Sources:

Shenzhen Municipal Ecology and Environment Bureau，China。

Thailans 1. Management Measures for Conservation and Sustainable Use in the Ban Don Mangrove Forests, Surat Thani Province, Thailand

1. Context and challenges

Ban Don Bay on the Gulf-of-Thailand coast is Surat Thani's ecological engine room. The bay hosts two SCS SAP priority habitats—**mangroves (~ 43,000 ha)** and **seagrass (~ 6,000 ha)**—which buffer storm surges and support the province's THB 6 billion artisanal-fisheries sector. The SCS SAP focus area covers ≈ **72,420 ha (434,575 rai)** across seven districts: Tha Chana, Chaiya, Tha Chang, Phunphin, Mueang, Kanchanadit and Don Sak.

1.1 Land-use mosaic and community dependence

An SCS SAP land-use survey (2024) combined drone imagery, village sketch maps and 400 household questionnaires to produce the first **Mangrove Land-Use Atlas**. Key insights:

Primary use	Respondents (%)	Notes
Fisheries (capture/collect)	**70 %**	Traditional hook-and-line, shrimp push-nets, shellfish gleaning
Food (subsistence)	50 %	Mangrove crab, edible halophytes
Charcoal & pole wood	2 %	Declining but persists in Chaiya
Tourism	3 %	Emerging kayak & board-walk tours
Medicinal plants	3 %	Folk remedies e.g. *Avicennia* bark

Economy link: 60 % of households derive direct income from mangroves; 81 % use mangrove resources in some form.

1.2 Pressures and governance gaps

Fragmented legal instruments—no dedicated wetland law; enforcement relies on Forestry, Fisheries and Marine Acts leading to gaps and overlaps.

Post-aquaculture legacies—> 1,000 rai of abandoned shrimp ponds fragment tidal flow; some are being reclaimed illegally since 2016.

User conflict over cockle racks—2019 disputes between gleaners and rack owners escalated to provincial mediation.

Limited patrol coverage—DMCR budget previously covered ≤ 50 patrol-days yr^{-1} across 120 km coastline.

Knowledge gaps—baseline biodiversity & socio-economic data scattered across agencies.

2. Actions taken

2.1 Ecosystem restoration & zoning

Reclamation & replanting. Since 2016 DMCR has repossessed > 600 rai of encroached land; survival rates of mixed-species plantings average 78 % after three years.

Integrated biophysical-socio surveys (2023-2024) underpin a draft Ministerial Regulation to declare all project mangroves "Conservation Mangrove Forest" (Articles 18 & 23).

Participatory zoning. Village mapping exercises produced eight use-zones (e.g., clam gleaning, crab bank, eco-tourism board-walk), annexed to the draft regulation.

2.2 Participatory governance under Article 18

Multi-stakeholder workshop (27 July 2023). 150 participants—community leaders from seven districts, DMCR, IUCN, UNDP, universities—reviewed management effectiveness and drew draft "Management Area Maps". Proceedings documented diverse knowledge, from charcoal kiln history to drone imagery overlays.

Article 18 public-hearing protocol adopted: presentations on legal basis, breakout mapping, plenary feedback, signed minutes attached to regulation dossier.

Marine Conservation Volunteers (MCVs). Recruited > 2,000 villagers (42 % women) under Article 16; trained on SMART patrol, GPS, basic ecology.

2.3 Knowledge & monitoring tools

Land-Use Atlas (PDF + GIS layers) now housed on MCRO-4 geo-portal; informs patrol planning and funding proposals.

SMART mobile patrols paired DMCR rangers with village teams; incident reports auto-sync to provincial command.

Drone & UAV surveys provide annual canopy-cover and pond-reversion monitoring.

2.4 Livelihood & gender actions

Food-from-Mangroves programme (Don Han village): 23 women created six value-added products (pickled *Sonneratia* fruit, mangrove-crab satay) increasing average monthly income by 17 %.

Eco-tourism pilots. Two kayak routes and one elevated board-walk certified by provincial tourism office; guides trained in bilingual interpretation.

3. Achievements

Legal milestone: Draft Conservation-Mangrove Regulation & zoning maps submitted to ONEP; Cabinet decision expected in 2026.

Patrol intensity quadrupled—SMART logs show 212 patrol-days yr^{-1} vs 50 pre-project; illegal-clearing cases ↓ 40 % (2022→2024).

Mangrove canopy recovering. Satellite NDVI indicates +12 % canopy density (2019-2024) in reclaimed zones.

Community capacity. 94 % of MCVs can now operate GPS/SMART; five youth clubs presented mangrove-science projects at provincial science fair.

Socio-economic uplift. Women-led product sales net THB 2.8 million cumulative; eco-tourism pilots host 3,100 visitors yr^{-1} with 90 % satisfaction scores.

Data-driven proposals. Atlas data leveraged to secure THB 8 million GEF Small Grants for pond-reversion pilot (concept note approved in May 2025).

4. Lessons learnt

Data first—zoning later. High-resolution land-use maps and household surveys-built credibility and avoided boundary disputes.

Article 18 hearings as trust-builders. Transparent, multi-language workshops diffused cockle-rack conflicts and anchored the regulation in local reality.

Co-patrols close manpower gaps. Pairing villagers with DMCR rangers multiplied coverage and fostered compliance.

Gender-responsive value chains bring conservation home. When women earn from mangrove products, families support protection.

Adaptive planting outperforms blanket planting. Diverse species and gap-filling enhance survival and biodiversity.

5. Future outlook & scaling-up

Locally Managed Marine Areas (LMMAs). Templates and capacity now in place for village-level LMMAs, contributing to Thailand's 30 × 30 target by 2030.

Blue-carbon potential. Restoration zones will feed into Thailand's emerging mangrove-carbon registry; preliminary MRV underway.

Replication. MCRO-4 plans to replicate the Atlas + Article 18 model in Songkhla Lagoon mangroves (proposal under review).

6. Sources & contacts

Ban Don Mangrove Best-Practice Thai Report (19 Jun 2025)

Land-Use Atlas & survey tables (2024)

Article 18 public-hearing proceedings & agenda (27 Jul 2023)

SMART patrol training manuals (MCRO-4, 2024).

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7. Pictures:

https://www.flickr.com/photos/200464537@N05/with/53687007988

Compiled by Suwimol Sereepaowong, NC-SCS SAP Thailand

Thailand 2. Ban Don-Seagrass Meadows: A Model for Sustainable Coastal Habitat Management

1. Context and challenges

Ban Don Bay, on the northeastern shore of Surat Thani Province, encompasses extensive intertidal flats where seagrass meadows cover approximately 8,761.5 rai (~ 1,402 ha) across Tha Chana, Chaiya, Tha Chang and Phunphin districts. Dominated by *Halophila ovalis*, *Thalassia hemprichii* and mixed assemblages, these meadows underpin artisanal fisheries, support endangered dugong foraging grounds and stabilize sediments to protect coastal villages.

Beyond ecological functions, Ban Don seagrasses sustain > 60 % of local households through shellfish nurseries and provide recreation opportunities for > 5,000 eco-tourists annually. However, multiple pressures and governance gaps have threatened these services:

Spatial fragmentation & jurisdictional ambiguity. Seagrass management falls between DMCR, Forestry, DOF and local administrations, leading to inconsistent regulation and enforcement vacuums.

Land-based pollution. Coastal shrimp and shellfish farms discharge nutrient loads and sediments, elevating turbidity to 6.1 NTU in 2023 and reducing light availability by 25 %.

Mechanical damage. Boat anchors, dredging and shell-raking uproot shoots, with an estimated 12 % loss of canopy in high-traffic zones during 2021–2022.

Data scarcity. Pre-2023 surveys were irregular and uncoordinated, hampering trend analysis and site-specific management.

Climate stress. Extreme tide events in 2020 led to localized die-off patches totalling 4.5 ha, highlighting vulnerability to sea-level anomalies.

These challenges underscored the need for an integrated, community-driven seagrass management framework aligned with SCS SAP principles.

2. Actions taken

Over three years, MCRO-4 and partners delivered a multi-faceted intervention package focused on assessment, governance, restoration, monitoring and livelihoods.

2.1 Comprehensive baseline mapping & diagnostics

From March to October 2023, 32 transects and 14 bathymetric lines were surveyed by DMCR, PSU researchers and 48 trained villagers. Data on shoot density, species composition and canopy height were digitized into a Seagrass Atlas hosted on MCRO-4's ArcGIS Online portal. Concurrent water and sediment sampling (12 stations) quantified turbidity, chlorophyll-a and nutrient loads.

2.2 Establishment of a locally managed marine area (LMMA)

Building on legal tools under Sections 16–18 of the Marine & Coastal Resources Promotion Act B.E. 2558 (2015), four Seagrass LMMA zones totalling 150 ha were co-designed in July 2023 through village mapping workshops with 120 fishers and community leaders. These

workshops used participatory GIS and yielded detailed zoning rules—no-take refugia, fishing corridors and eco-tourism corridors—formalized by sub-district councils in January 2024.

2.3 Seagrass restoration & habitat enhancement

In March 2024, a pilot restoration transplanted 2,000 greenhouse-grown *H. ovalis* shoots on Ko Set's north flats, achieving 84 % survival after six months. Expansion trials tested mixed-species plots combining *H. ovalis* with *T. hemprichii* to increase resilience. Artificial seagrass mats were also trialled in shallow zones (< 1 m) to trap sediments and facilitate natural recolonization.

2.4 Monitoring technology & community science

A SMART patrol system was introduced in May 2024, training 120 Seagrass Guardians in GPS mapping and infractions logging. Guardians now record observations via a mobile app, feeding real-time data to a public dashboard. Additionally, quarterly UAV surveys (eight flights per year) capture canopy cover metrics and detect illegal dredging. These datasets are reviewed in bi-monthly MCRO-4 coordination meetings for adaptive tuning of patrol routes and restoration sites.

2.5 Outreach, capacity building & livelihood integration

Between 2023–2025, MCRO-4 organized 22 outreach events—school eco-days, village forums and boat-operator briefings—reaching > 3,200 participants. Two women's cooperatives received training in seagrass-inspired weaving and guided seagrass tours, generating THB 450,000 in net sales by June 2025. Informational signboards and bilingual pamphlets increased community awareness, with 95 % positive feedback in follow-up surveys.

3. Achievements

Data foundation built. The Seagrass Atlas supports trend detection and targeted management, filling a decade-long data gap.

Regulatory empowerment. Four LMMA zones gazetted with enforcement backed by local by-laws; anchoring and dredging infractions prosecuted under Marine Act.

Ecological recovery. Pilot restoration plots expanded by 0.8 ha of continuous canopy; overall shoot density in LMMA zones rose 27 % year-on-year.

Enhanced compliance. Seagrass Guardian patrol-days reached 450 in 2024–2025, reducing illegal dredging incidents by 60 % and anchor damage by 35 % in monitored sites.

Community stewardship. > 120 volunteers formally registered; > 3,000 community inputs logged via mobile app; local councils allocate annual budgets (THB 0.5 m) for LMMA maintenance.

Socio-economic benefits. Eco-tourism and handicraft pilots provided supplemental income to 180 households, strengthening local buy-in.

4. Lessons learnt

Integrate data, law and community. High-resolution mapping combined with legal uptake under Sections 16–18 secured community ownership and compliance.

Phased restoration yields best results. Nursery-to-nursey and nursery-to-field transplant sequences outperformed direct planting by 40 % in survival.

Technology empowers guardians. The mobile app and UAV imagery provided transparency, accountability and rapid response.

Multi-stakeholder communication is vital. Regular coordination meetings among DMCR, local councils and community networks preempted conflicts.

Link conservation to livelihoods. Women's cooperatives and guided tours created direct economic incentives for seagrass protection.

5. Future outlook & replicability

Scaling to mangrove–seagrass mosaics. Building on success, MCRO-4 plans to link LMMA zones with adjacent mangrove restorations to enhance coastal resilience and blue-carbon sequestration.

Policy mainstreaming. Proposals are underway to incorporate seagrass LMMA design into the Marine Spatial Planning Master Plan (2021–2030) to inform zoning beyond Ban Don Bay.

Digital platform evolution. Next-gen geo-portal features include predictive modelling of climate impacts and a stakeholder grievance module.

Regional knowledge sharing. Ban Don's LMMA model will be presented at the upcoming ASEAN Coastal Management Symposium (August 2025) as a case study.

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Thailand 3: Integrated Policy Harmonization and Sustainable Management for the Don Hoi Lot Ramsar Site

1. Context and Challenges

1.1 Site profile

Location & size: 24.09 km² of inter-tidal mudflat, mangrove and coastal marsh at the mouth of the Mae Klong River (13°23′ N, 100°01′ E) covering four sub-districts of Mueang District, Samut Songkhram Province.

Ecological significance: Thailand's largest razor-clam (*Solen* spp.) bed; nursery ground for 24 commercial fish species; crucial stop-over on the East-Asian Australasian Flyway (EAAF) with annual counts of up to 3,200 migratory shorebirds across 59 species.

Ramsar designation: Site No. 1099 (2001).

Socio-economic importance: 5,736 households in four coastal villages dependent on artisanal fisheries, salt farming and wetland tourism (≈ 640 000 visitors yr-¹; revenue THB 650 million).

1.2 Problem Diagnosis

Over the course of 2023 the SCS SAP team facilitated a participatory causal-chain assessment that traced how broad socio-economic drivers cascade into concrete ecological impacts at Don Hoi Lot.

Upstream growth fuels pollution. Rapid industrialisation and urban expansion in the Mae Klong Basin have outpaced wastewater treatment capacity. Each monsoon flushes untreated effluent and plastic debris downstream; routine monitoring in 2023 recorded faecal coliform levels averaging **460 MPN 100 ml-¹**, well above Thailand's Class 3 water standards, while community clean-ups collected **2.2 t of solid litter in 2023–2024.**

Legal fragmentation erodes enforcement. At least four statutes—the Marine & Coastal Resources Act, Fisheries Act, Wildlife Preservation Act and Local Administration Act—assign overlapping mandates. Before the project, offences detected by DMCR rarely progressed because the provincial prosecutor questioned jurisdiction: of **34 illegal-gear confiscations in 2024, fewer than 10 % reached prosecution**.

Market pressure accelerates over-harvest. Rising seafood demand and middle-man competition pushed fishers toward illegal "Ai Ngoh" traps and year-round harvesting. Baseline surveys found **razor-clam density had fallen to 0.9 ind m-²**—less than half the 2010 estimate—and average shell length dipped below market-preferred 8 cm, reducing value.

Chronic funding gaps hobble management. Prior to 2024 the provincial budget could only support two patrol teams and limited fuel, translating to **≤ 60 patrol-days a year**; monitoring equipment was outdated and data seldom analysed, leaving decisions reactive rather than preventative.

Combined, these factors created a feedback loop of degraded water quality, dwindling clam stocks and eroded public confidence in regulation, underscoring the need for the integrated package described in Section 3.

1.3 Policy Landscape

Marine & Coastal Resources Management Promotion Act B.E. 2558 (2015) – sets out national/provincial committees but no site-specific funding instrument.

Fisheries Act B.E. 2558 (2015) – provides for gear/season regulation yet lacked local adoption.

Draft Ministerial Regulation on Environmental Protection Area (EPA) for Samut Songkhram prepared by ONEP since 2022 but stalled due to insufficient spatial data & stakeholder consensus.

2. SCS SAP Intervention

The UNEP/GEF **South China Sea & Gulf of Thailand Strategic Action Programme (SCS SAP)** set out to demonstrate how multi-level governance and site-based action can halt coastal habitat loss. At Don Hoi Lot the project delivered a **four-pillar package** that was rolled out in sequence yet designed to be mutually reinforcing:

Pillar 1 – Legal harmonization & policy uptake (SAP Component 2, Output 2.3). The work began with a legal gap analysis and a series of cross-walk workshops (May 2023) that brought together ONEP lawyers, DMCR officers, local governments and fishers' representatives. Using the findings, the team produced zoning and buffer-zone maps that ONEP adopted in the **Draft Ministerial Regulation designating Don Hoi Lot as an Environmental Protection Area (EPA)**. To avoid parallel regulations at local level, a five-year **Memorandum of Understanding (MoU)** was signed on 24 April 2024 by Marine & Coastal Resources Office No. 8, four tambon councils and the Department of Fisheries, committing all parties to the same size-limit, closed-season and patrol protocols. A formal public hearing on the draft EPA took place in February 2025 and the regulation is now before Cabinet.

Pillar 2 – Inclusive institutions & stakeholder platform (SAP Component 1, Output 1.5). In January 2024 the dormant **Samut Songkhram Provincial Marine & Coastal Resources Committee** was re-activated with an updated Terms of Reference that gave seats to the Local Conservation Network—a coalition of nine community groups created under the project. Parallel to that, 276 villagers (85 men and 191 women) were sworn in as **Marine Volunteer Guardians**, trained in basic law enforcement, GPS logging and first aid. The Committee now meets quarterly, and Guardians accompany official patrols, file incident reports and run outreach events in their villages.

Pillar 3 – Sustainable financing mechanism (SAP Component 1, Output 1.6). Recognising chronic budget shortages, the province issued a decree on 17 June 2024 establishing the **Don Hoi Lot Environmental Fund**. Seeded with THB 2 million from the provincial Environment Fund, it is replenished through (i) a THB 20 electronic tourist-conservation fee collected via QR-Pay at the main pier; and (ii) proceeds from the community's "trash-for-eggs" circular-economy initiative in which sorted plastics are exchanged for food vouchers. By June 2025 the Fund held THB 3.1 million—enough to finance 85 % of annual monitoring and patrol costs.

Pillar 4 – Technical measures, monitoring & knowledge sharing (SAP Component 3, Outputs 3.1 & 3.3). Scientific baselines for bathymetry, seagrass, water quality and shorebirds were completed in 2024, feeding into an **Integrated Management Plan (IMP)** endorsed in May 2025. Communities and DMCR divers installed 100 fish houses to enhance habitat complexity, while patrol teams began using the **SMART** mobile app linked to a public dashboard (online since January 2025) that shows litter-trap efficiency, patrol tracks and incident heat maps. Capacity-building extended beyond enforcement: women entrepreneurs

received training to develop value-added razor-clam products, and an annual youth eco-camp now embeds site stewardship in local school curricula.

Taken together, these pillars illustrate how the SAP's regional objectives translate into concrete, site-level actions that strengthen legal backing, secure financing and empower communities—laying the foundation for the results described in Section 4.

3. Results & achievements

3.1 Policy & legal

Draft Ministerial Regulation on EPA completed and submitted to Cabinet (Jun 2025) granting the site legal backing for zoning, EIA requirements and pollution levies.

MoU operationalized – 4 joint-enforcement patrols month-^{1}; unified gear-control notice (species/size/season) gazetted in all four LGUs.

3.2 Governance & participation

Provincial Committee meets on schedule; 75 % of resolutions implemented within two quarters.

Marine Volunteer Guardians contributed 3 192 patrol-hours (Jul 2024–May 2025) resulting in 21 on-site warnings and 11 formal case submissions.

3.3 Pollution reduction & habitat condition

Solid litter inflow ↓ 18 % (weight comparison Apr 2024 vs Apr 2025).

Median fecal coliform ↓ 52 % (460 → 220 MPN 100 ml-^{1}).

3.4 Fisheries & livelihoods

Razor-clam density rebounded to 2–3 ind m-^{2} in no-take zones; mean shell length ↑ 1.6 cm vs 2023.

45 women-led SMEs developed dried, marinated & gift-pack razor-clam products; average household income ↑ 18 %.

Youth eco-camp produced a bilingual "Razor-clam Guardian" handbook downloaded 7 800 times.

3.5 Financing & cost-effectiveness

Don Hoi Lot Fund covers **85 % of annual patrol & monitoring cost**; tourist fee acceptance rate > 92 %.

Cost-benefit analysis (wetland services vs management outlay) shows B:C ratio = 5.4 within five years

4. Lessons learnt & factors of success

Nested governance: aligning SAP regional commitments, national acts and tambon bylaws closed enforcement gaps.

Data-driven decisions: real-time SMART dashboard increased transparency and political support.

Ring-fenced funds: visible reinvestment of tourist fees-built trust; earmarking 20 % revenue for community projects incentivized participation.

Gender & youth mainstreaming: training women entrepreneurs and engaging schools linked conservation to livelihoods & future stewardship.

Adaptive management: quarterly review of indicators allowed timely adjustment of patrol routes and litter-trap placement.

Remaining challenges: invasive tilapia, upstream effluent (requires basin-wide MoU), climate-driven extreme tides disrupting surveys.

5. Replicability & scaling-up potential

The Don Hoi Lot experience demonstrates that harmonising multi-level policies, backed by a transparent local fund and strong community stewardship, can reverse habitat degradation and secure sustainable livelihoods within three years. The intervention provides a ready-to-replicate blueprint for Thailand's 12 other Ramsar wetlands and coastal provinces across the South China Sea. Recently, some activities have been done to replicat the Don Hoi Lot experiences, including:

- Policy templates (MoU, Fund Charter, fee ordinance) shared with Trang & Chanthaburi provinces through DMCR's coastal network (May 2025 workshop).
- ONEP considering bundling EPA and Fund model into forthcoming amendment of Royal Ordinance on Mangrove Conservation.
- ASEAN Centre for Biodiversity cited Don Hoi Lot as pilot for Ramsar-ASEAN Heritage dual-designation pathway (Aichi Target 11).

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Contact: Marine & Coastal Resources Office No. 8 (mcro8@dmcr.go.th)

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8. Pictures:

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Vietnam 1. Marine protected areas contribute to sustainable socio-economic development in Cu Lao Cham islands, Vietnam

1. Context and challenges

Cu Lao Cham Marine Protected Area (MPA) was established in 2005, covering an expansive 23,500 hectares. This includes a core area of 205 hectares, an ecological restoration zone spanning 192 hectares, 10,201 hectares for administrative services, a buffer zone of 11,290 hectares, and seven small islands. The typical ecosystems within the MPA are coral reefs and seagrass beds. Approximately 2,500 people are living in the MPA.

Before 2005, over 90% of households in the area relied on various fishing activities such as trammel nets, guns, and diving. They operate with baskets or small boats, main fishing grounds on coral reefs and seagrass beds. Unfortunately, these activities negatively impactted on coral reef ecosystems, seagrass beds, and biodiversity. However, local people were still trapped in a vicious cycle of poverty, with about 50% of households classified as poor.

2. Activities and achievements

In the context of increasingly depleted natural resources, declining biodiversity in the region and the poor living conditions of local people, along with communication efforts to raise awareness, the Management Board of the MPA and stakeholders have implemented many solutions such as:

Establish natural resource co-management models

A natural resource management plan with extensive discussion between local people - scientists - local people's committee was formed and implemented. Until now, the 5-year management plan has been implemented three times.

The Provincial People's Committee allocated 19.5 hectares of sea area for 95 households to protect and sustainably develop the exploitation of seafood resources. Accordingly, local people have agreed on a plan to manage and protect resources in the managed water area, as well as sustainable community fishing activities with contents such as: seasons, fishing gears, net sizes, fishing grounds, etc. under the supervision of the Management Board of the MPA.

Implemented co-management of Land crab with 43 participants, accordingly to protect and sustainably exploit Land crab *(Gecarcoidea lalandii)*, a community convention was developed and organized to implement. Based on the results of resource reserve assessment and reasonable exploitation output recommendations by scientists, on average each year, about 4,000 ÷ 7,000 individuals with a size exceeding 7 cm are licensed to exploit. At the same time, the exploitation season is determined from March 1 to July 31 to suit the reproductive behavior of Land crabs. Legally exploited Land crabs traded in the market are controlled through the application of an "Eco-label", individuals without an "Eco-label" are illegally exploited products.

To prevent and fight cases of illegal fishing in the MPA, a community patrol network was established with more than 50 participants. They are fishermen, who have traditional fishing activities on this fishing ground. During the process of operating at sea, if they detect violations, they will report and coordinate with the Management Board of the MPA to promptly handle them physically.

Efforts to restore resources and protect the environment

Restoring coral reef ecosystems: In parallel with zoning planning to protect natural coral reef ecosystems, restoration of degraded coral reef areas has been carried out by the MPA since 2013. With technical transfer from the Institute of Oceanography, the recovery method using the separation-transplant technique has been well received and implemented by the technical staff of the MPA and the local community. Until now, the MPA has restored more than 20 hectares, with over 100,000 coral reef corporations *(Pachyseris, Montipora, Echinopora, Acropora)*.

Restored 01 breeding ground for sea turtles: the MPA was once a place where many sea turtles lived, with 06 main breeding. However, with socio-economic development and lack of understanding of the value of sea turtles to biodiversity balance, turtles have no longer appeared in the past 30 years. Since 2016, with many efforts of the MPA such as: propaganda to protect sea turtles; organizing the protection area of 01 sandy beach which is the former breeding of sea turtles; mobilizing fishermen to reduce the use of fishing gear that causes bycatch of sea turtles (the three layer drift net, longlines); relocating 2,000 40-day-old sea turtle eggs *(Chelonia mydas)* from Con Dao National Park to hatch naturally in the MPA, etc. Until now, sea turtles have been recorded when foraging as well as on breeding in the MPA. The sea turtle egg translocation program has attracted great attention from the government, local people and organizations in efforts to protect and restore sea turtle in the MPA.

Cu Lao Cham/the MPA towards a plastic waste-free island: Starting with the waste classification program at the source according to the 3R model (Reduce - Recycle - Reuse), by 2009, Cu Lao Cham officially implemented the program to say no to bags nylon and has created a great reputation, being a bright spot in Vietnam's environmental protection. By 2018, Cu Lao Cham continued to develop this orientation with a program to reduce plastic straws and single-use plastic products, etc. Until now, 100% of local people and tourists are aware of seriously implementing these regulations of this program.

Support local people to develop sustainable livelihoods

In order to reduce fishing pressure and improve the livelihoods of local fishermen, the program to convert fishing boats into tourism boats to transport tourists around the islands has been implemented since 2009. As a result, the MPA has successfully converted 8% of fishing boats. With the economic and social efficiency of these converted households, numerous local people have converted their fishing boats to develop community tourism, and at the same time many households have also invested themselves in upgrading their fishing boats.

Building a homestay model: implemented since 2008, 35 local fishing households were trained in techniques such as cooking, housekeeping, communication, English, and other various skills. At the same time, they received financial support, techniques to renovate some facilities (toilets, bedroom equipment) to serve the reception of tourists. Nature and culture experience have also been established, promoted and connected to many travel businesses. Consequently, from having only a few thousand visitors in 2008, Cu Lao Cham now has more than 500 thousand visitors annually, bringing the primary source of income for local people.

Support on training for children of fishermen: in order to gradually reduce the number of fishery workers and anticipate the development of tourism in Cu Lao Cham, since 2006, over 50 young people who are children of local fishermen have been supported in training. Create professional skills: tour guiding; restaurant operations; hotels, etc. As a result, 100% of these individuals now have stable jobs, and havebecame an important human resource for local tourism

development, as well as contribute to improving the material and spiritual life of many fishing households.

3. Lessons learnt

After nearly 20 years of persistently implementing solutions, Cu Lao Cham's economy has shifted strongly towards tourism services, which now constituting over 70% of the island's economic activity. Poverty has been completely eliminated. GDP has increased 9 times compared to 2005, reaching nearly 2,250 USD/person. More than 12 new livelihoods have been created. Coral reefs are maintained at a stable level, with a coverage of 57%, and the sea environment is within the safe threshold according to national standards (QCVN 10:2023/BTNMT). The implementation process has resulted in some important experiences as follows:

1/ Determine the appropriate community development strategy, suitable to the natural, cultural and social conditions of local people. At the same time, there are short-term goals that are easy to successfully implement to create trust with people.

2/ There is widespread participation of people in the cycle: determining the conservation area management goals - planning - organizing implementation - monitoring - evaluating and benefiting from the results.

3/ Communication to raise awareness for the community is a process, carried out regularly, continuously and with focus and focus.

Compiled by Nguyen Van Vu, The Management Board of Cham islands Marine Protected Area

Vietnam 2. Circular economy demonstration model at Quy Nhon coastal fishing port

1. Background, context and challenges

Binh Dinh Province, located in Vietnam's South central coast, has significant potential for marine economic development, with 134 km of coastline and a maritime area of 36,000 km². The province has one of the largest fishing fleets in the country, with nearly 6,000 vessels (over 3,200 offshore), employing about 45,000 fishermen. The fisheries sector plays a key role in the local economy, contributing an average seafood export value of USD 145 million per year.

However, the sector also generates a large volume of plastic waste, especially from fishing operations and port activities. A 2023 survey by the Binh Dinh Sub-Department of Fisheries showed that around 300 fishing vessels pass through Quy Nhon fishing port each month, discharging over 4.1 tons of plastic waste, 0.86 tons of aluminum cans into the ocean, and 1.75 tons of plastic packaging upon docking. Additionally, waste from other coastal areas regularly drifts into the port area, adding to the problem. The combination of floating plastic, Styrofoam, and wastewater from seafood processing has severely polluted the port environment.

If properly collected and sorted, the recyclable waste from each fishing trip could generate over 33 million VND per month, helping reduce marine pollution and supporting the circular economy (CE). This also creates income opportunities for port sanitation workers and informal waste collectors.

To address these challenges, Binh Dinh Province is piloting a model to collect household waste directly on fishing vessels, integrated with the onshore system for waste collection, sorting, and recycling at fishing ports. This initiative is being implemented under the framework of the project "Pilot models for managing municipal solid waste and waste from the fisheries sector to promote the circular economy in Quy Nhon City" funded by the United Nations Development Programme (UNDP) in Vietnam. If successful, the model will contribute to transforming Quy Nhon into a cleaner, greener, and more sustainable fishing port.

2. Actions done

Pilot model for collecting and managing plastic waste from fishing activities in Binh Dinh Province

To address plastic pollution from fishing activities, the project has implemented a comprehensive model for collecting and managing plastic household waste generated on fishing vessels. Under this system, fishermen collect plastic waste during fishing trips and store it in mesh bags. Upon returning to port, waste collection staff board the vessels to receive the waste, which is then transported by specialized vehicles to the Plastic waste collection house.

At the collection house, the waste undergoes a three-step process:

1. Inventory – Waste is counted and assessed.
2. Sorting – Plastic waste is separated by material type to facilitate later recycling.

3. Packaging – Sorted waste is packed according to standard procedures for transportation.

The packaged waste is subsequently sent to a Material Recovery Facility (MRF), where it is processed following the "Reduce – Reuse – Recycle" model, minimizing environmental impact and promoting CE practices.

To support this model, the Binh Dinh Department of Fisheries has led several activities, including:

- Stakeholder consultations to gather input and refine the implementation plan;
- Awareness-raising and training programs for fishermen and coastal communities to highlight the harms of plastic waste;
- Commitment campaigns, resulting in agreements with over 200 vessel owners/captains to participate;
- Monitoring and evaluation to ensure the model is being followed and to provide technical support as needed.

These efforts have built community consensus and strengthened voluntary participation, creating a foundation for sustainable marine plastic waste reduction.

The Binh Dinh Fishing Port Authority plays a vital role by:

- Establishing a dedicated Waste Collection Team and issuing operational regulations to ensure transparency and effectiveness;
- Creating linkages among stakeholders, connecting vessel owners, collectors, and recyclers to form a circular value chain;
- Collaborating with private enterprises and providing operational and financial support to encourage fishermen’s participation and ensure the model’s sustainability.

In parallel, the Project Management Unit (PMU), with support from UNDP, has made key contributions:

- Distributing mesh bags to facilitate at-sea waste collection;
- Supporting the construction of the Collection House and providing equipment for sorting and packaging;
- Conducting training sessions and launching events to introduce the model and raise awareness of CE principles among stakeholders.

Together, these efforts represent an integrated and replicable approach to reducing plastic pollution from fisheries, contributing to the development of a green and sustainable fishing port in Quy Nhon.

Collection and transfer of household plastic waste from fishing vessels to shore at Quy Nhon fishing port

3. Achievements

The pilot project has recorded several notable achievements in reducing marine plastic waste and promoting a CE within the fisheries sector. As of mid-2024, 153 fishing vessels have actively participated in the initiative, collectively bringing back to shore approximately 2,000 kg of waste. Among this, 830 kg of household waste—primarily plastic bottles, aluminum cans, and food packaging—was sorted and processed for recycling.

Community awareness has significantly improved through a series of communication and education activities, including training workshops, media coverage (TV, newspapers), posters, flyers, and public campaigns at fishing ports and coastal communities. These efforts have helped foster behavior change and encourage active participation from fishermen and other stakeholders.

A major institutional milestone was the issuance of Decision No. 89/QĐ-SNN by the Binh Dinh Department of Agriculture and Rural Development on February 28, 2024. This regulation outlines the official procedures for monitoring and managing plastic waste on fishing vessels, applying to vessels 15 meters or longer, with optional application for those between 12–15 meters. It clearly defines the roles and responsibilities of Port Authorities, the Sub-Department of Fisheries, and local governments in waste collection, transfer, reporting, and data management.

The project has also contributed to job creation for informal workers through waste collection and sorting activities, while simultaneously enhancing the value chain of recycled plastic products and packaging. These outcomes demonstrate the project's success in combining environmental protection with social and economic benefits at the local level.

4. Lessons learnt

- The CE (CE) pilot model implemented at Quy Nhon coastal fishing port has proven effective in delivering environmental, social, and economic benefits—particularly by significantly reducing plastic waste discharged into the ocean. The model demonstrates high potential for replication at other coastal fishing ports across Vietnam.

- A key lesson is the importance of designing the model to align with the living and working conditions of fishermen, their cultural practices, and their levels of legal awareness. By using tailored communication approaches, providing on-board waste containers, and implementing simple waste collection and reporting procedures, the model has gained strong acceptance among the fishing community.

- Another lesson is the need for clear, legally grounded regulations developed with community consultation. In this model, rules and procedures were institutionalized through official decisions, ensuring that all fishing crew members and related units comply. This not only reinforces collective responsibility but also reflects the Vietnamese Government's commitment to tackling marine plastic pollution.

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Compiled by: Nguyen The Chinh, Vietnam National Coordinator

Vietnam 3. Co To district: A Plastic Waste-Free Zone

1. Context

Co To is a strategically located island district in northeastern Quang Ninh province, forming part of Vietnam's maritime frontier. It spans 53.68 km² of land across 74 islands and encompasses approximately 300 km² of rich fishing grounds, home to over 1,000 marine species, many of high economic value. Since its establishment in 1994, Co To has faced numerous challenges, including economic hardship, limited public awareness, and weak environmental consciousness. Widespread littering—especially of plastic waste—by both residents and fishing vessels was common, further exacerbated by the habitual use of non-biodegradable plastic bags and single-use items.

Adding to the crisis, harsh weather often washed large volumes of ocean plastic ashore, sometimes stretching for kilometers. During peak tourism seasons, daily waste generation reached 20–25 tons, with marine plastic waste alone accounting for 3–5 tons. With limited waste management infrastructure, these conditions posed serious threats to Co To's tourism development, marine conservation, and public health—creating an urgent environmental challenge for the district.

2. Actions done

Recognizing the environment as vital to its sustainable development, Co To district began efforts to restrict plastic bag and single-use plastic consumption in 2015. However, implementation did not take effect until 2018 and proved largely ineffective. To strengthen its commitment, the Co To District Party Committee integrated environmental protection into its 2020–2025 development agenda. On June 4th, 2021, Decision No. 175 was issued to officially launch the "Co To Island District Free of Plastic Waste" initiative, aimed at reducing plastic pollution across the island and its surrounding waters. In support, Regulation No. 08 was introduced, requiring cadres and Party members to lead by example. The initiative was rolled out through the political system, with Party members, youth unions, and mass organizations playing a central role in advocacy and public mobilization.

Daily communications via radio, the district's website, and social media highlight the environmental and tourism-related impacts of plastic waste. Educational campaigns include community meetings, contests, school programs, and household outreach. Students are taught about waste sorting, eco-friendly alternatives, and pollution prevention. A district-wide Zalo group—comprising local leaders and school principals—facilitates direct communication and coordination. Meanwhile, Steering Committee 35 monitors social media to respond swiftly to public concerns. As a result of these proactive and coordinated efforts, the project has received strong public support and has faced no significant online backlash.

On September 1st, 2022, the district initiated a one-year pilot program: "Tourists visiting Co To are not allowed to bring non-biodegradable plastic bags and single-use plastic items to the island." Initially, the district focused on disseminating this policy through provincial and national media outlets. Collaborating with Quang Ninh inland waterway port authority (Van Don unit) and passenger transport companies, they refused to transport passengers to Co To if

they did not comply with local recommendations. Under the motto “Minimize plastic bags and plastic waste early and from afar,” the district formed task forces led by the Fatherland Front and other socio-political organizations at Cai Rong Port (Ao Tien) to educate and persuade tourists. They also piloted the distribution of eco-friendly plastic bags as alternatives to non-biodegradable ones for tourists before boarding vessels to the island, aiming to gradually establish new habits and widely disseminate the district's message to visitors. This initiative has received positive reception and support from both residents and tourists visiting Co To. The tourism association, restaurants, hotels, and tour operators are required to ensure their clients are aware of the prohibition on bringing plastic bags and single-use plastic items before visiting Co To. Simultaneously, content is posted on social media platforms to gauge public opinion and make timely adjustments to implementation methods as needed. After one year of piloting, the district conducted a preliminary review to assess the results, commend outstanding organizations and individuals, learn from experience, and outline future tasks.

On September 15, 2023, Co To District officially mandated that all tourists visiting Co To are prohibited from bringing non-biodegradable plastic bags and single-use plastic items to the island. Furthermore, vessels not adhering to commitments made with the district are denied entry to Co To Port. This represents a stronger measure aimed at enhancing the effectiveness of plastic waste reduction and mitigating environmental pollution in the Co To sea and island area.

Regulation No. 08 mandates that cadres, Party members, youth union members, and members of socio-political organizations—particularly those residing at the grassroots level (Party members under Regulation 213)—act as role models in implementing the “Plastic Waste-Free Co To” project within their communities. This directive is operationalized through a series of practical activities, including district-wide clean-up campaigns every Thursday and the development of community-based models such as “Plastic Waste-Free Street” “Model Residential Area for Source Separation” “Organic Compost Pit” “Turning Waste into Money” “Friendly Bins” “Children’s Care Route” the “Green Sunday” movement, and “Clean the Sea” campaigns. Efforts also extend to mobilizing fishing vessel owners and passenger transport operators to collect and return waste to shore.

These initiatives have gradually improved environmental awareness among both residents and visitors. The district's achievements were recognized by President Vo Van Thuong during his visit on October 28th, 2023, where he praised Co To's environmental improvements after visiting multiple sites on the island.

In parallel, customary laws and community regulations have been amended to reinforce environmental protection. Full commitments have been secured from all restaurants, hotels, vendors at commercial centers, and households to use biodegradable plastic bags, reduce single-use plastic items, and practice household waste sorting. Regular inspections and monitoring are conducted, with prompt corrective measures applied to any establishments or individuals found in violation of their commitments to the local authorities.

Members of the Youth Union, young people, and students in Co To island district collect waste to clean up the beach

To transform Co To into a green island and foster sustainable tourism, the Co To District Party Committee has integrated this policy into schools (from preschool to high school). They are promoting extracurricular activities for students and the "small plan" movement, which involves collecting plastic waste for sale to fund youth teams. Environmental clean-ups are organized within schools and extended to beaches. The initial results of these children's activities indicate a positive shift in the awareness and actions of adults regarding environmental protection. The integration of the "Co To Island District Free of Plastic Waste" project into schools is seen as building a sustainable foundation for preserving Co To's environment in the future.

3. Achievements

(1) The “Plastic Waste-Free Co To” initiative was officially acknowledged in the conclusion of the Standing Committee of the Quang Ninh Provincial Party Committee during the mid-term review of the 15th Provincial Party Congress Resolution (2020–2025), in alignment with the implementation of the 13rd National Party Congress Resolution. It was identified as a critical task and solution for marine environmental protection in the remaining half of the term, with a clear directive to: “…strongly and resolutely implement a ‘no’ to plastic waste, especially in tourist areas, routes, destinations, and island communes.”

(2) As a result of the district’s effective marine conservation efforts, sightings of marine species such as dolphins, sea turtles, whales, and seagulls have become increasingly frequent in the waters surrounding Co To. This resurgence of biodiversity has attracted nature-oriented visitors and laid the foundation for developing eco-tourism as a distinctive product of the district.

(3) The environmental awareness of Co To's residents has markedly improved, particularly regarding the protection of marine and island ecosystems. This shift has contributed to a rise in tourist arrivals and economic growth, with the average per capita income in 2023 reaching approximately 130 million VND. Notably, Co To has eliminated poverty and is now striving to become a model new-style rural island district—characterized by prosperous residents and a high-quality, sustainable tourism economy.

4. Lessons learnt

First, elevating environmental protection to a national priority with clear, measurable goals within Party and government resolutions. Developing comprehensive, inter-ministerial policies that address land-based pollution and coastal habitat degradation in an integrated manner, rather than through fragmented approaches.

Second, sustained, nationwide public awareness campaigns using diverse media channels to educate citizens about the impacts of pollution and the importance of environmental stewardship.

Third, integrating environmental education into school curricula from an early age to cultivate a generation with strong ecological awareness and responsible habits

Fourth, developing and enforcing clear technical standards for various aspects of waste management, including on-site treatment, collection, and disposal, specifically tailored for coastal and island environments

Fifth, creating a unified voice among coastal and island communities to lobby for stronger environmental policies, increased funding, and technical support from higher levels of government.

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Philippines 1. Scaling up sea cucumber stock restoration through community-based culture production and reserve management

1. Context

The sea cucumber fishery in the Philippines is largely artisanal and multi-species. Because of the high market demand, ease in collection and the lack of management, sea cucumber stocks are overexploited. Sea cucumbers play important ecological roles such as reducing organic load, oxygenation of sediments, and nutrient cycling, thus enhancing benthic productivity in marine benthic ecosystems. One of the species associated with seagrass and mangrove areas is *Holothuria scabra,* commonly called sandfish. This species is widely distributed in the Indo-Pacific region. It is among the most highly valued in the trepang (dried sea cucumber) trade, with premium grade products priced up to USD 1,800 per kg in Chinese markets (Purcell et al. 2018). Because of the high market demand and lack of sea cucumber fisheries management, populations of this species have drastically declined in various locations. This species is listed as endangered in the IUCN red list.

To rebuild depleted populations and increase fishery production, the culture technology of *H. scabra* is being undertaken in different countries at various scales. In the Philippines, low-cost ocean nursery and grow-out systems have been developed to ensure that small fishers can adopt the technology and be used considering the different climatic conditions in the archipelago (Juinio-Meñez et al. 2017). Furthermore, population genetic studies have shown that populations of *H. scabra* are not a single genetic stock. To help conserve genetic diversity, hatchery production of juveniles from broodstock of the local genetic stock where the juveniles will be released. These are integral to the promotion of inclusive and responsible culture and stock restoration practices.

2. Actions done

Sandfish Sea Ranch Best Practices

Pilot sites for sandfish sea ranching have been initiated in different biogeographic areas in the country. In particular, the 5-hectare communal sea ranching in Victory, Bolinao Pangasinan in North Western Luzon has provided proof of concept that the release of hatchery-produced juveniles in an area managed with local communities generate ecological, social, and economic benefits (Juinio-Meñez et al. 2014). Prior to release, hatchery-produced juveniles (3-10 g) were stained with fluorochrome dyes to differentiate hatchery-produced and wild juveniles in the sea ranch. Quarterly monitoring of the population in the sea ranch have been undertaken since 2008 to estimate growth rates, survival, and standing biomass. Mass spawning was regularly observed after less than two years of initial release when a large proportion of the population were > 200 g. Estimated survival to sexual maturity of different batches ranged from 11-35%. Moreover, natural recruits were always found during the regular monitoring. These data unquestionably established that the sea ranch is functionally a reproductive reserve that provide larval supply to adjacent areas, and at the same time, maintains natural recruitment in the area through the high density of conspecific adults. Active participation of local community partners empowered them with first-hand knowledge and skills for the management of the sea ranch. Biophysical and socio-economic monitoring are imperative to evaluate impacts over time. Spill over economic benefits were indicated by the increase in landed catch after a few years and the positive change in the perception of some community members about the importance of the sea

ranch in rebuilding the fishery. The sea ranch managers themselves earned nominal monetary gains from shares in harvesting marketable sandfish (> 320 g). However, they also valued the non-monetary benefits such as strengthened group cooperation and aspiration to help ensure that the fishery can continue to provide a source of income to future generations. The shared responsibilities in managing the communal sea ranch did not prevent members from their regular livelihood activities.

Scaling and Integration through a Sea Cucumber Reserve

Increased sea cucumber production of cultured and wild stock is essential to realize greater benefits to small fisher households. The 5-hectare initial sea ranch is insufficient to scale-up impacts. The major challenges are: scaling-up to enhance long-term ecological and socio-economic benefits, and development a good local governance system. To address these, a pilot sea cucumber reserve is being established through the partnership among the local government unit (LGU), a research institution, an NGO and fisher organizations. The reserve is approximately 9 km^2 along the contiguous near shore area up to ~ 1.5 km from the shoreline fronting the villages of Pilar, Victory and Dewey in Santiago Island, Bolinao (see Figure 1). The reserve is primarily a seagrass area with some mangroves along coastal area of Pilar. This area was previously one of the main fishery areas for sandfish in the 1980s. The sea cucumber fishery in Santiago Island declined drastically from the 1990s to the 2010s with densities of twenty-four commercially important species in very low densities (Olavides et al. 2010).

Co-Management System

The key implementing mechanisms in the reserve are the implementation of the minimum harvest size limit (> 320 g), and a permit system. Priority use rights are allocated to registered fisherfolk in the three villages. The organizations involved in sandfish culture were granted exclusive harvest rights in their respective sea ranch areas and designated as enforcers and co-managers of the reserve. In return, aside from regular guarding, they participate in information dissemination activities to raise awareness of the ecological and socio-economic benefits of the reserve and encourage compliance to collection and permit regulations.

Community-based sandfish culture production cluster

Previously, ocean nursery rearing was done by the research project, and juveniles were then given to the local partners for grow-out. To scale-up culture sandfish production, local community partners in the three villages in the reserve area were trained to grow sandfish juveniles in ocean nursery systems. The three sites comprise a community-based culture production cluster that can also produce juveniles for restocking aside for grow-out to marketable size in their respective sea ranch areas. Post-settled juvenile sandfish (4-10 mm) produced at the hatchery at the University of the Philippines Bolinao Marine Laboratory are first reared in floating hapas up to about 3 g. To increase survival rate, the juveniles are grown in nursery sea pens for 2-3 months to > 30 g, prior to release for grow-out to marketable sizes. After almost a year, growth and survival in the three sites varied due to environmental conditions and some social issues among the groups. Nonetheless, sandfish in the community production sites have attained reproductive maturity. Through experience, the partners have learned site-specific considerations to improve growth and survival, and are working through mechanisms to be able to undertake their task more efficiently. The partners are now able to do the various culture activities on their own. This makes juvenile production more cost-effective, and positions the local community partners to be potential suppliers of juveniles for grow-out in other areas. This may be developed as an additional immediate income source aside from the harvest of marketable sandfish, which may take almost 2 years to reach premium grade sizes.

3. Key Lessons

Even with the best science available, restoration of depleted stocks takes a long time and should actively engage the local stakeholders from conceptualization, through implementation, monitoring and evaluation.

Small fishers and local community partners need to be empowered and provided technical and financial support for capacity development in culture and fishery management. While external partners such as research projects and civic society organizations can accelerate the establishment and piloting of demonstration sites, the long-term support of the local government is imperative. Public investments from local governments in terms of enabling local legislation is fundamental but not sufficient. The local government should institutionalize provisions of incentives and regular support to community organizations who contribute to fishery law enforcement and culture to rebuild stocks.

Effective coupling of fishery management with stock restoration through community-based culture are strategic to accelerate the recovery of stocks and increase economic benefits not only to the local partners but also to the greater community. The reserve is part of a major area for gleaning for various marine invertebrates. Gleaning is an important source of income for small fishers in the Santiago Island reef system and an essential component of domestic food security. Thus, the sea cucumber reserve promotes sustainable utilization of near shore invertebrate fishery resources as a whole and aligned with ecosystem-based fishery management that ensures benefits to small-scale fisher households.

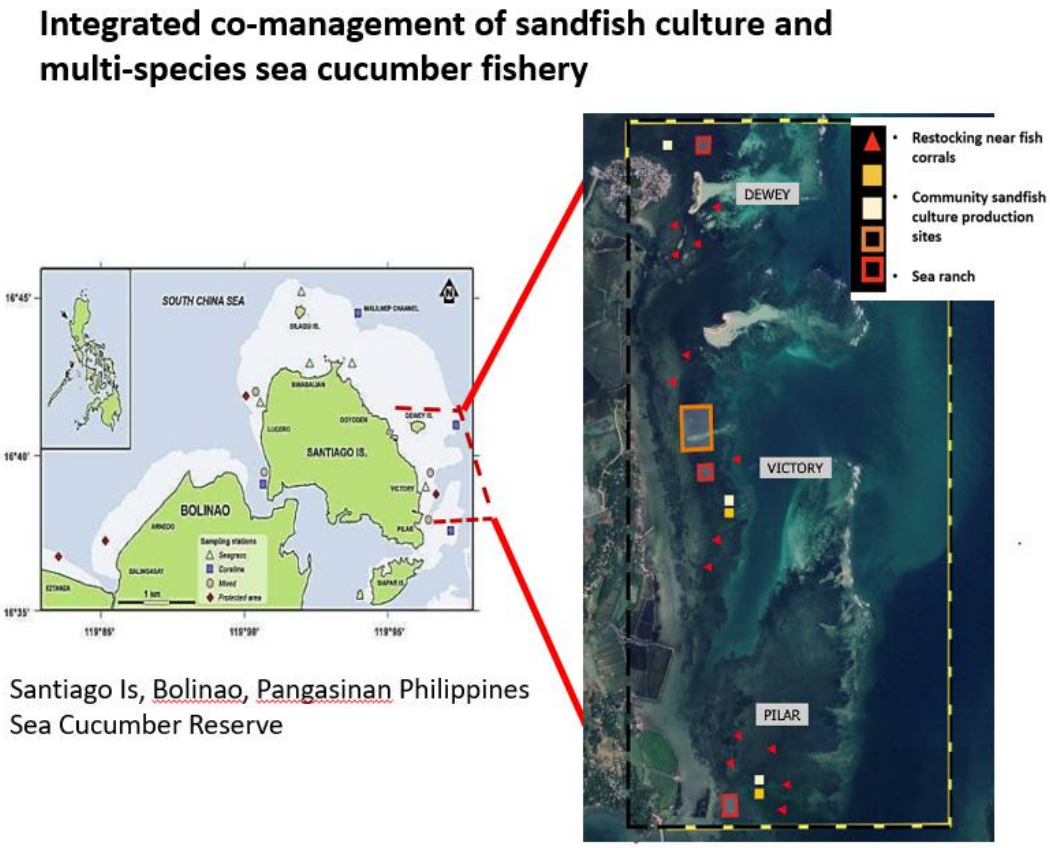

Figure 1. Location of sea cucumber reserve and community- based sandfish sites.

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Philippines 2. A Model of Community-Based No-Take Marine Reserve (NTMR) in Apo Island, Negros Oriental, Philippines

1. Background, Context, and Challenges:

In the early 1980s, Apo Island, located near the southern tip of Negros Oriental in Central Visayas, was experiencing significant degradation of its coral reefs and fisheries due to destructive fishing practices, including blast and cyanide fishing. These practices had reduced previously productive coral reefs into rubble fields with few edible fish. The need for a locally adapted and community-led solution to reverse the decline in fishery productivity and coral reef health became urgent. The Biology Department of Silliman University sought to empower the local community to take ownership of their marine resources and embrace a conservation strategy that would sustain their livelihoods and preserve marine biodiversity.

2. Actions Done:

In 1982, the Apo Island NTMR was established under a Municipal Ordinance enacted by the municipality of Dauin, making it the first community-based marine reserve in the Philippines. With intensive community organizing and capacity-building led by Silliman University scientists and social workers, the 10-hectare NTMR was co-managed by local stakeholders and later expanded to include additional hectares to accommodate marine tourism activities. The NTMR was integrated into the National Integrated Protected Areas System (NIPAS) in 1994, and governance was transitioned to the Protected Area Management Board (PAMB), with the Apo community and Silliman University representatives serving on the board. Ecological monitoring, enforcement by community members, and education campaigns were key components of the strategy. The reef was also surveyed annually, using standardized methods from the Australia-ASEAN Project and later supported by collaborations with James Cook University.

3. Achievements:

The Apo Island NTMR has become one of the most successful marine conservation models in the Philippines. Fish biomass increased fivefold from 25 to 125 tons per square kilometer over 26 years, including the return of top carnivores. The NTMR maintained stable fish yields of 15–20 tons annually over two decades. Approximately 10% of adult fish biomass in the reserve spills over into adjacent fishing areas, contributing to local fishery sustainability (Abesamis et al., 2006). In addition, recent studies using genetic parentage analysis revealed that fish larvae from Apo Island disperse as far as 9 kilometers to other fishing grounds in southern Negros, further validating the ecological connectivity and broader benefits of the NTMR (Abesamis et al., 2017). Economically, the NTMR generated about PHP 10 million annually in tourism revenue, 75% of which directly benefits the local community. Apo's success has inspired neighboring municipalities to establish their own MPAs and has gained international recognition, including being featured by the Shedd Aquarium in the United States.

4. Lessons Learnt:

Apo Island demonstrated that long-term protection, local empowerment, and participatory governance are key to successful marine conservation. Challenges such as initial resistance from fishers, the need for sustained enforcement, and fluctuating tourism pressures were addressed through persistent community education, inclusive decision-making, and strategic partnerships with academia, LGUs, and national government agencies. The importance of consistent ecological monitoring, stable funding, and adaptation to climate-induced stressors such as coral bleaching and typhoons was highlighted. The success of Apo NTMR reinforces that NTMRs require decades—not just years—of protection for full recovery, especially for top predators.

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Philippines 3. Bay-Wide Coastal Governance in Lanuza Bay, Surigao del Sur, Philippines

1. Background, Context and Challenges:

Lanuza Bay, situated along the eastern coast of Surigao del Sur in Mindanao, is a rich marine ecosystem shared by seven municipalities—Carrascal, Cantilan, Madrid, Carmen, Lanuza, Cortes, and Tandag. The area, home to productive coral reefs, mangrove forests, and seagrass beds, had been suffering from increasing degradation due to overfishing, the use of illegal and destructive gear such as fine mesh nets and Danish seines (liba-liba), and poor enforcement of fisheries laws. Fragmented jurisdiction across municipalities led to gaps in coordination and inconsistent enforcement. These challenges threatened not only biodiversity but also the livelihoods of coastal communities dependent on fishing. Commercial fishing vessels often encroached on municipal waters, and violations were difficult to apprehend due to limited local capacity and political pressures. The situation was further exacerbated by a lack of shared governance mechanisms and unified planning.

2. Actions done:

From 2006 onwards, the Lanuza Bay Development Alliance (LBDA) was formally established through a covenant among the seven municipalities, setting the foundation for integrated coastal governance. The alliance was initially supported by the Local Government Support Program (LGSP) and later by Voluntary Service Overseas (VSO) and the European Union. LBDA created the Bay-wide Enforcement Action Team (BEAT), which had divisions for coastal and upland enforcement and worked with municipal Bantay Dagat units. A unified fisheries ordinance was passed and enforced across the seven LGUs. The alliance developed a coastal zonation plan that defined marine protected areas (MPAs), sustainable use zones, rehabilitation areas, tourism zones, and NIPAS-covered areas. A Project Management Team (PMT) composed of municipal environment officers and civil society representatives was established to align municipal actions with the bay-wide Coastal Resource Management Plan. To improve transparency and operational efficiency, the alliance adopted a Manual of Operations and began monthly council meetings. These governance reforms were supported by stakeholder training, participatory assessments, and policy advocacy at the municipal and regional levels.

3. Achievements:

The institutional reforms and coordinated enforcement resulted in a marked improvement in coastal governance and resource condition. Illegal fishing declined significantly, as reported by communities and validated by patrol logs, with BEAT conducting over 140 joint patrols annually. Municipal enforcement coverage expanded to over 85% of reef areas. The performance of seven MPAs improved from Category 3 (low) to Category 1 (effective), based on the national MPA Management Effectiveness Assessment Tool (MEAT). Moreover, fishers from member municipalities began to report modest increases in fish catch, with some noting a return of species previously thought to be depleted. More than 300 individuals, including fisherfolk and women's groups, received training in paralegal enforcement, biodiversity

monitoring, and sustainable livelihoods such as seaweed farming and ecotourism. The alliance successfully secured external funds from the European Union and the Spanish government to support forest land use planning and marine protection. LGUs contributed annual counterpart funds (e.g., PHP 50,000 per municipality), and the LBDA enhanced interconnectivity among its members through improved internet infrastructure and knowledge-sharing platforms.

4. Lessons Learnt:

The Lanuza Bay experience underscores the importance of institutionalized inter-LGU collaboration in addressing habitat and fisheries challenges that span administrative boundaries. A shared vision, backed by formal agreements and operational tools, enabled unified enforcement and planning. However, legal frameworks must be complemented by consistent capacity-building, inclusive stakeholder participation, and financial sustainability mechanisms. The alliance also encountered challenges, including political resistance from influential commercial fishers, and legal threats to enforcers—issues that required external legal support and resilience from alliance members. Not all livelihood alternatives were successful due to biophysical constraints, underscoring the need for site-specific feasibility assessments. Moving forward, embedding participatory monitoring systems, mainstreaming gender and social inclusion, and integrating provincial-level support are critical for scaling and sustaining this model of bay-wide governance.

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Philippnes 4. Participatory MPA Networks in Calamianes Islands, Palawan, Philippines

1. Background, Context, and Challenges:

The Calamianes Islands in northern Palawan—comprising the municipalities of Coron, Busuanga, and Culion—are globally recognized for their exceptional marine biodiversity and ecotourism potential, serving as gateways to UNESCO-recognized reef systems and critical habitats for endangered marine species. However, the region has faced mounting pressures over the years from multiple fronts. Rapid and largely unregulated tourism expansion has led to coastal development, marine pollution, and overcrowding of sensitive reef areas. Overfishing, compounded by destructive practices such as illegal netting and gleaning in seagrass beds, has diminished fish stocks and degraded critical nursery habitats. These pressures have been exacerbated by climate-related disturbances, including increasingly frequent and intense typhoons, coral bleaching events, and rising sea surface temperatures—all of which threaten the resilience of reef systems.

A growing and more recent concern has been the threat of large-scale coastal reclamation projects, particularly in and around Coron Bay. Proposed reclamation for infrastructure and tourism resorts posed significant risks to seagrass beds, mangroves, and shallow reef flats—ecosystems that provide both biodiversity and coastal protection functions. These reclamation activities risk disrupting the ecological connectivity of reef and lagoon systems, potentially undermining local fisheries and marine-based livelihoods. Additionally, governance over the coastal and marine areas has historically been fragmented across the three municipalities. This has resulted in inconsistent enforcement of marine policies, overlapping jurisdictions, and limited coordination among local government units (LGUs). Many of the marine protected areas (MPAs) that were established prior to 2010 were poorly resourced, lacked standardized management protocols, and suffered from low community engagement, resulting in poor compliance and minimal conservation impact. These overlapping threats underscored the urgent need for a coordinated, participatory, and ecosystem-based approach to marine resource management in the Calamianes region.

2. Actions Done:

Between 2003 and 2010, several marine protected areas (MPAs) were locally established in Coron, Busuanga, and Culion through the initiatives of local government units (LGUs), barangay councils, and coastal communities, often with support from non-government organizations and conservation advocates. These efforts were community-led responses to the increasing degradation of coral reefs and fish habitats caused by overfishing, illegal fishing practices, and unmanaged tourism. The USAID-funded FISH Project (2004–2010) later provided crucial technical support in enhancing the effectiveness of these MPAs through science-based monitoring, governance strengthening, and policy integration.

In Coron, the Siete Pecados Marine Park was formally established in 2005 following a grassroots initiative from community members in Barangay Tagumpay. Spurred by concerns over rampant illegal fishing and declining fish stocks, residents proposed the MPA to safeguard the area's reef ecosystem while also securing their livelihoods. Since then, community members

have been actively engaged in managing and monitoring the MPA, including regular reef surveys, community patrols, and education campaigns.

From 2013 to 2017, the USAID ECOFISH Project expanded support for sustainable fisheries and MPA management across Calamianes, helping standardize enforcement protocols and develop participatory zoning plans. Sites like Concepcion Reef in Busuanga, Bugor Reef in Culion and Siete Pacados in Coron were prioritized for MPA strengthening, with zoning agreements crafted through stakeholder consultations involving fisherfolk, tourism stakeholders, and barangay leaders. The most recent wave of support came under the USAID-funded FISH RIGHT Project (2018–2025), which focused on scaling up successful community-led initiatives and promoting MPA networks. The project emphasized science-based governance, co-management mechanisms, and ecosystem connectivity. Local MPA Management Councils were reactivated or strengthened, joint patrols were institutionalized in partnership with LGUs and the Philippine Coast Guard, and reef monitoring was expanded using standardized ecological assessment protocols. Coral restoration and mooring buoy installations were also introduced to reduce anchor damage in high-use tourism sites. These cumulative efforts reinforced the Calamianes MPA network as a model of participatory marine resource management and climate-resilient conservation.

3. Achievements:

The network of participatory Marine Protected Areas (MPAs) across the Calamianes Islands has resulted in measurable ecological and economic gains. Long-term reef monitoring data show significant trends in coral cover improvement, albeit with site-specific variations. In Bugor Reef (Culion), coral cover increased by 26% over a 16-year period—from 41.4% in 2006 to 52% in 2022—demonstrating the effectiveness of sustained protection and community engagement. Concepcion Reef in Busuanga exhibited a cumulative coral cover gain of 8%, rising from 60.4% in 2006 to 65.2% in 2022. Although Siete Pecados Marine Park in Coron recorded only a modest coral cover increase of 2% between 2013 and 2022 (from 52% to 53.1%), it achieved an outstanding 70% increase in fish biomass—from 51.3 metric tons per square kilometer in 2013 to 87 mt/km² in 2022—highlighting the positive impact of its no-take zone and sustained enforcement efforts.

Economically, Siete Pecados emerged as a major ecotourism attraction, generating PHP 5.5 million (approximately USD 100,000) in conservation fees in 2019 alone (Mongabay, 2020). These revenues were transparently reinvested into community patrols, reef maintenance programs, and environmental education activities, especially targeting local youth. The park's strong performance and locally driven governance were nationally recognized when it won the Para El Mar Award for "Best Locally Managed MPA" in 2023. Its global significance was further affirmed when it received the prestigious Blue Park Award in 2024, awarded by the Marine Conservation Institute in a ceremony held in Greece, joining a select group of marine sanctuaries worldwide known for exceptional biodiversity protection.

Moreover, the participatory MPA model piloted in these areas has influenced nearby barangays to adopt similar co-management and science-based conservation approaches, contributing to the gradual emergence of a cohesive and functional MPA network across the Calamianes. The consistent application of standardized ecological monitoring, combined with strong local

governance structures and reinvestment of ecotourism revenues, has proven essential in sustaining ecological recovery and community buy-in over the long term.

4. Lessons Learnt:

The Calamianes experience highlights the critical role of participatory governance, capacity building, and sustained financial support in achieving long-term MPA success. Empowering communities to co-manage marine resources not only enhances compliance and enforcement but also builds stewardship and ownership. Linking conservation with ecotourism creates dual incentives—safeguarding ecosystems while generating sustainable livelihoods. Recognition at the national and international level boosted community pride and legitimacy, attracting additional resources and policy attention. However, challenges remain in scaling up restoration efforts and ensuring that benefits are equitably distributed across stakeholder groups. Continuous training, strong legal backing, and inter-municipal coordination are essential to expand the network and maintain high levels of effectiveness across multiple sites.

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Philippines 5. Coral Restoration through Filipinnovation in Marinduque Province, Philippines

1. Context and Challenges:

Marinduque, a coastal province in the MIMAROPA region, has long relied on its marine resources for food and livelihood, especially among its fisherfolk communities. However, decades of destructive fishing practices—such as muro-ami and blast fishing—combined with sedimentation, siltation, and weak governance of marine protected areas (MPAs), have significantly degraded its coral reefs. A 2018 assessment using the Automated Rapid Reef Assessment System (ARRAS), developed by UP Diliman and adopted by DOST-MIMAROPA, confirmed that several reef areas had live coral cover approaching zero. These findings prompted urgent calls for active intervention. The lack of local technical capacity and inadequate reef management tools further complicated restoration efforts, while climate variability and unsustainable coastal development intensified the threats.

2. Actions Taken:

In response, the Department of Science and Technology – MIMAROPA (DOST-MIMAROPA), in collaboration with the DOST-PCAARRD's Filipinnovation Coral Reef Restoration Program, launched the first large-scale coral rehabilitation initiative in the province. From June to July 2021, the project deployed a total of 20 Coral Nursery Units (CNUs): 10 in the marine protected areas of Tungib-Lipata in Buenavista and 10 more in Poctoy, Torrijos. Each CNU was placed at approximately 25 feet underwater and was designed to hold up to 500 "corals of opportunity" (COPs)—naturally dislodged but living coral fragments—per batch, several times a year. The initiative involved the active participation of fisherfolk groups, local government units, the Provincial Government of Marinduque, and Marinduque State College (MSC). While the university provided technical expertise and training, DOST-MIMAROPA led the procurement and deployment of the CNUs, coordinated ecological monitoring, and conducted educational outreach. DENR and BFAR issued permits, shared baseline data, and participated in evaluation activities. The approach ensured a community-inclusive process from planning to implementation.

3. Achievements:

The project successfully catalyzed reef rehabilitation in two municipalities and laid the groundwork for province-wide expansion. Initial ecological monitoring indicated encouraging results, with coral cover in restoration sites increasing from an initial range of 5–7% to 18–22% within one year of transplantation. The survival rate of coral fragments in the CNUs was reported to be high, validating the effectiveness of the asexual propagation and transplantation method. More than 120 individuals—including fisherfolk, LGU staff, and community volunteers—were trained in coral gardening, monitoring, and reef maintenance. This helped foster local ownership of the initiative. By mid-2021, preparations were underway to deploy the same technology in all six municipalities of Marinduque. Beyond ecological gains, the project also enhanced governance by improving inter-agency coordination and promoting a

participatory model of marine conservation. Through strengthened local stewardship, the project is gradually transforming degraded areas into ecologically functional reef habitats that support both biodiversity and livelihoods.

4. Lessons Learnt:

The Marinduque coral restoration experience highlights the importance of combining science-based methods with community-driven action. Locally adapted technologies such as CNUs, when paired with robust stakeholder collaboration, can accelerate reef recovery even in highly degraded environments. The project demonstrated that institutional partnerships, such as those among DOST, BFAR, DENR, MSC, and LGUs, are critical for mobilizing resources and ensuring the sustainability of restoration efforts. Community involvement—especially the engagement of fisherfolk—proved essential not only for implementation but also for monitoring and long-term protection. However, challenges remain. Algal overgrowth and sediment accumulation on CNUs required regular maintenance, underscoring the need for site-specific planning and adaptive management. Nonetheless, this initiative stands as a replicable model for other provinces and supports national goals of restoring marine ecosystems under climate and development pressures.

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UP-MSI. (2018). ARRAS Monitoring System Manual.

Combined by: Lucas R. Felix Jr. Ichthyofelix18@gmail.com Coral Reef Consultant, C3 Philippines

Philippines 6: Establishment of an additional management zone in the Malampaya Sound Protected Landscape and Seascape, Palawan Province, Philippines

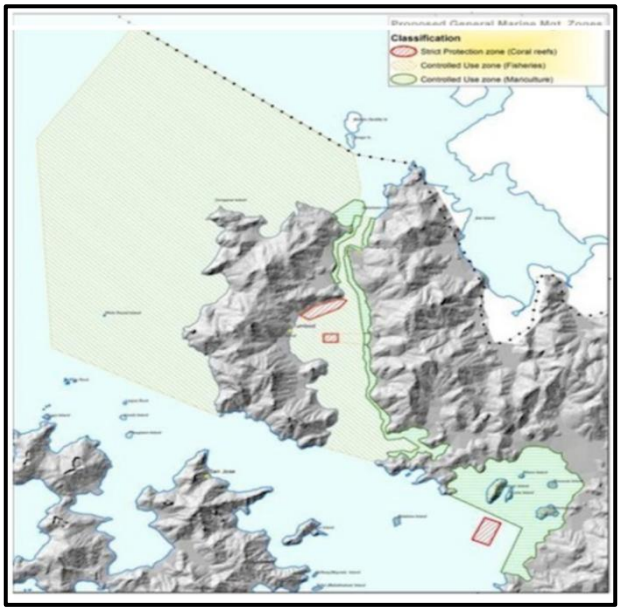
1. Context and challenges in habitat management:

Malampaya Sound Protected Landscape and Seascape (MSPLS) was established under the NIPAS Act (RA 7586) framework by the National Integrated Protected Areas Programme (NIPAP). Presidential Proclamation No. 324, signed by President Joseph Estrada on July 12, 2000, established the Malampaya Sound Protected Landscape and Seascape. The declared management zones, as designated in the management plans before 2015, have been concentrated within the Outer and Inner Sound but not the northwestern part of the protected area. Multiple use zones have been designated in the farther open water areas of the MSPLS. A strict protection zone was identified and mapped but it was deemed not enough to cover other sites (see map).

The outer MSPLS, specifically located in the northwestern part of barangays Tumbod and Liminangcong in the municipality of Taytay, province of Palawan, has wetland habitats of mangroves, seagrass beds, coral reef, estuarine, deep water, muddy and sandy areas which are largely unprotected in spite of belonging to the overall MSPLS.

2. Actions taken:

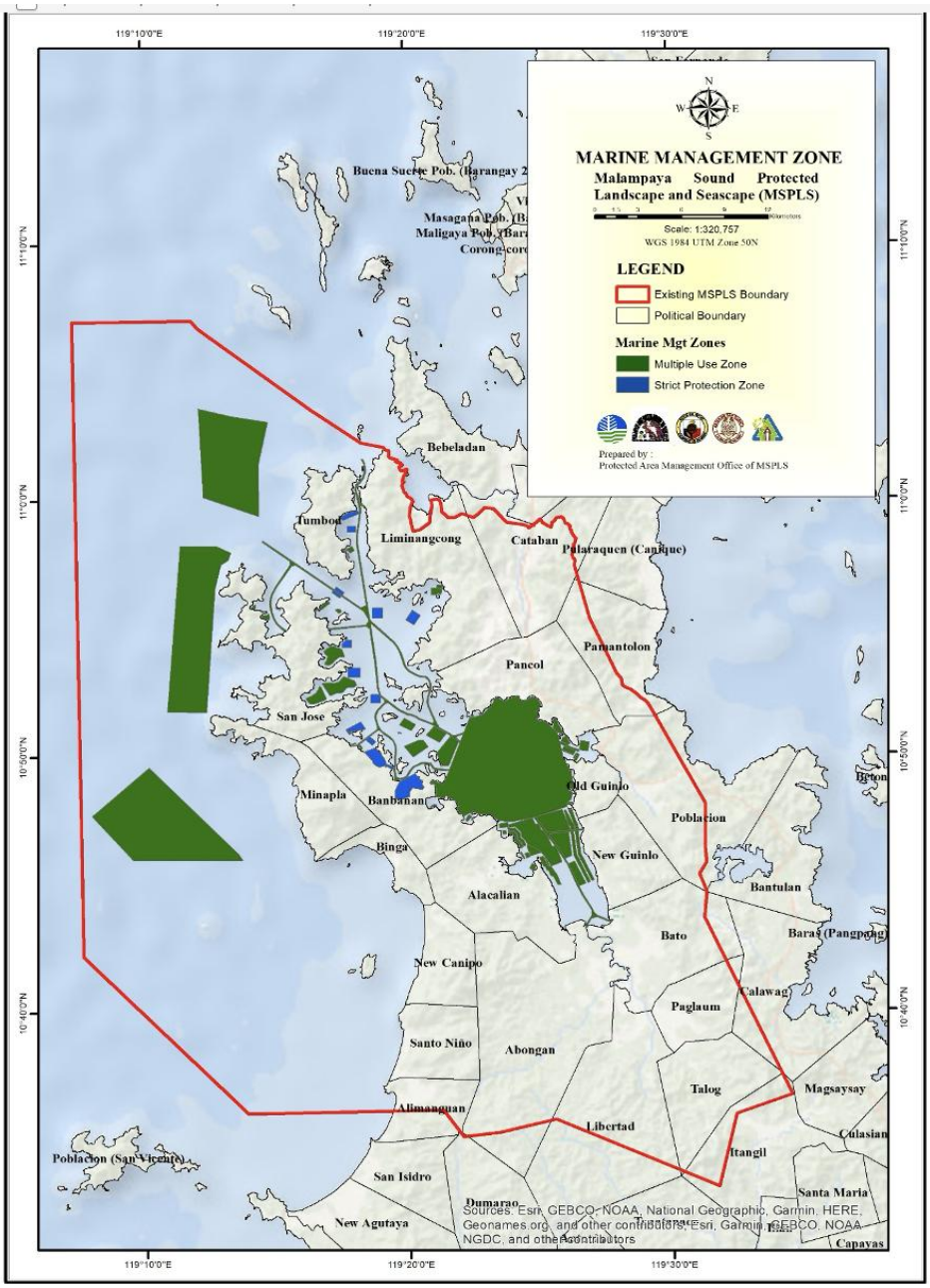
The Malampaya Foundation Inc. (MFI), a non-government organization based in the municipality of Taytay in Palawan, has implemented a Marine Biodiversity Conservation Program: Barangay Aquatic Habitat and Underwater Regeneration Assistance in the said area in barangays Tumbod and Liminancgcong. The program provided full technical, social, logistical, economic and scientific support to communities in the said area.



In 2013, the MFI has identified 8,000 ha as eligible to be a management zone and proposed the area to the Protected Area Management Board of the MSPLS. The proposal was supported by the local communities and barangay local governments. In April 2015, the PAMB had finally approved the proposal and designated the 8,000 ha as a management zone. The map below shows the area designated as an additional management zone within the MSPLS

Source: MFI, 2015

The declaration by the MSPLS PAMB to establish 8,000 ha within the protected area as an additional management zone has amended Proclamation No. 324 that included the establishment of designated management zones within the Outer Sound. Established multiple use zones outside the Outer Sound cover only the open water beyond the Tumbod Island and thus leaves the proposed area open to anthropogenic and environmental stresses. The map below shows the location of multiple-use zones within the MSPLS.



3. Achievement:

With the policy support and the endorsement of the MSPLS PAMB, the NGO and the communities can expand their activities within the new management zone and not be limited to the very small area of the strict protection zone found within the new management zone. They

have the new confidence of obtaining their goals and objectives successfully. As such, new activities are implemented. These are the following:

- **Mangrove Reforestation Programs:** Through initiatives like the National Greening Program, community members in San Vicente and Taytay rehabilitated degraded mangrove forests. These efforts, often spanning several years, have restored critical habitats while engaging locals in conservation work.
- **Marine Protected Area (MPA) Designation:** Local governments have designated critical wetland zones as MPAs. In San Vicente, for example, the establishment of the Marine Reserve has provided a safe haven for marine species while promoting responsible tourism and fishing practices.
- **Community Education Programs:** NGOs and local government units (LGUs) have spearheaded campaigns to educate residents about conservation, proper waste management, and the importance of wetlands. These programs have fostered a sense of environmental stewardship among communities.
- **Biodiversity Recovery:** Mangrove reforestation has rejuvenated ecosystems, leading to an increase in fish stocks and crustacean populations. These outcomes directly benefit local fisheries, providing food security and livelihoods.
- **Waste Reduction:** Community-driven cleanup initiatives have removed tons of trash from estuaries, reducing pollution and enhancing water quality. These efforts have also inspired ongoing local advocacy for sustainable waste management.
- **Enhanced Livelihoods:** Ecotourism projects, such as bird-watching tours and guided wetland excursions, have created alternative income streams. These initiatives demonstrate how conservation and economic growth can go hand in hand.

4. Lessons learnt:

Following the set procedures of the PA management and obtaining the endorsement of the governing body of the PA strengthen the resolve of the NGO, the communities and the other stakeholders in their conservation work. The approval of the new management zone has given the stakeholders renewed vigour and confidence in pursuing their conservation work and helping the communities alleviate themselves from poverty. Challenges remain however since the new management zone is interconnected to the outer and inner sound where the NGO do not have control on the activities being conducted therein. Hence, degradation and pollution of habitats still occur and their new area is still affected. This is where the governing body of the PA comes into play and helps in the conservation management of the whole PA and not just the new management zone.

5. Sources:

Malampaya Foundation. 2015. Malampaya Sound PAMB approves new 8,000 ha management zone within the protected area. https://malampayafoundation.org/news/malampaya-sound-pamb-approves-new-8-000-hectare-management-zone-within-the-protected-area accessed 19 March 2025

MSPLS General Management Plan 2019 – 2024

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Cambodia 1. Gender in Community-Based Natural Resources Management: A Case at Beoung Kachhang Community Protected Area in Cambodia

1. Context and challaneges

In Cambodia, the Community Based Natural Resources Management (CBNRM) is a mechanism developed based on the national policy to strengthen natural resource management and empower local people who live in and adjacent to the PAs and depend on resources. The establishment of Community Protected Areas (CPAs) allows local communities and indigenous communities to participate in the management of natural resources by exercising their traditional rights and culture, improving capacity, increasing the economy, and promoting gender equality.

Boeung Kachhang, which is located in Boeung Ka Chhang Village, Bak Klang Commune, Mondul Seima District, Koh Kong Province, is considered a remote village separated from the mainland by the Koh Por canal and it can be accessed by ferry or boat (about 750 meters from Pak Klang commune hall). The village comprises 157 families (576 persons, including 287 females). Nineteen families are women household heads. This community is in Peam Krasap Wildlife Sanctuary (PKWS), approximately 10 km (by road) and about 7 km (waterway) from Kemmrak Phoumin City. Fishing is the main occupation, while the secondary income sources are fish processing (fish farming, crabs, dried shrimp), construction or factory work, and government services. In the village, men spend more of their time at night doing fishing activities and taking a rest during the daytime. In contrast, women work during the daytime on household work, processing fish products, and participating in various community activities. Their families have shared different roles and are specific among family members and community activities. Women often participate more actively in community work and income generation activities than men.

In the 1990s, the natural resources in the Peam Krasop Wildlife Sanctuary were severely damaged by deforestation of mangroves for charcoal (charcoal kiln business), land clearing, shrimp farming, and the illegal use of fishing gear. Boeung Kachhang Community Protected Areas (CPA) was then established in 2001 under the initiation and coordination of the Koh Kong Provincial Department of Environment, local authorities, and villagers and in collaboration with the Coastal Zone Management Project (CZM/MoE), covering an area of 728 hectares, and with 114 families as members. The establishment aims to conserve and restore natural resources, particularly the mangrove forests, and improve the living standards of local people who depend entirely on fishing.

2. Actions done

Identification 0f gender roles and decision-making at family level

Women and men play crucial roles in the family. For daily activities in Beoung Kachhang village, about 70% of men are fishermen; they go fishing in the sea both within CPA area and outside at nighttime. Another 30% are port and factory workers near Cambodia-Thailand's border. Most families are fishing in the community area, and only families that have a big boat go fishing in the sea.

Women are mainly responsible for housework and taking care of the children. They are also directly responsible for processing fishery products, including dried shrimp and fish, crab, and meat received from their husband's fishing in the open sea. They sometimes join their husband in fishing too. Some young women work outside the village as factory workers at the border and provide a decent income, and then they do not have to migrate.

The value of the man as the head of the family continues to be practiced from generation to another; however, it does not indicate or specify that housework is only for women. Most men enjoy helping with housework, such as washing clothes, taking care of children, and processing fish. As mentioned above, women typically stay at home. They do not require to travel far from the village, so they tend to receive more opportunities than men to participate in the community's work, mainly during the daytime. For fishing men usually leave home between 5-6 pm and return between 4-5 am.

In Boeung Kachhang CPA, the wife and husband usually discuss family's tasks, from regular to important ones, even daily activities, before making any family decision. Joint decisions between spouses and adult children are made though women participating more in community work, and men working outside. Only in emergencies and for widows/widowers, who are single family heads, they will decide by themselves. This shows that females and males have mutual respect and value to each other regardless of their role in the family.

Table 1: Role of women and men at the family level

Issues to be decided	**Women**	**Man**	**Both**
Daily food expenses for the family	√		
Expenses on household materials			√
Determine the number of members (children) in the family			√
Children's education and needs			√
Choosing a career for family as well as individuals			√
Selection of fishing area / place		√	
Credit / Savings			√

Engaging women in community committees

The number of women in the PCA committee of is impressive. Among the seven committee members, four, equal to 57% (Table 2), are women who serve as deputy committee, secretary, cashier, and one in charge of the environment and waste.

With the roles of women in the community committee, they can understand social work and have opportunities to learn, increase their abilities, and feel empowered. This motivation and encouragement from family, relatives, and neighbors, most notably, the attention they receive from members and community leaders, drive them to fully participate to gain experience and continue to support community development and family livelihood.

Table 2 Members of Community Committee

Committees mandate	Community Committees	
	Women	Man
1st Mandate : 2001-2005	3	4
2nd Mandate : 2006-2008	2	5
3rd Mandate : 2009-2011	3	4
4th Mandate : 2011-2016	3	4
5th Mandate: 2016-2018	3	4
6th Mandate: 2018-2020	4	3

Motivation factors and barriers to women's participation in the community

The case study shows that the Boeung Kachhang community protected area is ongoing well and has progressed remarkably due to the efforts and solidarity of community members, local authorities, and other stakeholders. This is because the community members, especially women, are willing to participate in community development activities for the common good of improving the living standards of communities that benefit from the conservation of natural resources. Many women thought that the establishment of the community as a tool to address people's needs and citizens' expectations of economic benefit by providing livelihood support to communities in a variety of ways and empowered women through engagement in the community, skills training, management, and participation in the leading group activities that support the local community and economic processes.

The support of family and community members is essential in encouraging women to participate in community activities. In the case study, women received the consent and approval of their husbands for social work, which enabled them to become more involved in their community work and perform their work with focus and confidence. With the permission of husbands, families, and neighbors, women are encouraged to participate in the community. They support significant activities that build their empowerment and confidence to express their opinions and make various decisions. The composition of women in each community leadership committee reflects an effective way to encourage women to take part in problems solving and managing natural resources directly.

Women are generally very interested in participating in community activities, but they also need to ask permission from their husbands and families in advance to avoid dissatisfaction and family frustration. Family decisions show respect and mutual respect. However, experiences from the Boeung Kachhang CPA have also demonstrated that a small number of husbands or families are dissatisfied with women's participation in community activities or self-employment, mainly due to jealousy. Time is also an obstacle for women's full participation in community work, as they have to cover household chores that are recognized as unpaid work. Including the low levels of education and illiteracy, female community members are reluctant to participate in community affairs due to their lack of encouragement and confidence in their abilities.

3. Lessons leant

The case study demonstrated that men and women have different roles in community development. The strong women's activities in community work have contributed to the sustainability of the community and driven the change in gender roles in the community, family, and society as a whole nation. The success in women's participation in the community is due to the support of husbands, families, and men in the community, which demonstrate an increase in the level of respect and value given to each other that creates a better family communication environment, and society. After all, although women cannot do some of the same things as men, men recognize the involvement of women in community activities complementing each other to facilitate the community, family, and national development successfully.

Providing fair benefits with transparency and justice in Boeung Kachhange CPA to its members is an essential motivating tool to promote active participation in community activities. At the same time, community members both men and women should have the willingness, ownership, and responsible for cooperating, supporting, and implementing all community activities to ensure equal use and a fair share of community resources.

Women have played a crucial and active role in the community development of the PCA, which is an excellent example for other communities to adapt in contributing to the economic development of the community, significantly increasing livelihoods and improving the living in the community, which is fundamental in reducing the natural resource crime. The participation of women in community protected areas today is the positive progress moving forward to more women in CPA management. It is more potential for women to engage in community work beyond household chore, therefore raising awareness and recognition of housework as everyone work which is a fundamental step in reducing the gender gap in community protected area.

4. Reference:

Ly Sophorn, Keo Neaty, Chan Nara, Moeurn Sovann, Heng Thany, Ly Heng. 2021. *Gender in Community Based Natural Resources Management: Case Study of Beoung Kachhang Community Protected Area, Beoung Kachhange Village Bak Klong Commune, Mondol Sima District, Koh Kong Province*.

Cambodia 2. Community-Led Habitat Protection and Waste Reduction in Koh Kapik Community Protected Area, Peam Krasaop Wildlife Sanctuary, Koh Kong Province, Cambodia

1. Context and Challenges

Koh Kapik Community Protected Area (CPA) is located within the Peam Krasaop Wildlife Sanctuary in Koh Kong Province. The CPA covers an area rich in mangrove forests, mudflats, and estuaries, supporting critical biodiversity, including fish, crustaceans, and migratory birds. It is home to several fishing households who rely directly on coastal resources for subsistence and income.

In recent years, Koh Kapik has faced growing threats from:

- Unsustainable fishing practices, including illegal gear use and overharvesting of crabs and fish.
- Improper waste disposal, with household and tourism-related solid waste—especially plastics—accumulating in the mangrove system.
- Degraded mangrove cover due to past cutting and lack of community enforcement capacity.

The absence of sustainable use guidelines, pollution control mechanisms, and formal monitoring systems contributed to the degradation of the local ecosystem and declining fish catches. While the CPA model is legally recognized under Cambodia's Protected Areas Law (2008) and supported by Sub-Decree No. 69 (2017) on Community Protected Area Management, its implementation was often constrained by:

- Limited technical and financial support at the local level,
- Fragmented integration of habitat and pollution management,
- Weak awareness and enforcement among residents and visitors.

2. SCS SAP Intervention

The SCS SAP project piloted several management measures and low-cost technologies for sustainable use and land-based pollution control in Koh Kapik CPA, including:

- Development of community-use zoning plans, identifying core conservation, sustainable use, and restoration zones within the CPA.
- Introduction of crab bank models, allowing gravid female crabs to be safely returned to mangrove waters to maintain population recovery.

- Establishment of plastic waste collection points and segregation bins, managed by the CPA committee and supported by awareness campaigns in nearby villages and schools.
- Mangrove replanting and natural regeneration protection, with community-led patrols and monitoring systems.
- Training for local leaders on low-cost water quality monitoring using turbidity tubes and salinity meters.

3. Results & Achievements

- Improved fisheries sustainability: Crab bank and zonation activities led to noticeable increases in crab and fish availability within one year.
- Plastic pollution reduced: Over 500 kg of plastic waste was collected and removed from the mangrove system during community clean-up campaigns in 2023–2024.
- Stronger community governance: The CPA committee successfully enforced local by-laws and coordinated patrols, supported by enhanced community participation and collaboration with rangers.
- Restoration success: Over 10 hectares of degraded mangrove area were replanted, with high survival rates due to community stewardship.

4. Lessons Learnt & Factors of Success

- Empowering local institutions, like CPA committees, with practical tools and decision-making power builds long-term ownership.
- Simple, low-cost technologies, such as crab banks and handmade waste stations, are effective and scalable when embraced by the community.
- Youth engagement through schools and eco-clubs is crucial for promoting behavioral change on pollution.
- Integration of habitat and pollution measures results in more holistic and lasting ecological improvements than single-focused interventions.

5. Replicability & Scaling-Up Potential

The SCS SAP-supported interventions in Koh Kapik CPA demonstrate that locally appropriate, community-led management measures and simple pollution technologies can lead to measurable environmental and livelihood improvements. The integrated

focus on habitat uses, restoration, and pollution reduction offers a model for other coastal communities striving for resilience and sustainability. The Koh Kapik approach is highly replicable in other coastal CPAs in Cambodia and the region. Key elements for successful replication include:

- Tailoring sustainable use zoning to local resource use patterns;
- Integrating traditional knowledge with modern practices (e.g., crab banks);
- Building partnerships with local authorities and school networks;
- Mobilizing initial support from small grants or commune development budgets.

Scaling-up would benefit from linking CPAs with national initiatives such as the Plastic-Free Coastline Program and Blue Economy Strategy.

6. Sources

Koh Kapik CPA Committee Reports (2023–2024)

Ministry of Environment (2023). *Peam Krasaop Wildlife Sanctuary Management Plan*

Compiled by Thav Sopheak, NC-SCS SAP Cambodia

Cambodia 3: Strengthened Policies and Local Financing for Pollution and Habitat Management in Peam Krasaop Wildlife Sanctuary, Koh Kong Province, Cambodia

1. Context and Challenges

Peam Krasaop Wildlife Sanctuary (PKWS), located in Mondol Seima and Koh Kong Districts of Koh Kong Province, covers approximately 25,000 hectares and is one of Cambodia's most ecologically significant coastal protected areas. It hosts extensive mangrove forests, intertidal mudflats, seagrass beds, and wetlands, serving as critical nursery grounds for marine species and providing livelihoods for thousands of local people engaged in small-scale fisheries, aquaculture, and eco-tourism.

Despite its ecological and economic importance, PKWS has faced increasing threats from **land-based sources of pollution (LBSP)**, including:

- Untreated domestic wastewater and solid waste from surrounding villages;
- Agricultural runoff containing pesticides and fertilizers;
- Sediment and construction waste from expanding infrastructure.

These pressures have resulted in **mangrove degradation, water quality deterioration, and loss of habitat connectivity**. In addition, **limited coordination among authorities**, **weak enforcement of existing environmental laws**, and **lack of dedicated financial resources** hindered effective habitat and pollution management.

While Cambodia has several overarching policies and laws relevant to environmental management—such as the Law on Environmental Protection (1996), the National Strategic Plan on Marine and Coastal Resources Management (2016–2030), and the Circular Strategy on Environment (2023–2028)—they were not fully translated into operational guidelines or local action in PKWS. There was also **no specific financing mechanism** at the sanctuary level to support pollution control or habitat restoration initiatives.

2. SCS SAP Intervention

The SCS SAP project, through its national implementation in Cambodia, **prioritized the harmonization of national strategies with provincial action plans** and piloted **localized mechanisms for pollution and habitat management** within PKWS. Key interventions included:

- **Development of site-specific pollution reduction and mangrove management guidelines** through consultations with the Ministry of Environment, local government, and community members.

- **Capacity building for provincial and district officials**, particularly on integrating land-based pollution controls into protected area management.
- **Support for financial mechanism exploration**, including the use of commune development funds and community-based eco-tourism revenues to support habitat protection and waste management.
- Facilitation of **cross-sectoral coordination platforms** involving local rangers, CPA members, and provincial departments to ensure integrated decision-making.

3. Results & Achievements

- **Integration of pollution and habitat concerns into the PKWS Management Plan (2023–2028)**, with clear roles assigned to district and commune councils.
- **Improved interdepartmental coordination**: The Department of Environment, Department of Land Management, and local authorities began working under a unified work plan.
- **Increased community engagement**, with CPAs co-managing mangrove replanting sites and conducting waste education campaigns.
- **Pilot funding mobilized** through a portion of commune investment budgets and eco-tourism revenues directed toward habitat restoration and waste collection initiatives.

In conlusion, the SCS SAP project's support in Peam Krasaop Wildlife Sanctuary has demonstrated that **strengthened policies**, when localized and supported by community participation and tailored financing mechanisms, can effectively address land-based pollution and habitat degradation. The project laid the foundation for **sustainable coastal ecosystem management**, improved governance, and resilient community livelihoods.

4. Lessons Learnt & Factors of Success

- **Decentralized planning**—grounding national policies in local realities—ensured greater relevance and community ownership.
- **Participatory management**-built trust between communities and government, improving compliance and monitoring.
- **Flexible financial entry points**, such as aligning with existing commune fund disbursement processes, enabled quicker mobilization of resources.
- **Champion leadership at the provincial and district levels**, particularly from proactive rangers and commune chiefs, was critical to progress.

5. Replicability & Scaling-Up Potential

The PKWS model demonstrates the **value of aligning site-level action plans with national policy goals** while incorporating **local financing and governance mechanisms**. This model is highly replicable in other coastal protected areas in Cambodia, such as Kampot's Prek Thnout Community Protected Area and Ream National Park in Preah Sihanouk. Scaling up would require:

- Formalizing co-financing schemes between commune councils and CPA committees;
- Expanding training on integrated habitat and pollution management;
- Establishing a national fund or incentive scheme to reward subnational innovation in marine pollution reduction.

7. Sources & Contacts

Sources:

- Ministry of Environment (2023). *Peam Krasaop Wildlife Sanctuary Management Plan (2023–2028)*.
- Royal Government of Cambodia. (2023). *Circular Strategy on Environment 2023–2028*.

Compiled by Thav Sopheak, NC-SCS SAP Cambodia

Indonesia 1. Protection, Restoration and Community Engagement for Coral Reef Conservation in Bangka Belitung, Indonesia

1. Context and challenges:

Offshore tin mining has long been a source of significant damage to coral and seagrass ecosystems in Bangka Belitung. Mining waste increases water turbidity, inhibiting coral growth. Recently, Bangka Belitung is developing as a marine tourism destination, but unregulated snorkeling and diving activities are adding to the pressure. As a result, reef fish and other biological resources are declining drastically due to habitat degradation.

2. Actions done

- Conservation Areas:
  - Belitung Island Marine Tourism Park (132,000 ha, designated by the Ministry of Marine Affairs and Fisheries in 2019).
  - The Central and South Bangka Regional Marine Conservation Areas (KKPD) are managed by the local government with support from the Ministry of Marine Affairs and Fisheries and NGOs.
- Coral Restoration:
  - Coral transplantation at several tourist spots (Tanjung Kelayang Beach, Lengkuas Island, Lepar Island).
  - Artificial reef structures made of concrete and steel frames were installed by the community, NGOs, and the tourism sector.
- Marine ecotourism: Development of snorkeling/diving sites combined with environmental education programs.
- Developing a community-based management system involved numerous stakeholders from local government and communities at the district level (such as the Department of Marine Affairs and Fisheries, Bappeldada, Education Services, Tourism Services and NGOs.
- Promoting community awareness and education; consideration of local regulations; development of a resource management plan; information and public awareness activities; and evaluation of alternative livelihoods.
  - Public awareness activities included several community meetings, production and distribution of T- shirts and calendars to the Selat Nasik community.
  - Education activities took place in cooperation with the Education Service of Belitung District, and a syllabus was prepared and 1,400 guide books “Pesisir dan laut kita” (The Coast and Our Sea) were produced and distributed to all elementary school children in the Sub-District. Local teachers were also trained in using the guide book.
- Control of activities on the coral reefs was undertaken through regular patrols by 20 volunteer reef watchers.
- Enhancing community income: enhancing production and quality of locally produced fish crackers and generating new products including jerked fish (dendeng ikan) and durian toffee (dodol durian).
- Incorporating Traditional Knowledge and Practices into Local Management Regulations:
  - The development of the resource management plan and local regulations involved compiling all relevant information and consulting with the legal section of the local government of Belitung, the head of the sub-district, village chiefs, and prominent figures in the community, including fishermen.

- Build fishermen's awareness to stop doing destructive fishing so that the motivation and trust of fishermen emerge to protect coral reefs and coastal ecosystems, and fish will return in large numbers.
- This effort was carried out by conducting intensive discussions with the community by evoking old memories, where destructive fishing began. The community has an internal agreement, namely:
    - In 1970, there was a rule on preventing the use of certain fishing gear. The community agreement outlines a number of "rules," including the fact that anyone fishing in Gersik waters must use the same gear as local fishermen and ban the use of light fishing. However, this agreement broke due to violations and conflicts.
    - In 1999, an agreement was reached between the Local Government of Belitung District and the Local Government of South Bangka, according to which fishermen from South Bangka catching fish in the waters of Gersik village must follow the regulations that have been developed by the Gersik fishermen.
    - Some years later, a disagreement between the fishermen of Gersik, Belitung District, and Pongok, Bangka District arose in which the latter was accused of violating this agreement. On April 30, 2003, in Belitung, the parties resolved the dispute and agreed to adopt the following principles:
        - All disputes are to be settled in an amicable manner through discussion and not by force;
        - FAD (rumpon) located close to the operational area of purse seine (payang) must be marked with a 2 m pole;
        - Fish traps (bagan) may not be operated in the area of the FAD;
        - Fishermen using fish traps are to report to the Village Head or community chief before fishing;
        - In the wet season, the waters surrounding Bakau Island, Karang Gading, Karang Air, Karang Delapan, and Karang Berekam are open for both payang and bagan fishermen; and,
        - In cases of violation, the offender will be prosecuted according to the existing laws.
- Traditional knowledge and practices and agreed rules are incorporated into Local Management Regulations.

• Integration of Local Wisdom in the Management Plan and Regulations

- To integrate the existing agreements initiated by the fishing community of Gersik village into the Resource Management Plan for the entire Nasik Sub-District in a participatory manner with a zoning system:
    - "Red" zones were designated as areas that are completely protected;
    - "yellow" zones are areas of defined and limited use;
    - "green" zones represent areas that are open for all kinds of activities.
- The draft agreement was then carried out in public consultations and submitted to local governments for input.
- Draft of local regulations on coral reef management and fishing activities, and the use of gear based on the Gersik agreements, were considered by the Local Government of Belitung District.

3. Achievements

• Legal Protection: 132,000 ha of marine conservation areas in Belitung provide a strong legal framework for conservation.

- Community Engagement: Local fishing and tourism groups participate in transplantation and monitoring.
- Ecotourism Growth: Marine tourism provides an alternative economic source for the community, reducing dependence on mining.
- Pilot Restoration Success: Transplantation sites demonstrate new coral growth and increased tourist appeal.

4. Challenges and lessons learnt:

Main challenges, including:

- Small-scale: Restoration is still sporadic, disproportionate to the extent of damage caused by mining.
- Illegal mining: Illegal marine mining activities continue, even within conservation areas.
- Weak law enforcement: Limited regional oversight, making it difficult to protect areas from mining and destructive fishing.
- Tourism pressure: Without strict regulations, tourism has the potential to damage coral reefs being restored.
- Funding sustainability: Most restoration programs are project-based, with no long-term financing schemes.

Lessons learnt include:

- Development of local regulations (Perda) on the management of coral reefs has been done by several other districts in Indonesia. Therefore, the potency of replication would be quite high. Nonetheless, the phasing and the necessary timing for replication for each locality are quite different.
- The principles adopted at the site for dispute resolution between fishermen have potential for replication in other areas of Indonesia's South China Sea coast. Particularly in the Riau Islands area and coastal waters of West Kalimantan province, where similar fishing methods are used and conflicts exist.
- The experiences at the Belitung site have been used to plan a future fisheries initiative in Indonesia aimed at improving the management of important fisheries habitats. The success in integrating local wisdom in local management plan development has potential for upscaling to the sub-region level as part of this initiative.
- The community awareness and education materials have potential for direct use in adjacent subdistricts and districts, and efforts are being made to make these accessible via the Selat Nasik website.
- Translated versions of the training materials developed for the site could also be used in other South China Sea countries in the design of awareness-building activities.

5. Sources:

COREMAP-II reports (2005–2012). Direct communication with Dr. Nurul Dewani Mirah Sjafrie

Indonesia 2. Protecting and restoring coral reefs in Natuna and Anambas, Indonesia

1. Contexts:

Indonesia manages approximately 2.3 million hectares of marine areas in the Natuna and Anambas Islands, which are part of the South China Sea. Coral reefs in this region are crucial for traditional fisheries, biodiversity, and territorial sovereignty.

2. Actions done

- Establishment of Marine Protected Areas (MPAs):
  - Anambas National Marine Conservation Area (approximately 1.2 million ha, established in 2014).
  - Natuna Marine Tourism Park (approximately 1.2 million ha, established in 2014, managed by the Kupang National Population and Family Planning Agency (BKKPN).
- COREMAP Support:
  - Monitoring coral reefs and seagrass beds in Natuna and Anambas since 2005.
  - Community empowerment (Pokmaswas) in community-based monitoring and management.
- Reef restoration projects:
  - Coral transplantation in several locations in Anambas (a collaboration between NGOs & the Ministry of Marine Affairs and Fisheries).
  - Trialization of artificial reefs (concrete structures & steel frames) for new coral substrate.
- Research and monitoring:
  - LIPI (now BRIN) and universities conduct ecosystem condition surveys every 2–3 years.
  - Data is used to support reports on the status of Indonesia's coral reefs and MPA policies.
- Community livelihoods:
  - Development of marine ecotourism in Anambas (snorkeling/diving sites with coral education programs).
  - Economic diversification to reduce dependence on capture fisheries.

3. Achievements

- Protected area expansion: Two large MPAs (Natuna and Anambas) serve as strongholds of Indonesian conservation in the South China Sea, encompassing >2.4 million hectares of water.
- Improved public awareness: Through COREMAP, local communities are beginning to understand the importance of reef monitoring and conservation.
- Ecosystem monitoring: Natuna and Anambas are now routinely included in the national Reef Health Index (RHI) database.
- Restoration & Rehabilitation: Hundreds of transplanted coral units are growing in pilot sites, albeit on a small scale.
- Strengthening sovereignty: Conservation in Natuna and Anambas simultaneously strengthens Indonesia's position in the geopolitics of the South China Sea (ecology & blue economy).

4. Challenges and lessons learnt:

They're existed main challenges as follows:

- Illegal, Unreported, and Unregulated (IUU) fishing by foreign fishermen (trawls, bombs, cyanide).
- Overfishing by local fishermen.
- Physical damage from anchors, coastal development, and uncontrolled tourism.
- Geopolitical pressures: Border areas are prone to conflict, making routine monitoring difficult.
- Climate impacts: Mass bleaching events have been recorded in Natuna following El Niño.

Lessons learnt include:

- Weak monitoring: The area is very large, however, with limited patrols and facilities.
- Small-scale restoration: Transplantation and artificial reef efforts are not commensurate with the extent of degradation.
- IUU Fishing: Destruction by foreign vessels continues to occur, despite increased patrols by the Indonesian Navy and the Ministry of Marine Affairs and Fisheries.
- Funding and human resources: The sustainability of conservation programs depends on donor support and the state budget.
- Climate change threat: Periodic bleaching (1998, 2010, 2016) reduces the effectiveness of local efforts.
- Ecological connectivity: Natuna–Anambas is of great regional importance, but there is minimal transboundary conservation cooperation.

5. Sources:

Ministry of Maritime Affairs and Fisheries (KKP). National Marine Conservation Area Data (Natuna and Anambas).

COREMAP-II reports (2005–2012).

LIPI. Monitoring of Coral Reefs in Natuna and Anambas.

Indonesia 3. Preventing marine pollution from land-based sources through waste banks in Bank Sampah Bersinar, Indonesia

1. Background, context, challenges.

Bank Sampah Bersinar (BSB) or Bersinar Waste Bank located in Baleendah Sub-district, Bandung Regency, West Java Province, Indonesia. This area is adjacent to the Citarum River, which flows into the north coast of the Java Sea. The surrounding communities generally lack environmental awareness leading to improper waste disposal including into the Citarum river. The Citarum river is unfortunately known as one of the most polluted rivers in Indonesia due to this issue. Waste or garbage carried by rivers is considered as the significant contributor to marine pollution from land-based sources, impacting not only coastal and marine area but also extending to other islands and even countries. Both the government and local communities frequently organize river cleanups to remove waste from the Citarum River, aiming to reduce its environmental impact. These cleanups also serve as a crucial campaign to raise public awareness about proper waste management.

The Bank Sampah also known as "Waste Bank" is a waste management system developed by the Ministry of Environment in 2012, in this system, residents deposit their segregated non-organic waste, which is then sold for recycling, and the residents receive money in return. This system promotes circular economy principles, reduces waste, and provides income to local communities. Residents who save garbage as customers also have a savings book and can borrow money which is later paid with garbage. This is actually a community-based waste management system to manage waste and reduce its impact on the environment while potentially providing an income source for those involved.

The BSB, was initiated in 2014 as a social enterprise. However, in 2019, recognizing new business opportunities and aiming to increase environmental contribution, the management then decided to transition into the waste management business, operating as a Parent Waste Bank. The initial activity carried out by BSB was socialization and education to sort/segregate waste that still has economic value. BSB collaborates with Waste Bank Units at the neighborhood, village, office and school levels, by picking up waste from the Waste Bank Unit, the collected waste is then further processed either by BSB or by its business partners.

As mentioned, BSB initially focused on socialization and education, then turned into a place for storing waste, sorting waste, processing waste and developing innovations for waste processing services. The community participating in the waste bank as customers will get savings from the economic value of the waste they deposit. The BSB guarantees that its customers will get the best price, and the collected waste will be picked up based on a schedule from the collection point in each Waste Bank Unit. BSB is committed to ensuring customers benefit from its services, particularly for essential needs like electricity, water, telephone bills, and payments for children's education and healthcare.

Photo source: VOE Indonesia

The challenges faced by BSB are first, encouraging people to consistently sort waste at source ensuring that only residual waste with no economic value goes to landfills. This behavioral change requires continuous education and takes time to implement effectively. Second, motivating people to leverage the economic opportunities available through proper waste management. Developing innovative and engaging programs will be crucial in encouraging community participation in waste management initiatives. Overcoming these challenges will significantly contribute to reducing coastal and marine pollution originating from land.

2. Actions done

Due to the fact that the community has limited environmental awareness, therefore the initial effort carried out by BSB is to focus on educating and encouraging behavioral change to foster greater environmental responsibility. This approach involves promoting waste sorting by type (e.g. paper, plastic, metal, diapers, cloth waste, electronic waste, etc.) and highlighting the economic value of waste. BSB collaborates with Waste Bank Units at the Neighborhood Level, as well as offices and schools, inviting them to become BSB valued customers.

BSB provides assistance to the communities to independently manage their waste. Waste that has been segregated is weighed and then converted to money or e-wallet balances according to the weight and type of waste before it is brought to BSB facility. In managing waste, BSB actively collaborates with various partners in its waste management effort. BSB is also continuously developing innovations to enhance its waste management services.

To encourage the community members to segregate their waste, BSB assures its members of the economic benefits by guaranteeing the best prices for sorted waste. BSB is committed to picking up the sorted waste according to a schedule at designated locations. As a Family Waste Bank BSB is actively engaged in these activities.

Waste received by BSB at the Material Recovery Facility will be segregated, for in-organics waste are segregated as follows:

- Plastics: PET, HDPE, LDPE, PP, Flexi, etc.
- Paper: Carton, HVS, Cardboard, UBC, etc.
- Glass: Colored and non-colored
- Metal: Can, aluminum, tin, etc.
- Others: Cloth waste, Styrofoam, Cooking oil, etc.

As for the organic waste will be treated using several methods, including composting through the open windrow technique, the use of black soldier flies, vermicomposting, and hydrothermal treatment.

Organic and Non-Organic Waste Recovery:
Material Recovery Facility

Cloth waste treatment at BSB

3. Achievements

BSB's activities upt to 2024 for the individual membership has reached a total of 40.000, and 855 Waste Bank Units located in Bandung and surrounding areas. Since its inception, BSB has processed a significant amount of waste with 715 tons of non-organic waste, 31 tons of organic waste, 7.5 tons of used cooking oil, 3 tons of e-waste, 68 tons of diaper waste, 5 tons of used clothing waste, and 1 ton of used mask waste.

BSB's waste processing methods include:

- Plastic waste, this is processed into Refuse Plastic Fuel (RPF) or coal substitute fuel. BSB partners with other organization for this process, and BSB classified plastic into 30 different types
- Used diapers. Since 2021 BSB has been collecting 4-5 tons of used diapers per month from Waste Bank Unit and direct deliveries. These are processed into biodegradable paper pots, recycled paper, liquid fertilizer, and RPF. The innovation for processing baby diapers was developed by BSB in collaboration with the Paper Center, The Ministry of Industry.
- Other non-organic waste items such as e-waste and used clothes, BSB collaborates with third party processors.
- For organic waste, BSB handles the processing of organic waste in-house by creating compost and developing Black Soldier Fly (BSF) cultivation.

BSB's activities have contributed significantly reduce the amount of waste going to landfills and prevented waste from being dumped into streams, which in turn helps our

landfills last longer. The activities carried out at BSB in waste management have gain a lot of attention of other local governments, not just those around Bandung but also places like Toba Regency in North Sumatra, Sorong Regency in Papua are interested to develop their own waste management system.

In addition to the achievements mentioned, BSB also carries out other initiatives that benefit the surrounding community. These include opening a minimarket where people can shop by paying with waste, holding events like affordable markets, organizing typical West Java market snacks and culinary, providing English language courses, and developing integrated farming.

Waste management system at BSB has received several awards and recognitions, including:

- 1st Winner of BASIC (Bank Sampah Innovation Competition) by PT Astra International Tbk.
- Best Waste Bank in Indonesia 2021 from the Ministry of Environment and Forestry
- One of the selected Innovators for the first Project Showcase by the Indonesia National Action Partnership (NPAP).
  Selected innovator in Plastic Waste to Value South-East Asean.
  Sabilulungan Award and 3 R independent-based waste management from Bandung Regent

4. Lesson learnt

- The economic benefits offered by this initiative are clearly a great way to attract community participation in waste management. BSB's experience is a prime example of how waste, originally considered worthless, can be transformed into an item with monetary value. Communities that collect segregated waste can deposit it at BSB to receive a savings balance or exchange it for goods that meet their needs.
- Education is a crucial factor in effective waste management. Beyond the economic benefits it brings to communities, improved waste management through education will also lead to a decrease in pollution, including reduced waste discharge into rivers, and contribute significantly to lessening marine pollution from land-based sources.
- Every household produces waste, making community involvement in waste management essential. This involvement is key to reducing waste at its source.
- Collaboration with 3rd parties who process waste-based products needs to be established. This type of partnership will help create a circular economy and ensure the sustainability of the waste bank.

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