Thailand National Ecosystem Assessment

Marine Biodiversity and Ecosystem Services

Summary for Policymakers

CHULA UNISEARCH

Disclaimer:

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Abbreviations

AI	Artificial Intelligence
BCG	Bio-Circular-Green Economy
BES-Net	Biodiversity and Ecosystem Services Network
B	Billion
CBD	Convention on Biological Diversity
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CSR	Corporate Social Responsibility
DDPM	Department of Disaster Prevention and Mitigation
DMCR	Department of Marine and Coastal Resources
DMF	Department of Mineral Fuels
DNP	Department of National Parks, Wildlife and Plant Conservation
DOF	Department of Fisheries
DPSIR	Driver-Pressure-State-Impact-Response
ECNEQ Act	Enhancement and Conservation of National Environmental Quality Act
EAFM	Ecosystem Approach to Fisheries Management
EBFM	Ecosystem-Based Fisheries Management
EEC	Eastern Economic Corridor
EHIA	Environmental and Health Impact Assessment
EIAs	Environmental Impact Assessments
EPAs	Environmental Protected Areas
EU-ETS	European Union Emissions Trading System
ES	Ecosystem Services
FPIC	Free, Prior, and Informed Consent
GDP	Gross Domestic Product
GISTDA	Geo-Informatics and Space Technology Development Agency
ICZM	Integrated Coastal Zone Management
ILK	ILK
IPBES	Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services
IUU	Illegal, Unreported and Unregulated
KMGBF	Kunming-Montreal Global Biodiversity Framework
LMMAs	Locally Managed Marine Areas
M	Million

M&E	Monitoring and Evaluation
Marine BES	Marine BES
MD	Marine Department
MIP	National Maritime Interests Protection Policy Committee
METT	Management Effectiveness Tracking Tool
MFF	Mangroves for the Future
MPA	Marine Protected Area
MOTS	Ministry of Tourism and Sports
MSP	Marine Spatial Planning
MSDHS	Ministry of Social Development and Human Security
NAP	National Adaptation Plan
NBSAP	National Biodiversity Strategy and Action Plan
NESDC	Office of the National Economic and Social Development Council
NESDP	National Economic and Social Development Plan
NEA	NEA
NMCRC	National Marine and Coastal Resources Management Policy and Plan
OA	Ocean Accounts
OECD	Organisation for Economic Co-operation and Development
OECMs	Other Effective Area-Based Conservation Measures
ONEP	Office of Natural Resources and Environmental Policy and Planning
PA	Protected Areas
PES	Payment for Ecosystems Services
PFC	Provincial Fisheries Committee
PPP	Public–Private Partnerships
SDGs	Sustainable Development Goals
SEEA	System of Environmental-Economic Accounting
SEA	Strategic Environmental Assessment
TDRI	Thailand Development Research Institute
TEV	Total Economic Value
TEU	Twenty-foot Equivalent Unit
THAI-MECC	Thai Maritime Enforcement Command Center
THB	Thai Baht
TRF	Thailand Research Fund
T	Trillion
UNEP	United Nations Environment Programme
WTTC	World Travel and Tourism Council

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1 | Introduction

Thailand is one of the most biodiversity-rich countries in Southeast Asia. There is a wide variety of ecosystem and habitats including tropical rainforests, mangrove forests, deciduous forests, mountain ecosystems, marine/coastal areas, inland wetlands, and dry/semi-humid zones. The Gulf of Thailand, Andaman Sea and their interactions with the watersheds and major river basins provide various productive ecosystems necessary for the well-being of the Thai people.

Thailand's marine ecosystems are among the nation's most valuable natural assets, underpinning biodiversity, economic prosperity, and societal well-being. Mangrove forests, seagrass beds, coral reefs, and estuaries provide essential services—from carbon sequestration and coastal protection to fisheries and tourism—and harbor endangered species like dugongs, sea turtles, and dolphins. In 2014, Thailand's ocean economy, built on these ecosystems, was valued at Thai Baht (THB) 24 Trillion (T), underscoring their immense contribution to national economic and ecological security.

Background and rationale

Despite the multiple values of Thailand's critical ecosystems, they are under threat: rapid development, population growth, climate change, and unsustainable use are degrading their health and resilience. For example, over 70% of seagrass beds are now in poor to fair condition, and coral reefs suffer from mass bleaching, pollution, and unmanaged tourism. If left unchecked, such degradation will undermine biodiversity and the services—food security, coastal protection, livelihoods—that people and the economy rely on. Recognising this urgent challenge, Thailand has embraced a science-policy-society approach to bridge knowledge and action.

The Thailand NEA (NEA) is a pioneering effort to synthesise knowledge on marine ecosystems and inform decisive policy responses. Its development started in 2021 with the financial and technical support of the NEA Initiative of UNEP-WCMC as part of the global Biodiversity and Ecosystem Services Network (BES-Net) initiative. Thailand's NEA also aligns with the country's commitments under the Convention on Biological Diversity (CBD), the Kunming–Montreal Global Biodiversity Framework (KMGBF), and the Sustainable Development Goals (SDGs). It comes at a critical time: as Thailand works to meet international biodiversity targets and climate objectives, the NEA provides the evidence base to guide action and fulfil those commitments for marine ecosystem components.

Thailand's NEA focuses on marine ecosystems, identified as national priorities during an inception process in 2020–2021. The Office of Natural Resources and Environmental Policy and Planning (ONEP) under the Ministry of Natural Resources and Environment (MNRE) led this effort, with Chula Unisearch, Chulalongkorn University as the technical lead, and a multi-agency Project Steering Committee providing high-level oversight of the development of the assessment. The rationale for the NEA is clear: marine biodiversity underpins Thailand's socio-economic fabric, but existing knowledge is fragmented and not fully integrated into policy. Previous environmental reports highlighted issues but often lacked clear policy guidance and failed to evaluate the effectiveness of responses. Consequently, they had limited impact on decision-making. The NEA was designed to address this gap by adopting a solution-oriented approach–not just cataloguing the state of nature but illuminating why it matters for Thailand's development and what can be done about it. By focusing on marine ecosystems—areas where climate change, coastal development, and resource-use conflicts are acute—the NEA serves as a timely tool to support Thailand's Blue Economy aspirations, its biodiversity conservation goals and climate adaptation needs. Its findings are intended to feed directly into national strategies (for instance, the Sixth and the Seventh National Biodiversity Strategy and Action Plan) and sectoral plans, ensuring that marine ecosystems receive priority in sustainable development planning.

Definition of Marine BES

In this report the term "Marine BES" means the ecosystem structure, functions and interactions which determine the state and condition of the marine ecosystems and their services in the coastal and offshore areas under national jurisdiction including the internal waters, the territorial sea, the contiguous zone and the exclusive economic zone (EEZ).

Methodology and Approach

Thailand's NEA was conducted through a participatory and policy-oriented assessment process designed to ensure scientific and informal knowledge credibility, stakeholder ownership, and relevance to national decision-making.

The assessment followed a four-stage process

1 Scoping
Identification of priority issues and policy questions through stakeholder consultations.

2 Expert Evaluation
Synthesis of scientific literature, national data, and ILK (ILK) by an interdisciplinary expert team.

3 Review and Approval
Peer review and validation by experts, government agencies, stakeholders, and the national steering committee of the NEA technical report and Summary for Policymakers; and by stakeholders through the national trialogue process.

4 Dissemination and Use of Assessment Findings
Communication of key findings to decision-makers and stakeholders and their uses in policy processes and decision-making.

Two conceptual frameworks guided the assessment

The IPBES conceptual framework was used to examine relationships between biodiversity, ecosystem services, and human well-being while weaving diverse knowledge systems, including scientific and local knowledge systems. The Driver-Pressure-State-Impact-Response (DPSIR) framework was applied to identify causal linkages between socio-economic drivers, environmental pressures, ecosystem conditions, impacts on society, and potential policy responses.

A central feature of the Thai NEA was its broad stakeholder engagement, including scientists, policymakers, civil society, private sector representatives, and coastal ethnic and local communities. Multi-stakeholder meetings called "Trialogues" facilitated dialogue between scientists, policymakers, and ILK holders, ensuring that the assessment findings reflect real-world conditions and policy and societal needs.

To support long-term planning, the Thai NEA also incorporated scenario analysis, exploring alternative futures for Thailand's marine and coastal ecosystems under different development and governance pathways to 2030 and 2050.

This participatory and inclusive approach strengthened the science-policy–society interface, ensuring that the assessment provides credible and actionable evidence for national policy processes and decision-making.

Objectives of the Thailand NEA

The Thailand NEA aims to strengthen evidence-based decision-making for marine ecosystems by addressing the following objectives:

1 **Assess the status and trends of ecosystems and their services:**
Evaluate the current condition, historical trends, and future outlook of Thailand's marine ecosystems and the ecosystem services that they provide to society.

2 **Identify Drivers and Pressures affecting ecosystems:**
Analyse the drivers of environmental change, including socio-economic development, governance challenges, and climate change.

3 **Assess the contributions of ecosystems to human well-being and the economy:**
Highlight the ecological, social, and economic importance of marine ecosystems for livelihoods, food security, coastal protection, and national development.

4 **Identify response options to enhance sustainability:**
Evaluate policy, governance, and management options that can reduce pressures, restore ecosystems, and ensure the sustainable use of marine resources.

5 **Explore future scenarios for nature and society:**
Assess possible future trajectories for ecosystems and human well-being under different development and policy pathways.

6 **Strengthen the science-policy-society interface:**
Support the establishment of a National Biodiversity Platform to improve knowledge exchange, monitoring, and integration of biodiversity evidence into policy and decision-making.

2 | Objectives of this Summary Report

The main report addresses the objectives stated above in detail. The purpose of this summary is to highlight the findings with special emphasis on policy implications. In each section a main policy question is stated with key messages and the resulting recommendations.

The Level of Confidence

Four specific confidence terms have been developed by IPBES (IPBES (2018) The IPBES Guide on the Production of Assessments https://bit.ly/2wCfQHB). For Thailand, the lead authors used these confidence terms to communicate how assured they were about their key findings:

1	**Well established:** The highest level of confidence. Findings have significant, robust evidence with high levels of agreement.
2	**Established but incomplete:** There is general agreement on the conclusions, but the available evidence is limited.
3	**Unresolved:** There is a lot of evidence or data, but their conclusions do not agree and expert agreement remains low.
4	**Inconclusive:** Limited or no evidence and very little agreement among available data.

Overall Policy Recommendation

Policy Question 1:

How can Thailand strengthen integration across ecosystem assessments to better link biodiversity, ecosystem services, and human well-being?

Key Message 1: Thailand has established a strong foundation for marine ecosystem assessment, but current approaches remain fragmented and insufficiently integrated. *(Well established)*

While institutionalise assessments have improved data availability and consistency, they tend to focus on selected ecosystems and biophysical indicators, with limited integration of ecosystem services, socio-economic dimensions, and cross-ecosystem interactions.

Recommendation: Key Message 1

Strengthen future assessments by adopting integrated, ecosystem-based approaches that link biodiversity, ecosystem services, and human well-being across spatial and sectoral scales.

Policy Question 2:

What mechanisms are needed to ensure that science-based assessments inform effective policy and implementation?

Key Message 2: Bridging the science-policy interface is essential to ensure that assessment findings translate into effective policy and action. *(Well established)*

Past assessments have often lacked clear pathways for policy uptake, resulting in a disconnect between knowledge generation and decision-making.

Recommendation: Key Message 2

Institutionalize mechanisms—such as a National Biodiversity Platform—to facilitate continuous dialogue between scientists, policymakers, and stakeholders, and to ensure that NEA findings are systematically integrated into national and subnational planning processes.

Policy Question 3:

How can Thailand improve data systems and research to close critical knowledge gaps and guide informed decisions?

Key Message 3: Addressing knowledge gaps requires strengthening monitoring systems, data integration, and interdisciplinary research. *(Well established)*

Significant gaps remain in temporal and spatial data, understanding of Drivers and Pressures, and valuation of ecosystem services, particularly for underrepresented ecosystems such as mudflats, sandy beaches, and offshore habitats.

Recommendation: Key Message 3

Enhance national monitoring systems through coordinated data-sharing platforms, expanded coverage of ecosystems, and the use of innovative approaches such as remote sensing, citizen science, and ecosystem accounting.

Policy Question 4:

How can ILK be integrated into national assessment and decision-making processes in a respectful and effective way?

Key Message 4: Recognising and integrating ILK is critical for inclusive and effective ecosystem management. *(Well established)*

ILK provides valuable insights into ecological change, resource use, and sustainable practices, yet has been underrepresented in formal assessments.

Recommendation: Key Message 4

Develop participatory mechanisms to incorporate ILK into monitoring, assessment, and decision-making processes, while respecting the cultural, social, and institutional context of Thailand.

Policy Question 5:

How can Thailand align its Blue Economy goals with ecosystem integrity and long-term sustainability?

Key Message 5: Transitioning towards a sustainable and inclusive Blue Economy requires aligning economic development with ecosystem integrity. *(Established but incomplete)*

Current development pathways place increasing pressure on marine ecosystems, threatening their ability to sustain long-term economic and social benefits.

Recommendation: Key Message 5

Promote a sustainability-oriented blue economy that integrates ecosystem service values into planning and investment decisions, encourages private sector engagement, and supports nature-positive pathways.

Policy Question 6:

What tools and approaches can help Thailand anticipate and manage risks and trade-offs in an uncertain future?

Key Message 6: Future planning must consider uncertainty, trade-offs, and long-term scenarios to enhance resilience. *(Well established)*

Marine and coastal ecosystems are subject to multiple interacting pressures, including climate change, requiring forward-looking and adaptive approaches.

Recommendation: Key Message 6

Utilise scenario analysis and integrated planning tools—such as marine spatial planning and climate adaptation strategies—to guide decision-making under uncertainty and support resilient development pathways.

Policy Question 7:

How can the NEA process support Thailand's global commitments and national policy coherence on biodiversity and climate?

Key Message 7: The NEA provides a critical opportunity to strengthen Thailand's contribution to global biodiversity and sustainability agendas. *(Well established)*

By aligning with the KMGBF, SDGs, and climate commitments, the NEA can serve as a key evidence base for national and international reporting.

Recommendation: Key Message 7

Ensure that NEA outputs—particularly the Summary for Policymakers—are actively used to inform NBSAP implementation, national reporting, and cross-sectoral policy coherence.

3 | Status and Trends of Marine BES

Assessing existing knowledge of Thailand's Marine BES, defined here as marine and coastal biodiversity and ecosystem services, is crucial for identifying and comprehending current scientific understanding and ILK, assessing gaps and uncertainties, and evaluating trends over time. Knowing such information is crucial for generating evidence-based insights to inform decision-making and future policy development.

Total Area **323,488** km²

Gulf of Thailand	Andaman Sea
202,676 km²	120,812 km²

Key ecosystems

Mangrove forests
(~ 2,780 km²)

Harboring diverse terrestrial and marine flora and fauna while providing essential and nursery grounds, coastal protection and serving as a vital carbon sink.

Seagrass beds
(~ 257 km²)

Serving as vital nursery grounds and habitats for diverse marine life, particularly dugong, while also acting as a critical carbon sink.

Coral reefs
(~ 238 km²)

Providing a vital sanctuary for diverse marine life and serving as diving destinations that drive both local and national economic growth.

Figure 1: Thailand's marine biodiversity and ecosystems

In addition to mangrove forests, seagrass beds and coral reefs, other marine ecosystems include sandy beach ecosystems, coastal lagoons and estuaries, and offshore marine environments. Each of these ecosystems plays a vital role in supporting biodiversity and providing essential ecosystem services that benefit both coastal communities and the national economy.

THAILAND'S MARINE BIODIVERSITY

With a coastline of approximately 3,148 km, stretching along the Gulf of Thailand to the east and the Andaman Sea to the west and its marine area of about 320,000 km² Thailand's marine biodiversity is among the richest in Southeast Asia due to its long coastline and location between the Andaman Sea and the Gulf of Thailand, supporting a wide variety of marine animals and plants across coastal and offshore ecosystems.

Marine mammals

Whales and dolphins
27 species

Dugong
1 species

Mammals in mangroves
39 species

Marine reptiles

Sea turtles
5 species

Sea snakes
More than
20 species

Reptiles in mangroves
More than
25 species

Marine fish

More than
1,400 species

241-983 species of reef associated fish

Marine birds

More than
280 species

Water birds, forest birds, shore birds, and sea birds

Marine Arthropods

More than **2,295** species

- **1,505** species
- **247** species
- **181** species
- **150** species
- **84** species
- **43** species
- **36** species

Figure 2: Overview of species diversity of marine mammals, reptiles, birds, fish, and arthropods in Thai waters

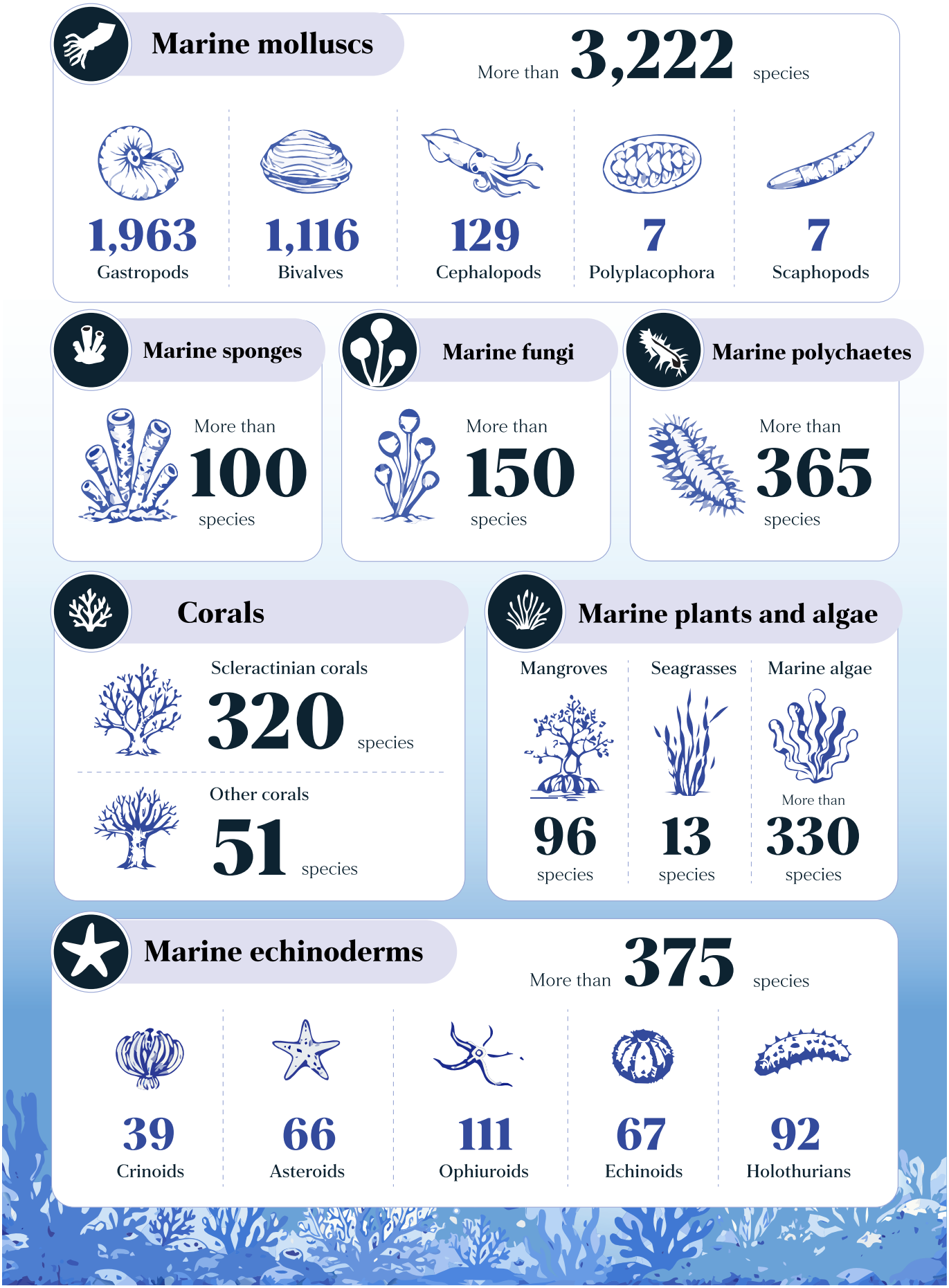

Figure 3: Overview of species diversity of marine molluscs, sponges, fungi, polychaetes, corals, echinoderms, plants and algae, in Thai waters

Policy Question 8:

What are the status and trends of Marine BES, and how are they linked to ecosystem services and human well-being?

Key Message 8 (a): Major marine ecosystems have degraded over the past decades. *(Well established)*

Thailand has various marine and coastal ecosystems including mangrove forests, seagrass beds, coral reefs, and other ecosystems such as beach ecosystems, coastal lagoons and offshore ecosystems, which play vital roles in maintaining marine biodiversity and providing essential ecosystem services. However, major marine and coastal ecosystems have experienced significant declines over recent decades due to anthropogenic activities and climate change.

Table 1: Status and trends of marine biodiversity

Ecosystems	Current status		Trends		Major drivers
	Extent	Condition	Extent	Condition	
Key marine ecosystems					
Mangrove forests	2,780 km2 of pristine mangroves (Year 2020)	No long-term monitoring and its impact data available	Increase in coverage of mangrove forests	No long-term monitoring and its impact data available	Discrepancies between different resolution satellite imagery; drivers such as climate change, coastal development, encroachment, inappropriate restoration practices, but also restoration achievements
Seagrass beds	257 km2 of potential area for seagrass beds (Year 2020)	In 2024, only 17% of healthy seagrass beds was found	No long-term change data of potential areas for seagrass beds available	Decrease in percentage of healthy seagrass beds since 2010	Sedimentation, climate change, dredging, pollution, destructive fishing practices
Coral reefs	238.7 km2 (Year 2018)	In 2024 51% was in healthy condition, 29% and 24% was in fair condition, and damaged condition, representatively	No long-term change data of coral reef areas available	Increase in percentage of healthy reefs after the 2010 bleaching event	Climate change, unsustainable tourism, coastal development, pollution, destructive fishing practices
Other ecosystems					
Beach ecosystems	Lengths of muddy, sandy and rocky beaches are 1,020.62 km, 1630.75 km, and 3261.1 km, respectively (Year 2024)	No long-term monitoring data available	Decrease in shorelines without coastal erosion and equilibrium shorelines	No long-term monitoring data available	Climate change, coastal erosion, urbanisation, coastal development, pollution, unsustainable tourism
Coastal lagoons	No long-term monitoring data available	Habitat degradation, degradation in water quality	No long-term monitoring data available	Water quality and habitat quality	Urbanisation, coastal development, land-based pollution

Recommendations: Key Message 8 (a)

8.1 Promote the conservation and sustainable use of Marine BES by establishing integrated Marine Spatial Planning (MSP) approaches, strengthening area-based conservation measures (e.g., Marine Protected Areas (MPAs), Other Effective Area-Based Conservation Measures (OECMs), and Locally Managed Marine Areas (LMMAs)), and applying an Ecosystem Approach to Fisheries Management (EAFM). These efforts should be aligned with tourism management based on ecological carrying capacity to maintain the integrity of ecosystem structures, functions, and services.

8.2 Scale up and sustain ecosystem restoration efforts to reverse degradation of marine ecosystems and habitats. Restoration initiatives should aim not only to recover ecosystem structure, but also to restore key ecological functions and the services they provide.

8.3 Reduce land-based and sea-based pollution, particularly nutrient runoff, wastewater discharge, plastics, and marine debris, to mitigate impacts on marine ecosystems. Climate mitigation and adaptation should also be integrated into marine policy, with a focus on protecting and restoring blue carbon ecosystems to enhance carbon sequestration and contribute to climate resilience.

8.4 Strengthen monitoring and data systems to support adaptive management, enabling policymakers to adjust strategies in response to emerging ecological trends, risks, and uncertainties in a timely manner.

8.5 Enhance governance, coordination, and sustainable financing mechanisms by strengthening inter-agency coordination, which is essential to align policies across sectors and levels of government. Also, innovative financial and economic instruments are needed to ensure the long-term sustainability of conservation efforts.

Key Message 8 (b): Declining marine and coastal biodiversity and ecosystem degradation over the past decades have inevitably reduced ecosystem service quality. *(Established but incomplete)*

Marine ecosystems provide valuable and diverse types of goods and services to humans, categorised into provisioning, regulating, supporting, and cultural services, and these are directly linked to human well-being. Despite the significant contributions of marine ecosystem services, they remain insufficiently studied. Given the strong linkages between ecosystems and the quality of their services, marine biodiversity and ecosystem degradation over the past decades has inevitably reduced ecosystem service quality.

Table 2: Classification of marine and ecosystem services

Ecosystem Services	Intermediate Services	Final Services	Goods/Benefits
Provisioning	Similar to those listed in supporting services (e.g. primary production, larval & gamete supply, nutrient cycling, water cycling, formation of habitats for species)	• Fisheries resources supply • Algae & seaweed supply • Ornamental materials • Genetic resources supply • Water supply	• Seafood (wild, farmed), e.g. animals and seaweed • Fish feed from trash/bait fish • Biofuels, e.g. biodiesel from marine fungi • Sea salt production • Ornaments & aquaria • Medicines & blue biotechnology, e.g. bioactive compounds extracted from brown algae, microalgae, marine bacteria, ascidian, sea cucumber, sponge. • Genetic materials
Regulating	• Biological control • Natural hazard regulation • Waste breakdown and detoxification • Carbon sequestration	• Climate regulation • Natural hazard protection • Wastewater treatment & sedimentation control	• Healthy climate and clean water • Prevention of coastal erosion • Coastal protection by mangroves and beach forests • Wave attenuation by coral reefs • Waste burial / removal/ Neutralisation in mangroves and seagrass beds
Cultural	Similar to those listed in supporting services, particularly formation of the habitats for species and formation of seascape	Seascapes and landscapes	• Tourism and recreation, e.g. diving, sailing, beach recreation, whale/whale shark watching, bird watching, recreational fishing, walking along mangrove trail • Spiritual and cultural well-being e.g. religious places or shrines that are respected by local people • Education and research • Local knowledge and experience • Mental health benefits
Supporting	• Primary production • Larval & gamete supply • Nutrient cycling • Water cycling • Formation of habitats for species physical barriers; seascape/landscape • Gene pool protection	Similar to those listed in final services and goods/benefits of provisioning, regulating, and cultural services.	

Recommendations: Key Message 8 (b)

8.6 Strengthen understanding and recognition of marine ecosystem services by developing and applying ecosystem service valuation frameworks to quantify the economic, social, and ecological value of marine ecosystem services using recognised approaches (e.g., natural capital accounting, System of Environmental-Economic Accounting (SEEA) and ocean accounts).

8.7 Mainstream ecosystem services into national policy and planning to ensure long-term economic stability and the sustainability of ecosystem assets, by integrating ecosystem service valuation into national accounting and Environmental Impact Assessments (EIA) and policy making process, which allows policymakers to comprehend the true cost of environmental degradation.

8.8 Protect and restore high-value ecosystem service areas as well as reduce threats influencing the quality of ecosystem services, ensuring the delivery of ecosystem servicesensuring the continued delivery of ecosystem services, without being degraded by anthropogenic and natural threats.

8.9 Mainstream nature-based solutions (NbS) as cost-effective, resilient alternatives to hard infrastructure in climate adaptation and disaster risk reduction strategies, delivering multiple co-benefits, including coastal protection, biodiversity conservation, carbon sequestration, and enhanced livelihoods.

8.10 Strengthen monitoring of marine ecosystem services by investing in long-term socio-ecological research to provide decision-makers with evidence needed for adaptive management, ensuring that policy remains responsive to environmental shifts.

Key Message 8 (c): Empirical evidence clearly indicates declining marine and coastal environmental quality. *(Well established)*

Available empirical evidence indicates that marine environmental quality in Thailand has deteriorated over recent decades. This decline is reflected in the increased frequency and severity of environmental pressures, including biological invasions, deteriorating water quality, marine debris, coral bleaching, coastal erosion, oil spills, eutrophication, and overfishing.

Table 3: Status and trend of some marine environmental quality issues

Marine environmental quality	Current status	Trends	Major drivers
Biological invasion	Invasive marine species in Thailand's waters such as black stripped mussel *(Mytilopsis adamsi)*, golf ball sponge *(jetiila japonica)*, ascidian *(Esteinascidia thurstoni)*, Blackchin tilapia *(sarotherodon melanotheron)*	No long-term monitoring and impact data available	Marine transportation and trade of marine species
Water pollution	The water quality at most monitoring stations met the water quality standards	Although overall water quality met the standards, water quality in areas with intensive human activities remains poor	Agricultural runoff, discharges of untreated wastewater from urban, touristic areas, industries etc.
Marine debris	The quantity of debris collected at the mouths of five major rivers discharging into the Upper Gulf of Thailand from 2017 to 2024 was a total of 65,560,273 pieces per year of floating debris (weighing 646 tons per year)	River debris collection has declined, yet large amounts of debris still enter the sea, leading to increased marine species strandings caused by marine debris	Land-based pollution, coastal and recreational activities, fishing and navigation activities
Coastal erosion	Thailand loses approximately 30 square kilometers of coastline annually due to erosion	Decrease in length of shorelines without coastal erosion and equilibrium shorelines	Climate change, land subsidence, unsustainable coastal development, inappropriate protection measures
Oil spills	In 2024, 24 oil spills and tar balls were reported, mostly found in Chonburi Province	Increase in the occurrence of oil spills from 2017 to 2023	Maritime accidents, industrial discharge, and operational mistakes in oil extraction and transport
Eutrophication	Thailand recorded 49 red tides in 2024	Increase in the occurrence of red tides from 2014 to 2023	Agricultural runoff, urban wastewater, and industrial discharges
Coral bleaching	In 2024, anomalous sea surface temperature caused coral bleaching in both the Gulf of Thailand and the Andaman Sea	Increasing frequency of bleaching events	Climate change, rapid change in water salinity
Overfishing	Wild catch totaled 1.4 million tons in 2024	50% decline in total wild catch compared to that reported in 1995	Overexploitation, destructive fishing practices, habitat change, climate change

Recommendations: Key Message 8 (c)

8.11 Improve governance and policy coherence and strengthen cross-sector coordination to address the cumulative and synergistic impacts by focusing integrated land-sea management approaches, including watershed, coastal and marine environment to address upstream drivers such as nutrient runoff, sedimentation and pollution.

8.12 Enhance pollution management and enforcement, then particularly wastewater, solid waste, and marine debris, by implementing a combination of polluter pay principles, regulatory tools and economic incentives for circular economy and sustainable consumption.

8.13 Apply ecosystem-based fisheries management (EBFM) to promote sustainable fisheries along with maintaining overall functional integrity of the marine environment and fisheries resources such as eliminating IUU fishing, and strengthening effective surveillance and enforcement while promoting co-management schemes.

8.14 Promote sustainable marine tourism by applying existing concepts such as sustainable tourism, regenerative tourism and net-zero tourism as drivers of conservation, reduced impact and fulfilling tourist experiences.

8.15 Restore degraded ecosystems and environment through passive and active restoration approaches by removing local threats and stressors, and implementing active restoration activities such as mangrove plantation, seagrass transplantation, and coral reef restoration.

8.16 Strengthen an integrated system that combines monitoring and citizen science to support effective emergency response and adaptive management. This may include investing in real-time data systems, standardised indicators, and early warning tools for unprecedented events, while building local capacity in monitoring, compliance and local stewardship.

Policy Question 9:

What are the knowledge gaps, and how can these gaps be addressed to better understand nature's contributions to people, enhance resilient social ecological systems, and enable nature-based solutions?

Key Message 9: Despite progress made in research, monitoring and assessment, significant knowledge gaps remain to support evidence-based policymaking. *(Well established)*

Based on the assessment of existing knowledge on Thailand's Marine BES, four major gaps have been identified. These gaps limit the effective conservation, sustainable management, and evidence-based decision-making as well as policy integration of marine resources.

Biodiversity information gaps:

The availability and accuracy of data on the extent of marine ecosystems remain limited and inconsistent, for example, extent of coral reefs, actual extent of seagrass beds, key biodiversity areas located offshore. The lack of consistent, long-term monitoring restricts understanding of ecosystem health, cumulative impacts, and the effectiveness of conservation and restoration measures, making it difficult to establish effective ecosystem management. Thailand also lacks comprehensive baseline data on marine biodiversity, including unrecorded species, ecosystem connectivity, genetic diversity and ecological roles of species. In addition, data on trophic interactions, ecosystem resilience, and species vulnerability to climate change is limited, constraining the ability to assess ecological change, human impacts, and conservation effectiveness as well as climate change adaptative capacity.

Socio-economic and ecosystem services knowledge:

Information on the socio-economic value as well as cultural values of marine ecosystems and their services is insufficient. Ecosystem services are rarely quantified or integrated into planning, leading to undervaluation and overexploitation. There is weak integration of ecological and socio-economic data, including limited use of international accounting frameworks. This limits the understanding of the linkages between ecosystems and human well-being, therefore leading to ineffective, non-evidence-based marine resource management.

Understanding of anthropogenic and natural Drivers and Pressures:

The cumulative and synergistic effects of multiple stressors such as pollution, tourism and fishing practices, and climate change, as well as land-sea interactions are not well understood. Gaps remain in identifying sources and pathways, types and magnitude of impacts, making it difficult to fully understand cumulative and synergistic impacts, localised climate change vulnerability, and long-term ecological impacts.

Ecosystem monitoring and restoration challenges:

There is a significant lack of standardised methods and robust indicators for ecosystem monitoring and restoration, which affects effective assessment and long-term management of marine ecosystems. Currently, various institutions employ different methodologies for collecting data, analysing ecosystem health, and evaluating restoration outcomes. This inconsistency makes it difficult to compare results across locations or over time and prevents the establishment of a unified national or regional baseline. Public and community participation in monitoring and restoration is still limited. Stronger standardisation coordinated protocols, and inclusive engagement mechanisms are needed to support effective marine conservation and restoration.

Recommendations: Key Message 9

9.1 Promote and support research to close critical data gaps in biodiversity, ecosystems, and ecosystem services as well as interdisciplinary approaches that link ecological conditions with socio-economic dimensions and integrate ILK.

9.2 Advance understanding of cumulative and synergistic impacts by developing frameworks and models to assess the combined effects of multiple stressors, including pollution, overfishing, tourism, and climate change. Strengthen land–sea integration to identify vulnerability hotspots and enable proactive management interventions.

9.3 Establish a national long-term marine monitoring program and knowledge integration system with standardised indicators, methodologies, and advanced technologies (e.g., eDNA,remote sensing and AI). This system should track ecological changes, distinguish natural variability from human impacts, assess restoration progress, and support adaptive management. It should also address data fragmentation by enabling cross-sector collaboration and data-sharing.

9.4 Build institutional and technical capacity while promoting community and citizen science participation. Provide adequate resources and training for central and local authorities, as well as stakeholders. Ensure sustained investment through national budgets and innovative financing mechanisms to support long-term monitoring and close knowledge gaps.

9.5 Strengthen science-policy interfaces by integrating biodiversity, ecosystem service values, and knowledge of cumulative and synergistic impacts, and ILK into economic and policy frameworks, thereby supporting evidence-based policy formulation and decision-making.

Policy Question 10:

How can Thailand improve its monitoring and assessment systems to address knowledge gaps in Marine BES?

Key Message 10: Improvement of monitoring and assessment is needed to close existing knowledge gaps. *(Well established)*

While the decline of Marine BES is well-documented, effective responses are often ineffective due to the existence of knowledge gaps e.g. insufficient and fragmented data, inconsistent monitoring frameworks. Closing these knowledge gaps requires an improvement of monitoring frameworks towards a more robust, integrated approach to data collection that integrates diverse knowledge systems. This enhanced evidence-based approach is critical for science-based policy making, ensuring that conservation strategies are not only informed by the best available data but are also adaptive enough to support the long-term health of the ecosystem services.

Recommendations: Key Message 10

To enhance understanding of the current status and long-term trends of Marine BES the following recommendations are proposed to address existing data gaps, improve the consistency and quality of monitoring, strengthen the integration of scientific and local knowledge, and support evidence-based management and conservation planning:

10.1 Developing national biodiversity monitoring protocols to enhance the effectiveness of monitoring. It is essential to improve indicators to comprehensively capture biodiversity status and trends, including genetic diversity, ecosystem services, and socio-economic dimensions. This requires the standardisation of data collection methodologies to ensure consistency, continuity, and comparability across time and regions. Furthermore, monitoring protocols should align with internationally recognised frameworks such as the IPBES Conceptual Framework and the KMGBF. Additionally, the integration of biophysical and socio-economic information in line with international frameworks, particularly the SEEA, Ocean Accounts (OA), and MSP, should be developed.

10.2 Expanding assessments beyond coastal zones to strengthen research and understanding on ecologically important offshore ecosystems, including underwater pinnacles, offshore platforms, and pelagic and benthic zones. This expansion should promote comprehensive studies of ecological dynamics, species interactions, ecological connectivity, and the impacts of human activities such as fishing, shipping, and resource extraction.

10.3 Integrating anthropogenic and natural Drivers and Pressures to comprehensively understand ecosystem changes and support evidence-based decision-making. Biodiversity assessments, through collaborative efforts among government agencies, academic institutions, NGOs, local communities, etc., should integrate both anthropogenic and natural drivers to understand combined impacts on marine biodiversity and ecosystems as well as land-sea interactions and ecological interconnectedness, particularly the influence of upstream land-use change, deforestation, agricultural runoff, and urban development on marine ecosystems and the delivery of ecosystem services. Assessments should also incorporate climate change vulnerability and resilience metrics, including projections of climate-related phenomena such as sea-level rise, increasing sea surface temperatures, and ocean acidification, as well as their impacts on species, habitats, and coastal communities.

10.4 Leveraging cutting-edge technology and participatory monitoring approaches to enhance data collection and to support effective ecosystem monitoring systems through applying innovative technologies such as remote sensing, GIS technology, AI technologies, molecular tools (e.g., environmental DNA), and stable isotope analysis. The inclusion of citizen science, ILK and community engagement should be integrated in participatory monitoring and surveillance to strengthen monitoring efforts and foster stewardship, enhancing local ownership and capacity as well as their environmental awareness. Additionally, Indigenous and local monitoring tools and scientific information could help enrich evidence-based decision making, build common understanding, and promote more effective communication among stakeholders, ultimately leading to more inclusive and robust ecosystem management.

4 | Drivers, Pressures and Impacts

The DPSIR framework has been systematically applied to analyse the driving forces and pressures affecting changes in Marine BES. This approach provides a structured understanding of the causal chain, linking, for example,socio-economic development (Drivers) to human activities (Pressures), and subsequently to changes in environmental conditions (State) and their ecological and socio-economic impacts.

Importantly, many of the identified Drivers and Pressures—such as coastal infrastructure development, land-use change, and economic expansion—originate from sectors and agencies beyond the direct mandate of the Department of Marine and Coastal Resources (DMCR). As a result, the degradation of marine and coastal resources, including coastal erosion, cannot be effectively addressed by a single agency alone.

By clearly identifying these upstream Drivers and Pressures, the DPSIR analysis serves as a critical tool to inform cross-sectoral policy integration and coordination. It enables relevant agencies to recognise their roles in contributing to environmental change and to incorporate preventive measures into their respective policies, plans, and development pathways. This is essential to avoid or minimise adverse impacts on marine ecosystems and biodiversity at the source, thereby ensuring more effective and sustainable management outcomes.

This approach highlights that addressing marine and coastal degradation is not solely an environmental management issue, but a cross-sectoral governance challenge that requires shared responsibility and policy coherence across multiple sectors.

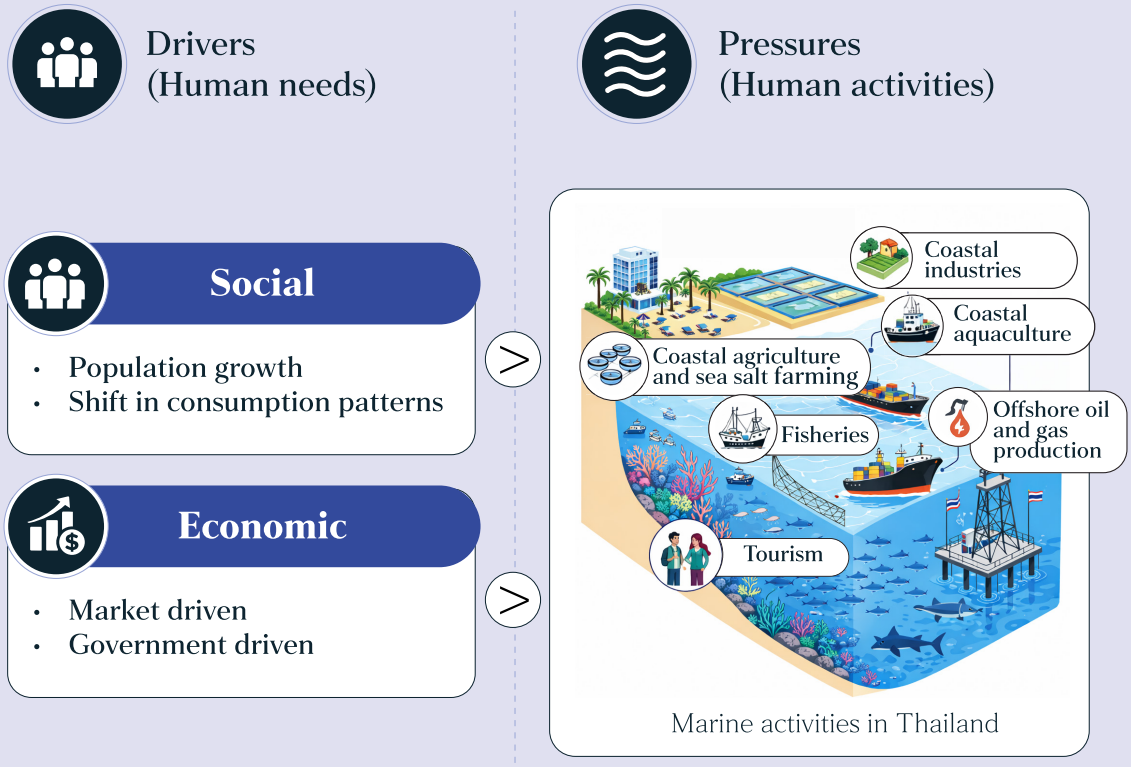

Figure 4: The social and economic forces driving human activities that generate pressures on Marine BES

Policy Question 11:

What are the Drivers and Pressures which affect Marine BES?

Key Message 11 (a): A combination of both government and market-driven forces are key drivers of change affecting Marine BES. *(Established but incomplete)*

Social Drivers: Thailand's population has remained relatively stable over the past decade, with a demographic shift toward an aging society. This population trend, which includes rapid aging and a declining workforce, has influenced patterns of economic activities. In particular, the declining working-age population, who mainly work in the fisheries and service sectors, has caused increased migration of both Thai and foreign workers. Although the population is quite stable, a shift in consumption patterns have led to greater resource consumption. The unsustainable resource uses and inadequate central waste treatment system have caused land use changes, resource degradation and higher levels of pollution, and ultimately threaten Marine BES.

Economic Drivers: The expansion of tourism, fisheries and aquaculture, coastal industries and urbanisation have been evident in Thailand's 23 coastal provinces. The contribution of the Coastal Economy (Gross Provincial Products of coastal provinces) constituted up to one-third of the national GDP (approximately 30%) (NESDC, 2022). This expansion is being driven by consumer demand and market supply, particularly in the rapidly growing sectors of coastal tourism, fisheries and aquaculture, and maritime transport. The continued expansion of these activities will generate considerable pressure on Marine BES.

Despite being guided by the principles of sustainable development (incorporated in the 20-Year National Strategy, the 13th National Economic and Social Development Plan (NESDP), and environmental plans), the country's development in recent years has led to increased pressures on Marine BES. A notable example is the visa-free policy, which has resulted in an increase in the number of coastal tourists and marine-based tourism activities. Research by the World Travel and Tourism Council (WTTC) indicates that coastal tourism is a high-impact sector with a substantial environmental footprint and is closely associated with ecosystem degradation when not properly managed (Iberostar group, 2025)

An example of a market driven force is the increasing prices for durian. Information provided by local people during the Trat field trip for the NEA, confirmed that steep sloping lands in coastal areas have been converted into durian orchards. This has led to greater sediment and chemical runoff into the sea. According to the "ridge-to-reef" approach, such runoff is a major factor contributing to the degradation of coral reefs and seagrass meadows in many regions worldwide (Carlson RR., et al, 2019).

Furthermore, the Eastern Economic Corridor (EEC) initiated in 2017, although based on the Bio-Circular-Green (BCG) model, continues to intensify coastal land use. Effective management is required to prevent and mitigate pollution, shoreline erosion, and resource-use conflicts. The World Bank has identified these trends as key factors contributing to the increasing pressures faced by Thailand's coastal ecosystems (World Bank, 2025).

Natural Drivers Thailand contributes less than 1% of total global GHG (GHG) emissions, with total emissions measuring approximately 422.4 million tons of CO_2 equivalent in 2024. GHG emissions have been dominated by the energy and transport sectors, with additional contributions from agriculture. Despite the low emission, Thailand is highly vulnerable to climate change. Climate risks have been driven by a combination of geographic exposure and human-induced pressures, particularly rapid urbanisation, infrastructure expansion, and steadily increasing GHG emissions. The country has been exposed to more frequent extreme weather events such as floods, droughts, storms, and landslides. These drivers amplify climate stressors including sea-level rise, higher sea surface temperatures, and ocean acidification, accelerating coral bleaching, disrupting marine food webs, and undermining fisheries, coastal livelihoods, food security, tourism, and disaster risk reduction.

Recommendations: Key Message 11(a)

11.1 Promote use of the DPSIR Framework. Encourage economic agencies, including the National Economic and Social Development Council (NESDC), to adopt the DPSIR framework to effectively identify key drivers, address the root causes of Marine BES-related problems, and formulate appropriate policy responses.

11.2 NESDC should develop more indicators that effectively monitor and evaluate Drivers and Pressures in order to support the development of policy responses for the sustainable uses of marine resources and conservation of Marine BES.

Key Message 11 (b): Pressures on Marine BES come from economic sectors that generate the major share of national revenue, particularly coastal land-use changes driven by tourism, fisheries, shipping, and coastal industries. *(Established but incomplete)*

Pressures are human activities that affect Marine BES, and there are diverse human activities that involve intensive use of marine resources. Key activities include tourism, ports, and shipping, fisheries and aquaculture, and offshore oil and gas. Additionally, emerging activities such as desalination and renewable energy generation provide the opportunity for future Blue Economy development.

Tourism is the economic sector that contributes the most to GDP. In 2024, marine tourism constitutes nearly half of the tourism revenue, with 128 million tourists, representing approximately 36% of all tourist arrivals. Cruise tourism has also become popular; the number of cruise trips has increased from 133 in 2023 to 162 in 2024. The primary terminals serving these vessels are Patong Bay in Phuket and Laem Chabang Port in Chonburi.

Tourism growth beyond the environmental carrying capacity—together with insufficiently regulated cruise ship activities—has intensified multiple pressures on marine ecosystems, including physical damage, pollution, resource overuse, and biological invasions collectively accelerating marine ecosystem degradation.

Fisheries and coastal aquaculture, despite declining in production volume have increased in economic value, especially production from shrimp farming. The volume of marine capture landed by commercial fishing vessels declined from 1,177,368 tons (THB 55,787 M) in 2016 to 1,029,061 tons (THB 40,539 M) in 2021, followed by a slight rebound to 1,071,506 tons in 2023 (THB 43,671 M). Small-scale fisheries are vital for food security and provide livelihoods for millions, contributing 20.7% of total fish production (2023) (DMCR, 2024; DOF, 2024a; DOF, 2021). The composition of production from marine capture in 2023 shows that food fish accounted for the largest proportion (57%). This was followed by bycatch (27%), shrimp and crab (7%), squid and shellfish (8%), and other species such as jellyfish (1%) (DOF, 2024a).

Coastal aquaculture production has increased over time, largely as a response to the decline in marine fisheries production. During 1977–1986, this shift towards aquaculture was further reinforced by policy interventions implemented by the Department of Fisheries (DOF). In 2023, white-leg shrimp farming accounted for the largest share across all dimension, including production area (216.91 km^2), production volume (392,544 tons), and economic value (THB 57.44 B). This is followed by marine finfish farming, with a covering area of 18.2 km^2, production volume of 55,734 tons, and a value of THB 5.74 B (DOF, 2024a).

While coastal aquaculture plays an increasingly important role in enhancing seafood supply and easing pressure on capture fisheries, its rapid expansion has also raised environmental concerns such as pollution, land-use changes and invasive alien species, that require stronger management and regulatory frameworks to ensure sustainable development and protect marine ecosystems and coastal communities.

Maritime shipping and port operations play a vital role in trade and the national economy. Among the major ports (Bangkok, Laem Chabang, and Map Ta Phut), Laem Chabang Port is the primary hub for national import-export activities, with 11,692 vessel calls in 2023, a total cargo throughput of 94.10 million metric tons (MT) and 8.676 million Twenty-foot Equivalent Unit (TEU)[1] of container traffic (PAT, 2024). The expansion of maritime transport has intensified environmental pressures through coastal habitat loss, pollution from port operations and shipping activities, and the risk of chemical contamination, posing significant threats to marine ecosystems and potentially to human health.

[1] Twenty-foot Equivalent Unit (TEU) is a standard, non-physical unit of measurement used in shipping and logistics to express the cargo capacity of ships, ports, and trucks. It is based on the volume of a standard. It is based on the volume of a standard long 20-feet long intermodal container.

Coastal industries have expanded substantially across all 23 coastal provinces, particularly in the EEC, where both the number of factories and the total investment value have continued to increase. In the coastal agricultural sector, the primary activities include rice cultivation, fruit orchards, and forestry. Recently, however, concerns have emerged regarding the rapid expansion of durian plantations in coastal zones, which require large quantities of freshwater and agrochemicals, posing potential risks to coastal water quality.

Urbanisation and the construction of coastal protection infrastructure have further contributed to the degradation of natural ecosystems. Additionally, salt farming represents a significant coastal agricultural activity and remains an important land-use type in coastal areas. Thailand has approximately 27.99 km^2 of sea salt farming distributed across seven provinces, with Samut Sakhon (42.0%) and Phetchaburi (41.8%) serving as the primary production areas (DOAE, 2024). Although the total production area has decreased, salt production has shown an upward trend, reflecting improved productivity driven by the adoption of new technologies. Nevertheless, salt farming remains a land-use pressure that requires sustainable management to maintain ecological balance within coastal ecosystems.

Offshore oil and gas production remains a major activity in the Gulf of Thailand, with over 416 petroleum installations currently in operation and the Tantawan–Benjamas field producing more than 4.3 million barrels of crude oil in 2022 (DMF, 2022). Although environmental safeguards are in place, the sector continues to pose risks of oil spills from drilling, oil transfer, vessel discharge, and illegal dumping leading to water quality degradation, contamination of marine organisms, and oxygen depletion. In addition, 58 decommissioned installations (DMF, 2024) present new challenges, as many structures have existed long enough to form novel ecosystems that support marine biodiversity. While retaining some structures in place could provide conservation benefits, decommissioning activities themselves generate ecological pressures, including sediment disturbance that affects benthic habitats, underwater noise pollution, and GHG emissions. Collectively, these factors create significant pressures on Marine BES, underscoring the need for careful planning and sustainable management of both active and decommissioned offshore infrastructure.

Recommendations: Key Message 11 (b)

11.3 Encourage government agencies to use the Blue Economy Approach for national and regional economic development plans/projects in the ocean sector in order to reduce pressures on Marine BES.

11.4 Mainstreaming Marine BES into the 14th National Economic and Social Development Plan (NESDP) (2028–2032) and its sectoral development plans/ projects as well as develop direct policy responses to mitigate pressures affecting Marine BES.

11.5 Promote community and local participation as a mechanism for promoting the Blue Economy at the local level.

11.6 Support the Subcommittee on Marine Spatial Zoning under the National Maritime Interests Protection Policy Committee (MIP) in applying MSP for the establishment of Marine Zones for development, conservation and buffer zones to enable sustainable use of marine areas for both current and future needs.

Policy Question 12:

What are the impacts of marine resources degradation on the environment and human well-being?

Key Message 12: Resources depletion, ecosystem degradation and decline of environmental quality ultimately affect human well-being. *(Unresolved)*

In the DPSIR framework, impacts reflect the consequences of changes in Marine BES on ecosystem functions, ecosystem services, and human well-being. In the NEA, these impacts are systematically assessed using the seven dimensions of human security—health, environment, economy, food, social/cultural, personal safety, and rights/ participation—to highlight the systemic risks arising from marine ecosystem degradation.

Table 4: Impacts arising from changes in Marine BES

Marine ecosystem services /Human security dimensions	Provisioning Services e.g. marine food production (fisheries)	Regulating Services e.g. climate regulation carbon sequestration coastal protection	Supporting Services e.g. habitat formation (mangroves/coral reefs)	Cultural Services e.g. marine recreation/tourism
Health	Toxins in seafood such as mercury affect consumer health	Climate change affects health, e.g., heat-related illnesses	Waste accumulation affects coastal health	Ecosystem degradation affects mental health & well-being
Environment	Overfishing reduces biodiversity	Coral bleaching due to rising sea temperatures	Habitat degradation due to mangrove loss	Resource degradation from overuse, e.g., coral trampling
Economy	Decline in local fisheries income affects coastal economies	Decline in ecotourism affects income	Increased costs for coastal protection infrastructure	Tourism income declines with resource degradation
Food	Reduced fish stocks lead to food insecurity	Ecosystem changes affect marine food sources	Loss of breeding grounds reduces seafood production	Loss of traditional food sources/changes to traditional diets
Social/ Cultural	Loss of traditional livelihood such as artisanal fishing	Loss of habitats that are also cultural sites in coastal areas	Disruption of cultural stewardship that support key habitats	Loss of local identity such as traditional performances and cultural spaces
Safety (personal)	Conflicts over resources may lead to community insecurity	Sea level rise causes coastal flooding	Saline intrusion affects productivity in coastal farmland	Tourist decline affects local business security
Rights/ Participation	Communities lack participation in resource management policies	Lack of data and participation in climate solutions	Communities lack access and participation in restoration	Non-transparent management, e.g., concessions without community input

Resource depletion, ecosystem degradation, and declining environmental quality have tangible and unresolved effects on human well-being.

For example, the degradation of marine ecosystems, such as coral reefs, mangroves, and seagrass beds, reduces fish stocks and undermines small-scale fisheries, directly affecting food security, income stability, and livelihoods of coastal communities. Declining ecosystem services also increase vulnerability to natural hazards, as the loss of natural coastal protection elevates risks from storms, flooding, and coastal erosion, with significant implications for personal safety, health, and economic security.

Impacts on human well-being also extend beyond environmental and economic losses to health, social, and cultural dimensions.

Deteriorating water quality and ecosystem health contribute to heightened public health risks, including waterborne diseases and exposure to pollution. At the same time, the loss of culturally significant coastal ecosystems affects social cohesion, cultural identity, and community resilience. In the NEA, such examples illustrate how environmental change translates into multi-dimensional human security impacts, reinforcing the understanding that ecosystem degradation poses systemic risks to long-term human well-being and sustainable development.

Recommendations: Key Message 12

12.1 Improve laws and regulations related to EIA, SEA and EHIA to effectively address the impacts caused by development projects and activities both by the government and the private sector.

12.2 Improve the monitoring process conducted by relevant authorities to ensure the implementation of EIA measures

Policy Question 13:

How can marine ecosystem assessments in Thailand be reoriented to better identify and address Drivers and Pressurs rather than focusing primarily on environmental outcomes?

Key Message 13: Shifting marine ecosystem assessments from an outcome-based approach to one that systematically identifies and addresses Drivers and Pressurs is essential for tackling root causes of degradation and achieving effective, long-term improvements in Marine BES. *(Unresolved)*

Marine ecosystem assessments in Thailand have traditionally focused on evaluating the status of marine and coastal resources, such as mangrove forests, coral reefs, and seagrass beds. These assessments tend to emphasise outcomes or symptoms of degradation, rather than identifying and addressing the Drivers(underlying causes) and Pressures (direct impacts) that lead to environmental change. This outcome-based approach is largely due to several key limitations such as insufficient and inconsistent data as data and information systems on economic and social factors are not designed for identifying Drivers and Pressures in the marine sector. The existing national assessment system does not differentiate inland and marine activities, therefore making it difficult to reflect the real economic contribution of marine activities to the overall economy of the country as well as to assess the impacts of marine economic activities on Marine BES.

Recommendations: Key Message 13

13.1 Develop marine-specific socio-economic information systems and indicators to accurately evaluate the impacts of Drivers and Pressures on Marine BES and consequently on human-well-being.

13.2 Encourage government agencies such as the Ministry of Social Development and Human Security (MSDHS), the Ministry of Public Health, NESDC, DOF, and the Department of Disaster Prevention and Mitigation (DDPM) to collect and compile quantitative data on the impacts of ecosystem services on all dimensions of human well-being.

13.3. Promote community and local participation in collecting community-based data and incorporate local knowledge into assessments of the impacts on human-wellbeing, including engagement of local community and ethnic groups.

5 | Economic Value of Thailand's Marine Biodiversity and Ecosystems Services

Thailand's marine ecosystems contribute in multiple, often under-recognised ways to national development. They support critical production systems, underpin tourism revenues, and provide essential regulating services that enhance livelihood security, reduce disaster risks, and maintain ecological integrity. However, these contributions remain insufficiently reflected in national decision-making. Development continues to proceed in ways that diminishes natural capital, often because trade-offs are evaluated without economic evidence that captures the true contribution of ecosystems. In this context, the policy questions identified in this report point to a central need to establish a coherent and credible understanding of how marine and coastal ecosystems support national welfare and how their value can be incorporated into planning and investment decisions. Such an understanding is foundational for aligning economic development with ecological sustainability and ensuring that long-term welfare is not compromised by short-term gains. The policy questions on the economic value of Thailand's coastal and marine ecosystems are discussed below.

Policy Question 14:

How do marine ecosystems and their ecosystem services contribute to the national economy and human well-being in Thailand?

Key Message 14: Marine ecosystems and their services play a critical role in Thailand's national economy and human well-being. *(Well established)*

Understanding economic value is fundamental to policymaking on the sustainable use of marine ecosystems. Economic value provides a framework for understanding the benefits that ecosystems confer on society. These benefits extend well beyond market-based activities and include a broad set of services that directly or indirectly contribute to human well-being. In Thailand, marine ecosystems support subsistence and commercial fishing, recreational and tourism activities, coastal protection, climate regulation, water purification, and cultural identity. Many of these services, particularly regulating and cultural services, do not have market prices and therefore tend to be overlooked in economic analysis and policymaking.

Because ecosystem services are not priced, their degradation is often perceived as costless. In practice, the loss of a regulating service whether from mangroves, coral reefs, or seagrass translates into substantial long-term costs borne by communities, businesses, households, and the public sector. Economic valuation helps overcome this problem by making explicit the benefits that ecosystems provide and the costs associated with their decline. Economic valuation helps overcome this problem by making explicit the benefits that ecosystems provide and the costs associated with their decline. In doing so, valuation supports more informed decision-making and provides a basis for comparing development options, assessing trade-offs, and designing policy instruments. It clarifies where nature-based solutions[2] and other interventions can yield substantial economic returns. Recognising economic value is therefore not an academic exercise but a necessary component of sustainable resource management.

Strong economic evidence supports conservation of key marine ecosystems, but incomplete valuation limits policy integration. Thailand already possesses a substantial body of valuation evidence, particularly for mangroves, coral reefs, and seagrass ecosystems. Much of this work including valuation studies undertaken by Nabangchang and Vincent (2019), demonstrates that these ecosystems make significant contributions to both local livelihoods and national welfare. In the case of mangroves, valuation studies show that they provide high levels of fishery-related income, considerable non-use values, and meaningful carbon sequestration and storage benefits. Restoration projects have repeatedly demonstrated that the economic benefits generated over time far exceed the costs of rehabilitation. These findings underscore the vital role of mangroves in strengthening coastal resilience, by supporting adaptation to climate change, and providing a reliable foundation for sustainable fisheries.

Similarly, valuation work by Nabangchang (2021a) (2021c) on coral reefs shows that reefs generate substantial recreational and tourism benefits, support artisanal fisheries, and protect coastal areas from wave action and erosion. Studies have shown that the public is willing to pay for improved reef protection and better wastewater management, reflecting strong societal demand for maintaining healthy coral ecosystems. These findings highlight both the economic vulnerability associated with coral degradation and the potential gains from effective management.

[2]The United Nations Environment Assembly (UNEA) definition for Nature-based Solutions is: actions to protect, conserve, restore, sustainably use and manage natural or modified terrestrial, freshwater, coastal and marine ecosystems that address social, economic and environmental challenges effectively and adaptively, while simultaneously providing human well-being, ecosystem services, resilience and biodiversity benefits (UNEA, 2022).

Seagrass ecosystems, although less studied, have also been valued in ways that provide important insights. Research led by Nabangchang (2023c) shows significant non-use values associated with dugong conservation as well as measurable carbon sequestration benefits. Such findings demonstrate the ecological and cultural importance of seagrass meadows and highlight the need for improved MPA management and conservation financing.

Despite this progress, valuation remains incomplete for many ecosystems and services. Beaches and dunes, which underpin a major share of Thailand's tourism economy and provide natural protection against coastal hazards, are only partially valued. Offshore ecosystems remain largely unexamined, despite their importance for fisheries and biodiversity. Many regulating services—including nutrient cycling, water purification, and storm buffering—remain unquantified. Pollution-related costs and cumulative impacts across ecosystems are similarly under-assessed. These gaps limit Thailand's ability to fully understand the economic implications of ecosystem change or design comprehensive, nature-positive investment strategies.

Failure to account for ecosystem value results in economic losses and increased environmental risk. Actions taken without a clear understanding of ecosystem value can result in unintended and often costly outcomes. Tourism development in sensitive coastal areas has contributed to coral degradation, beach erosion, and water quality decline (Barbier, E. B., 2007a ;2007b; Barbier, E. B., & Cox, M., 2003; Barbier et al., 2008; Barbier, E. B., 2014). Overexploitation of fisheries and conversion of mangroves for aquaculture have reduced nursery habitat and undermined the productivity of marine ecosystems. Coastal infrastructure projects—ranging from seawalls and ports to land reclamation—have often been approved without recognising the ecosystem services they displace. These developments have increased erosion, disrupted sediment flows, degraded habitats, and made coastal communities more vulnerable to extreme events.

These patterns reflect a broader absence of valuation in decision-making processes. When economic assessments fail to consider the multiple values of ecosystem services, solutions may appear more cost-effective than ecosystem-based alternatives, even when long-term evidence suggests the opposite. Similarly, the lack of valuation within budgeting processes tends to result in underinvestment in conservation and restoration, even when such investments would generate substantial economic benefits. Without valuation, choices that reduce ecosystem health can appear economically rational, even though the long-term costs to society are significant. Addressing this disconnect requires integrating valuation into planning, permitting, and investment appraisal.

Credible economic valuation depends on strong biophysical evidence of ecosystem conditions and service flows, institutional capacity, and clear policy purpose. For valuation to inform policy, certain preconditions must be met. First, robust biophysical data are required to quantify ecosystem extent, condition, and the ecological processes that underpin service flows. In Thailand, data availability is strongest for mangroves, coral reefs, and seagrass ecosystems, while significant gaps remain for beaches, lagoons, and offshore systems. Second, socio-economic data linking ecological functions to human well-being are essential. In many areas, these data are incomplete or inconsistent, especially regarding beneficiaries, distributional effects, and non-market values.

Valuation must be supported by standardised methodologies, inter-agency coordination, and mechanisms for integrating valuation results into environmental assessments, marine spatial planning, natural capital accounting, and public budgeting. There is also a need for consistent judicial procedures for assessing ecological damage and enforcing compensation. Finally, valuation must be undertaken with a clear purpose, whether to inform infrastructure decisions, guide restoration investments, design financing instruments, or assess policy trade-offs. In some contexts, decision-making may also require complementary approaches that recognise non-economic values of nature or assess impacts through non-monetary indicators such as health, well-being, or social outcomes. Economic valuation should be understood as one important component of the broader set of ecosystem values, which may also include ecological, cultural, social, and relational values that are not always captured in monetary terms. Without these preconditions, valuation is unlikely to influence policy in a meaningful way.

This analysis demonstrates that marine ecosystems are productive natural capital that contribute substantially to national welfare, but gaps in valuation, data, and institutional capacity limit their integration into policymaking.

Recommendations: Key Message 14

14.1 Integrate economic valuation into decision-making frameworks by embedding it in policy appraisal, cost-benefit analysis, investment screening, Environmental Impact Assessments (EIAs), and major infrastructure approvals, while ensuring ecosystem service losses are reflected in public investment decisions.

14.2 Recognise the full value of ecosystem services in development choices by systematically accounting for non-market benefits such as coastal protection, carbon sequestration, and cultural values, using valuation evidence to assess trade-offs, and promoting nature-based solutions where they deliver stronger long-term returns.

14.3 Strengthen the valuation evidence base and methodological consistency by consolidating existing studies into a national reference database, prioritising under-assessed ecosystems, expanding valuation of regulating services, improving research on pollution and cumulative impacts, and developing standardised national guidelines.

14.4 Enhance safeguards, accountability, and precaution in development planning by enforcing mitigation and compensation measures based on credible valuation, reviewing past investments to identify hidden environmental costs, and applying precautionary approaches in ecologically sensitive coastal areas.

14.5 Build enabling systems, institutions, and governance capacity through systematic biophysical monitoring, stronger data integration across agencies, technical training, inter-agency coordination, clear policy objectives for valuation exercises, and stronger legal and judicial mechanisms for ecological damage assessment and compensation.

Policy Question 15:

What are the investment gaps, and how can the private and financial sectors engage meaningfully in supporting the use of Thailand's NEA key findings regarding conservation, sustainable use, and restoration efforts?

Key Message 15: Closing investment gaps requires strategic mobilisation of the private and financial sectors. *(Established but incomplete)*

Thailand's marine ecosystems generate substantial economic benefits, yet investment in their protection and restoration remains significantly below what is required. Public budgets alone are insufficient to address the scale and urgency of conservation needs. Closing this investment gap therefore requires mobilising private capital and strengthening the engagement of the financial sector alongside public institutions.

Existing financing tools—such as donations, entrance and access fees, environmental taxes and levies, and conservation trust funds—provide a foundation but require revitalisation and better coordination. Transparent and well-governed financing mechanisms can build confidence among donors, philanthropic organisations, and private actors, ensuring sustained and predictable funding flows. Corporate Social Responsibility (CSR) contributions should be strategically aligned with national conservation priorities, moving from ad hoc support toward structured investment roadmaps.

A key priority is the development of bankable investment packages for conservation and restoration projects. These should demonstrate economic feasibility, clarify expected benefits, and identify financial risks familiar to investors. By improving project design and financial structuring, conservation initiatives can better attract commercial banks, impact investors, and institutional investors.

The financial sector should also be encouraged to integrate environmental considerations into lending and investment decisions through policy incentives, disclosure requirements, and risk-sharing arrangements. A modern green investment approach—grounded in natural capital valuation—can incorporate the long-term economic value of ecosystems into financial planning and public budgeting. In combination, strengthened financing mechanisms, structured private-sector engagement, and supportive policy frameworks can help shift Thailand toward a more diversified and resilient conservation financing model.

Recommendations: Key Message 15

- 15.1 Strengthen governance and transparency of conservation financing mechanisms.
- 15.2 Encourage financial institutions to integrate environmental risk into lending criteria.
- 15.3 Promote innovative instruments (blue bonds, blended finance, carbon finance).
- 15.4 Align CSR investments with national conservation priorities.

Policy Question 16:

How can existing public investments minimise negative impacts but at the same time be 'nature-positive'?

Key Message 16 (a): Public investment must avoid causing environmental harm and actively contribute to nature-positive development. *(Established but incomplete)*

A recurring challenge in Thailand's development pathway is that the economic value of ecosystem degradation is rarely fully incorporated into public investment decisions. While environmental impact assessments are required, the broader economic consequences of lost ecosystem services—such as coastal protection, fisheries productivity, and carbon sequestration—are often not systematically quantified. As a result, public investments may create unintentional negative impacts on natural capital at significant economic cost in the medium and long term.

Moving toward nature-positive development requires integrating ecosystem valuation directly into planning, budgeting, and regulatory processes. Estimating the economic value of potential environmental damage should become a standard component of decision-making for public and private investments. This ensures that risks are fully assessed, trade-offs are recognised and precautionary measures are properly considered, while recognising that some losses and damages may also be non-economic in nature.

Where negative impacts are unavoidable, they should be minimised and, if necessary, adequately compensated based on credible valuation of losses, alongside appropriate consideration of non-economic losses and damages. Ensuring that "no net loss" principles apply consistently across sectors strengthens accountability and reinforces the recognition of natural capital as an economic asset.

Nature-positive public investment does not impede development; rather, it aligns infrastructure expansion and economic growth with long-term sustainability. By embedding ecosystem values into public decision-making, Thailand can move from reactive mitigation toward proactive stewardship, safeguarding marine natural capital for current and future generations.

Recommendations: Key Message 16 (a)

16.1 Apply "no net loss" or "net gain" principles across sectors.

16.2 Prioritise nature-based solutions in coastal infrastructure.

16.3 Ensure full compensation for unavoidable ecosystem damage.

Key Message 16 (b): Thailand's future sustainable pathway depends on systematically incorporating the value of coastal and marine natural capital into policymaking and investment decisions. *(Established but incomplete)*

Incorporating economic values into Thailand's development pathway requires a shift in how marine and coastal ecosystems are understood and managed. Evidence from valuation studies—particularly studies conducted by Nabangchang (2023)—demonstrates that restoration and conservation investments can yield substantial economic benefits. For example, mangrove restoration generates returns through enhanced fisheries productivity, increased coastal protection, and carbon sequestration, far outweighing the costs of rehabilitation. These findings support integrating mangrove conservation into national climate strategies and coastal zone management and provide a basis for attracting investment through blue carbon finance and other innovative funding mechanisms.

Similarly, valuation of coral reefs shows that reefs contribute significantly to tourism revenue, local livelihoods, and coastal protection. Incorporating these values into planning and tourism management supports measures such as improved wastewater treatment, visitor controls, zoning for low-impact activities, and incentive schemes that encourage reef-friendly practices. Such measures can help sustain the tourism sector while protecting the ecosystems on which it depends.

Valuation work on seagrass ecosystems, especially the non-use values associated with dugong conservation, highlights strong societal support for biodiversity protection. These values can guide the design of financing mechanisms that Mobilise public and private resources for conservation, strengthen community engagement, and enhance the effectiveness of MPA management.

Embedding valuation into public investment decision-making is also essential. When ecosystem values are included in EIAs, cost-benefit analyses, and infrastructure planning, public investments can be designed to minimise ecological harm and promote nature-based solutions. This helps shift investments toward "no net loss" and, ideally, nature-positive outcomes. Valuation can also support the development of conservation trust funds, blue bonds, and biodiversity credits, enabling more systematic financing for restoration and protection.

Incorporating economic values into Thailand's future development pathway provides a foundation for more informed and equitable decision-making. It enhances the country's ability to prioritise high-value ecosystems, strengthen resilience, Mobilise finance, and chart a development trajectory that aligns economic growth with ecological integrity. In doing so, it supports long-term well-being for current and future generations.

Recommendations: Key Message 16 (b)

16.4 Integrate coastal and marine natural capital into national development and climate strategies.

16.5 Incorporate ecosystem values into marine spatial planning and coastal zone management.

16.6 Develop natural capital accounting systems for marine ecosystems.

16.7 Scale up restoration where economic returns are demonstrably high.

16.8 Mobilise long-term financing mechanisms to sustain conservation outcomes.

6 | ILK and Marine BES

ILK held by Chao Lay communities and small-scale fishers represents an invaluable, evidence-based system for understanding and managing Thailand's coastal and marine ecosystems. This knowledge—accumulated over centuries of direct observation and adaptive management—must be formally recognised and woven into national policy frameworks to achieve sustainable resource management, social equity, and ecosystem resilience.

Policy Question 17 :

What is ILK and who are the knowledge holders? How does ILK contribute to the sustainable use and conservation of coastal and marine resources?

Key Message 17 (a): ILK held by Chao Lay and small-scale fishing communities in Thailand reflects relational understandings of human-nature relationships and contributes to the sustainable use of Marine BES. *(Well established)*

ILK represents a holistic compilation of philosophical principles, worldviews, traditional and adaptive practices, value systems, and skills developed by Indigenous Peoples and local communities It embodies a profound relationship system between humans and "nature". ILK offers a nuanced understanding of human-nature interconnectedness. Traditional local coastal communities perceive humans as an integral, inseparable part of the natural world, emphasising a deep symbiotic relationship with the environment. There are two main groups of knowledge holders in coastal and marine ecosystems, Chao Lay and small-scale fishers.

Table 5: Showing two groups of coastal peoples who retain ILK

Group	Description	Settlement	Number	Detail
Chao Lay	Widely known as sea gypsies or sea nomads, Chao Lay are ethnic groups that reside, derive their livelihoods, and maintain cultural practices deeply intertwined with marine, coastal, and island environments.	In **5** Andaman coastal provinces	Estimated **14,000** individuals in 46 communities (data as of 2025)	There are 3 subgroups: the Moken, Moklen, and Urak Lawoi.
Small-scale fishers	Coastal people who catch marine life with simple tools, and fishing is often carried out by family or kin members, from making and maintaining fishing gear to fishing, sorting, and processing/selling. Most of the produce is for household or local consumption and/or sold without maximising profits. Small-scale fishing communities often possess knowledge, traditions and customary management that promote sustainable resource utilisation.	In **23** Gulf of Thailand and Andaman coastal provinces	Estimated **40,814** artisanal fishing vessels (under 5 gross tonnage or GT, data as of 2024)	The number of small-scale fishing population and households is still inconclusive.

Chao Lay and small-scale fishing communities often embody sustainable resource management through relational values and customary practices. Their use of simple, hand-operated tools enables intimate observation of marine systems that technology-dependent operations cannot achieve. This knowledge encompasses critical ecological insights: weather patterns, current and tidal dynamics, species behavior, and early detection of unusual environmental changes.

A Moken man with dugout boat, Surin Islands, Phang Nga Province

Small-scale local fisher at Tha Sala, Nakhon Si Thammarat Province using small boat equipped with PVC pipe floats

Figure 5: Way of living of Chao Lay and small-scale fishers

Recommendations: Key Message 17 (a)

17.1 Formally recognise and support Chao Lay and small-scale fishers as stewards and primary observers of marine ecosystem change in all policy sectors. The overall public and policy attitude toward Chao Lay and small-scale fishers often tends to focus on poverty, precarity and "low" education attainment. This stereotype persists, so their in-depth knowledge about the marine environment has often been neglected. The first step, then, is to recognise and explicitly acknowledge these people as "knowledge holders". This should be a high priority in policy, planning, and implementation of marine ecosystems and biodiversity management. The Protection and Promotion of the Ways of Life of Ethnic Groups Act B.E. 2568 (2025) provide a legal infrastructure for the formal recognition and support of ILK.

17.2 Mainstream ILK into national policy frameworks across all sectors, aligned with the KMGBF, CBD Article 8(j) on traditional knowledge, and NBSAP. International frameworks on biodiversity and ILK serve as a guideline for developing national policies. Thailand's 5th NBSAP (2023-2027) has progressive language that aligns with KMGBF in the protection of traditional knowledge held by ethnic groups, including their sustainable use of biodiversity resources. National policy frameworks, especially the 14th National Development Plan that is now in the drafting stage, have to mainstream ILK to ensure "quality growth" along with the meaningful engagement and roles of ILK in decision-making, and in participating in national biodiversity initiatives. The inclusion and promotion of ILK provide empirical evidence for improved policy decision-making.

17.3 Mandatory implementation of ethical principles in ILK engagement. Ethical principles of working with ILK ensure that it is valued, appreciated and respected. Government agencies and stakeholders engaged with ILK must adopt established principles, including but not limited to Free, Prior, and Informed Consent(FPIC), equitable benefit-sharing, and community-centered governance frameworks. ILK represents far more than utilitarian resources, it embodies intrinsic values rooted in relational contexts, moral frameworks, and collective stewardship responsibilities. If ILK is converted to serve certain objectives that do not align with the values or principles of the communities, the integrity of knowledge may be lost. Adopting and ensuring such principles will guarantee a transparent, accountable process, enhancing social equity, and in turn, strengthen the capacity of ILK communities to engage meaningfully.

Key Message 17 (b): Chao Lay and small-scale fishing communities often practice environmental stewardship rooted in reciprocity with nature, which has historically functioned as effective community-based marine management through customary rules and self-regulation. *(Well established)*

Importantly, Chao Lay and small-scale fishing communities do not view ecosystem benefits as mere "services." Instead, they practice stewardship rooted in reciprocal relationships—expressed through rituals, offerings, and oral traditions—that translate into effective conservation ethics and self-regulation. Historically, their customs created de facto marine and coastal management systems: seasonal fishing restrictions, species-specific prohibitions, diversifying fishing grounds, cyclical resource rotation that prevented overexploitation, etc.

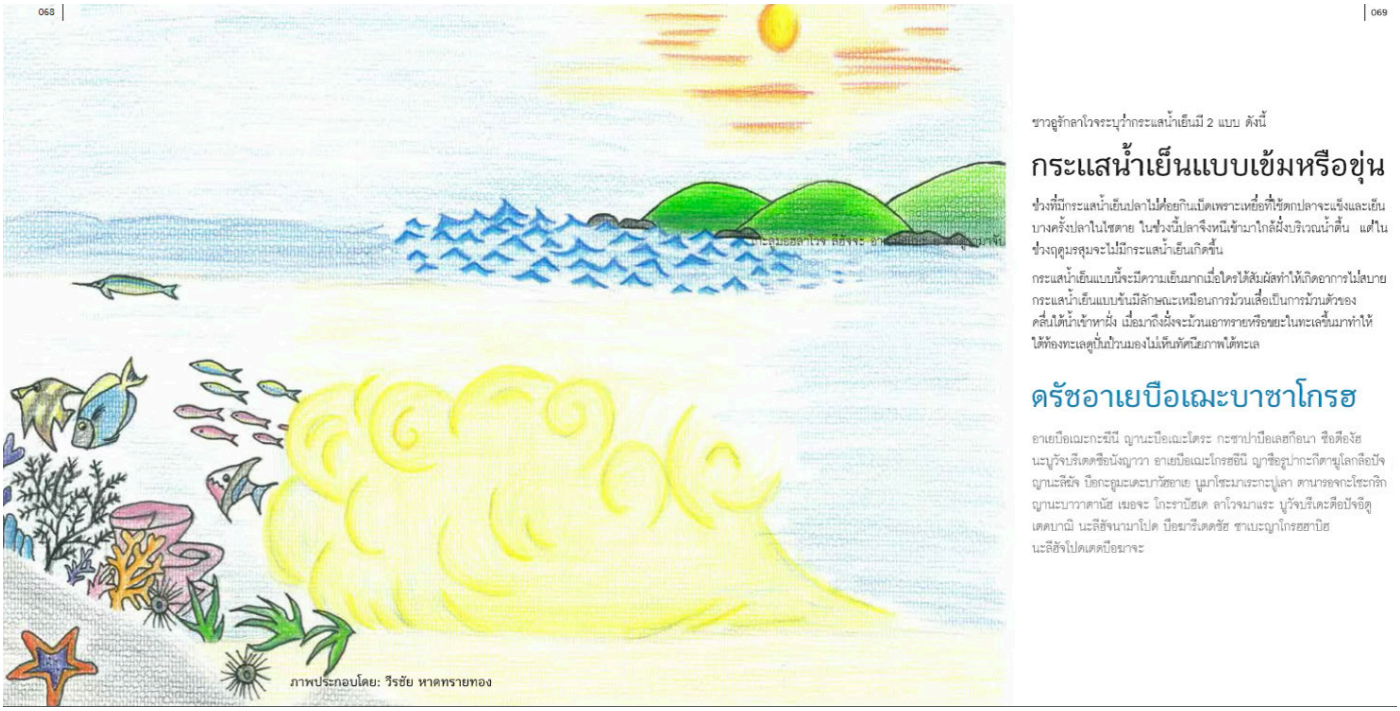

Figure 6: Knowledge of the Urak Lawoi showing various types of underwater currents in Phuket (Source: Kruea-in, 2015)

Recommendations: Key Message 17 (b)

17.4 Promote local customary marine governance and develop formal recognition and support. The policy framework should promote ILK and customary management, including supporting local administrative units to develop statutory mechanisms for communities to affirm and enforce customary rules while aligning them with national biodiversity conservation objectives. Government resources are needed to facilitate joint work between government agencies, local administrative units and community organisations. Improved compliance through culturally embedded governance will eventually reduce enforcement costs from the government in the long run.

17.5 Provide social and economic/financial support for customary stewardship practices. Marine stewardship rooted in relational values suggests that Chao Lay and small-scale fishers value ecological balance as an intrinsic good. There should be social and economic/financial support to reward stewardship and conservation practices. This can be done by creating payment for ecosystem services (PES) schemes for community marine conservation outcomes (e.g. habitat protection) in order to further support locally-driven development and conservation initiatives. Preferential market access for sustainable catch approaches should also be promoted along with sustainable community enterprises that generate income while reinforcing conservation worldviews and norms.

17.6 Establish networks among Chao Lay and small-scale fishing communities. Chao Lay and small-scale fishing communities possess valuable ILK and customary governance practices, and by creating networks of communities-of-practice, these communities can share diverse experiences and lessons learned in integrating customary governance with contemporary biodiversity management approaches, strengthen collective management capacity and build resilience through knowledge exchange. The policy framework needs to provide resources and institutional support for these initiatives, including coordination mechanisms and platforms for sharing experiences.

Policy Question 18:

How does ILK play a role in understanding the status and trends/changes of biodiversity and coastal and marine ecosystems?

Key Message 18: ILK contributes to the assessment of marine and coastal change through a multiple evidence-based approach. *(Established but incomplete)*

As long-term inhabitants with generational memory embedded in place names, geographical vocabulary, oral history, and keen seasonal observations, these communities detect subtle environmental shifts that large-scale assessments miss. This represents a critical advantage for monitoring biodiversity loss, ecosystem transformation, and environmental impacts. ILK is also important as an early warning system, as in the case of the tale of the seven giant waves which helped the Chao Lay survive by fleeing to higher ground during the Indian Ocean Tsunami in 2004. Despite its great potential for the assessment of unusual coastal change and for early warning systems, ILK has been marginalised, typically included as minimal, unsourced supplementary information to scientific data.

Tha La Community in Phuket Province, Thailand, experienced significant degradation of its marine ecosystem, particularly the rapid disappearance of seagrass beds. An elder who was the leader of seagrass conservation group noticed the change and expressed his deep concerns:

> In my 75 years of life, I have seen this bay covered with seagrass beds. I cast my fishnet and trap shrimp here. I believe the seeds of seagrasses come from this area. If the seagrasses disappear, our community will surely face a food crisis, as seagrasses are home to fish and other sea animals.
>
> *Jurun Radnaphol*

Figure 7: Incident of significant seagrass degradation recognised by the local conservation group as unusual from its normal seasonal change

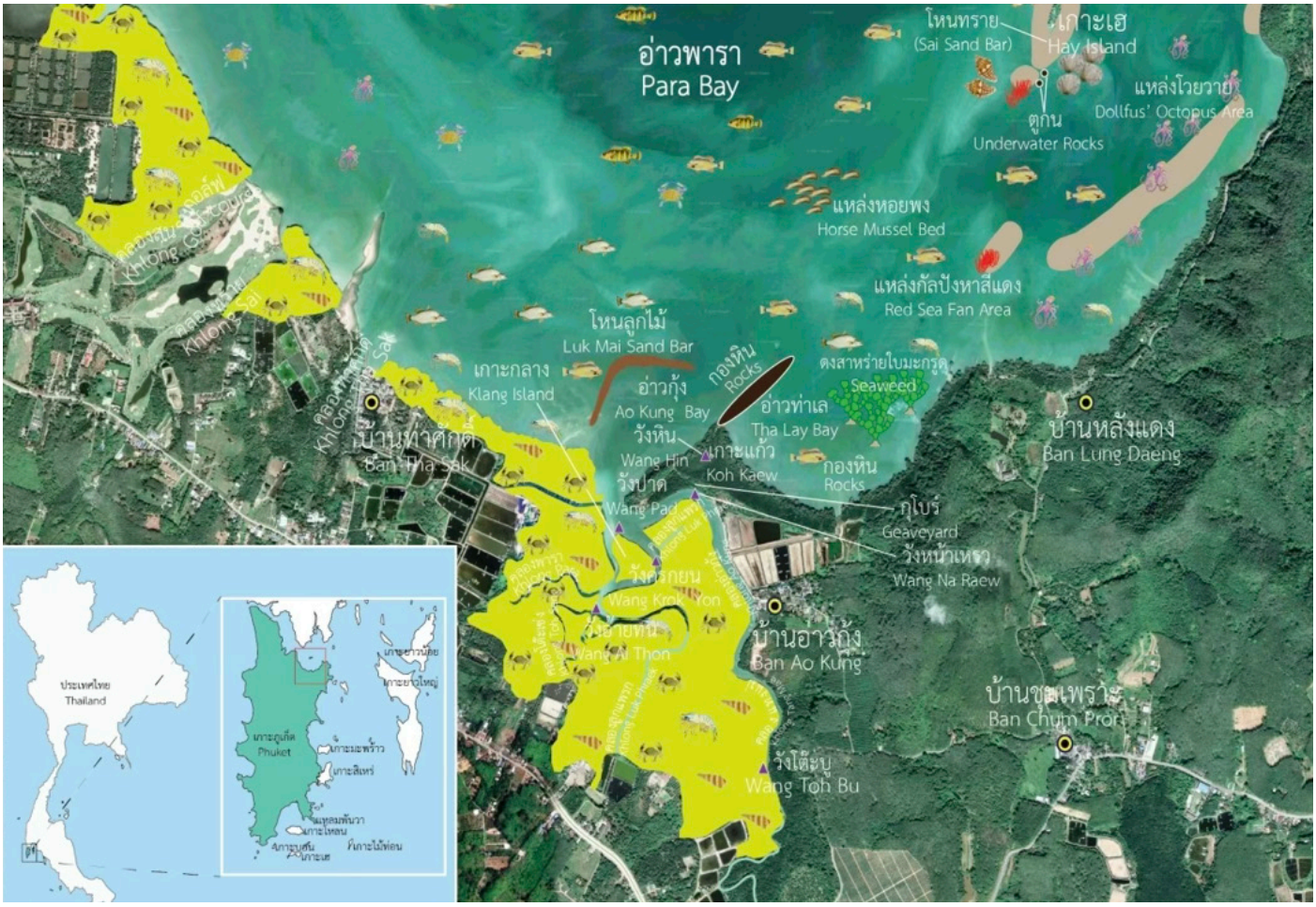

Figure 8: Map of Ao Kung in Phuket showing local place names marine features derived from ILK (Source: Field School Project, 2024)

Recommendations: Key Message 18

18.1. Weave ILK into ecosystem assessments, biodiversity monitoring, and climate adaptation strategies. The policy framework should encourage weaving of ILK into ecosystem assessments, biodiversity monitoring protocols, and climate adaptation strategies. ILK should be recognised as a co-equal knowledge system with scientific approaches, not as supplementary or secondary data sources. Chao Lay and small-scale fishing communities possess intergenerational observational capacity and adaptive knowledge systems that enable them to detect natural changes and have distilled their observations into indicators which can serve as monitoring tools. The Thailand NEA has already illustrated the potential of ILK in ecosystem assessments.

18.2 Mandate collaborative research protocols that include community engagement in design, approach and methodology, and decision-making on ecosystem studies conducted in their territories. Thailand's national research framework must assert requirements for community acknowledgement and collaboration in ecosystem studies, development and conservation initiatives, and environmental research conducted within local communities and territories/marine areas. This includes community recognition as co-researchers, community agreement regarding data dissemination and application. Such protocols are essential to maintain the integrity of ILK and to prevent knowledge misappropriation. In addition, the protocols will fulfill Thailand's international obligations under the CBD and Nagoya Protocol.

18.3 Support co-production of knowledge, bridging ILK and scientific approaches to generate novel insights on conservation, invasive species management, climate adaptation, etc. The policy framework must support co-production of knowledge, because connecting different knowledge systems and incorporating worldviews and methodologies from ILK will yield fresh perspectives and new insights. For example to:

1 Create new knowledge and reconceptualisation on land/seascape; studying these different classification systems, categories, and criteria or adding new dimensions to existing ones can generate novel insights and discoveries.

2 Value small, overlooked but critical details and ensuring small-scale features are recorded and become important databases for detailed comparative analysis across space and time.

3 Generate new research questions or prompt knowledge review for science to illuminate contemporary global challenges, such as invasive alien species from ILK worldviews and observation.

Policy Question 19:

What is the current status of ILK? What driving factors and pressures affect it? If it deteriorates, how would it impact coastal and marine resources?

Key Message 19 (a): ILK is declining primarily as intergenerational transmission to younger generations weakens. *(Well established)*

ILK is gradually disappearing. It is held primarily by aging elders, while younger generations face limited opportunities for transmission, due to limited/restricted access to training grounds (territories) and are pushed into low-wage labor. When communities lose place-based access, their capacity to observe, learn, and transmit knowledge erodes. When social institutions governing sustainable practices weaken, conservation ethics dissolve. Without intervention, Thailand risks losing centuries of empirical expertise.

Spiritual practice by leaders

Most of them are getting old and seen by outsiders as irrelevant in the modern world

Figure 9: The elders who are spiritual leaders and knowledge keepers

Three interconnected pressures pose critical threats to ILK and coastal sustainability:

1 **Restricted resource access:**

Privatisation, tourism development, and conservation zones have systematically excluded Chao Lay and small-scale fishers from traditional fishing grounds and anchoring areas, undermining their ability to practice traditional livelihoods and transmit knowledge. As access to these place-based environments is lost, the cultural meaning and significance of these areas, as well as knowledge connected to natural resources and a sense of belonging and attachment to them, are progressively diminishing.

2 **Ecosystem degradation:**

Large-scale industrial development—from charcoal concessions to para-rubber and oil palm plantations, shrimp farms, large-scale commercial trawlers, development of large seafood industry for export, and mass tourism focusing on growth and quantity—has transformed coastal and marine ecosystems, driving biodiversity loss and undermining the resource base these communities depend upon.

3 **The lack of policy, implementation, and funding support for ILK:**

Policies usually prioritise instrumental valuation of nature (economic extraction) over social-ecological sustainability. Laws and policies neglect small, marginalised communities with ways of life different from the larger society, and sometimes criminalise fishing and foraging practices rather than support them. ILK remains absent from national assessment frameworks and policy processes.

Recommendations: Key Message 19 (a)

19.1 Fund and support community-led documentation initiatives where local members serve as "community researchers" and (co-)authors. Policy frameworks should focus on participatory planning and budget allocation to develop the skills of community members to become "community researchers" who collect, record, compile, analyse and connect ILK data regarding the relationships between biodiversity and cultural diversity. "Community researchers" should be equipped with tools for data collection and management and taught how to use data to jointly develop community plans to improve quality of life and continue to manage resources in a balanced and sustainable way. Such initiatives need to promote youth learning and intergenerational relationships, as well as create collaborative networks for shared learning, enabling knowledge and skill sharing across communities, and supporting the development of culturally protected areas. The support on lifeways and historic data is indicated in Chapter 4 of the Protection and Promotion of the Ways of Life of Ethnic Groups Act B.E. 2568 (2025), thus the infrastructure of funding and support is already in place.

19.2 Establish secure, locally controlled databases integrating spatial, temporal, and cultural data for ecosystem monitoring and knowledge revitalisation. Once ILK has been recorded and compiled, promotion in terms of database development becomes necessary. This database will contain both spatial and temporal data useful for monitoring and assessing changes, and will serve as a repository for restoring and transmitting ILK. The Geo-Informatics and Space Technology Development Agency (GISTDA) created and updates a Marine GI Portal which can be a geoinformatics knowledge platform that facilitates weaving together systems of knowledge while prioritising local needs and practical applications. Thailand's NBSAP recognises the importance of community databases (Target 5 of KMGBF), and establishing robust policies that guarantee long-term funding and technical capacity is critical for weaving ILK into these systems and ensuring its practical use in biodiversity conservation efforts.

19.3 Protect community data sovereignty and ensure communities' right to control data ownership, access, use, and ensure equitable benefit sharing arising from the use of their data and knowledge, in line with the Nagoya Protocol on Access and Benefit Sharing (ABS), national ABS legislation, and other locally established/agreed community biocultural protocols. Consideration must be given to recognising data sovereignty, which means the right to own and make decisions regarding the storage, access, control, and use of this data. This will help prevent sensitive data from being disclosed, misinterpreted, distorted, and exploited or used in ways inconsistent with the values and worldview of the data owners. Thailand must establish mechanisms to protect community data sovereignty, ensuring communities retain ownership and control over their biodiversity data and ILK. By establishing clear legal protections and accountability mechanisms, communities will be empowered and counted as genuine partners in biodiversity conservation while ensuring they benefit equitably from knowledge use.

Key Message 19 (b): Weakening ILK causes cascading effects across the three domains of community viability, ecosystem integrity, and policy effectiveness. *(Established but incomplete)*

ILK decline directly undermines social equity, ecosystem integrity, and conservation policy effectiveness as described below.

1 Community Viability

When communities lose secure access to coastal resources and the social institutions that govern sustainable use, the implications extend far beyond livelihood loss. These communities become economically vulnerable as individuals, families, and households struggle to find alternative livelihoods that do not rely on their traditional skills and expertise. Many are pushed into precarious low-wage labour in construction and service industries—eroding household resilience and community cohesion. More critically, when place-based access is severed, the intergenerational transmission of knowledge fails as younger generations have no opportunity to learn from elders or practice marine skills. The cultural and ethnic integrity of these communities is threatened as customary knowledge-sharing mechanisms—central to social bonding—progressively dissolve as communities become individualised and fragmented.

2 Ecosystem Integrity

ILK has been marginalised in national ecosystem and biodiversity assessments, typically relegated to minimal, unsourced supplementary information. This represents a critical gap in evidence-based policymaking. Communities with centuries of continuous presence and observation possess irreplaceable knowledge of historical ecology, past land-use changes, and gradual ecosystem transformations that scientific monitoring alone cannot capture. Their detailed observations of subtle environmental cues—informed by intuition and rapid risk responsiveness—contribute to vigilance and early warning capacity. When these communities are estranged from their territories through restricted access, their knowledge and capacity to observe and assess environmental change gradually fades. Without this embedded knowledge system, national assessments remain incomplete, monitoring becomes less effective, and adaptive management capacity is diminished.

3 Conservation Effectiveness

The decline of ILK, together with policies that overlook or neglect such knowledge, and the enforcement of conservation measures without regard to cultural practices and traditions, often undermine the effectiveness and efficiency of conservation and can even generate resistance among local communities. Chao Lay and small-scale fishers have deeply ingrained values rooted in customary traditions that govern coastal and marine activities. Therefore, the subconscious awareness of "conserving" coastal resources is a matter of cultural and relational values, distinct from policymakers and conservationists who base their focus on ecosystem integrity and formal, concrete conservation measures. In many cases, Chao Lay and small-scale fishers may disagree with rigid, written, and formally structured measures. Conversely, incorporating customary traditions into conservation fosters voluntary cooperation and reinforces the importance of knowledge as a key factor in successful conservation efforts. Without supporting policies and implementation, Thailand faces a triple loss: erosion of community viability and cultural continuity, degradation of ecosystem assessment capacity, and reduced effectiveness of conservation efforts. Recognising and supporting ILK offers a path toward inclusive approaches where conservation goals, community wellbeing, and evidence-based assessment reinforce one another.

Figure 10: ILK revival showing lightweight, easy-to-carry, and environmentally friendly bamboo traps

Recommendations: Key Message 19 (b)

19.4 Support access rights for subsistence-based livelihoods and knowledge transmission in the community traditionally used and conserved areas. Policy frameworks must protect ILK communities' rights to access and sustainably use biodiversity resources for subsistence-based livelihoods within their traditionally used and conserved territories. This access is fundamental to intergenerational knowledge transmission and conservation effectiveness. These policy frameworks should guarantee communities' customary and sustainable use rights for subsistence purposes within traditional territories, explicitly protect knowledge transmission activities (ceremonial practices, traditional teachings, seasonal harvesting, etc.), and recognise culturally protected areas, LMMAs and other community protected areas, as legitimate conservation mechanisms. Chao Lay have foraging strand areas, fishing grounds, and temporary shelters (or "ba-khad" in Urak Lawoi language, sometimes referred to as "rotating sea"). These should be recognised and supported through agreements within the community itself, between communities, and between communities and state agencies.

19.5 Develop policies that protect ILK communities from the negative impact of development or conservation. Thailand must establish mandatory, comprehensive impact assessment frameworks that integrate ILK along with scientific analysis to identify and mitigate development and conservation project harms. While Thailand has expanded environmental, social and health impact assessments, critical gaps remain. Protocols integrating ILK analysis alongside scientific assessment mandatory. CBD's Akwe: Kon Voluntary Guidelines should become a binding national standard for development and conservation projects affecting community territories. In addition, ILK should be considered an essential part of in-depth data collection and monitoring throughout project implementation. Other policy recommendations are to establish community grievance mechanisms and remedy processes. By centering ILK in impact assessment and ensuring communities control monitoring and remediation processes, Thailand protects communities from harm created by projects, while simultaneously strengthening conservation and development decision-making through integrated knowledge systems.

19.6 Redefine and legally protect small-scale fishing as a cultural meaningful and sustainable livelihood. Existing policies reduce small-scale fishing to an economic occupation with minimal returns. Furthermore, women in fishing communities are often portrayed narrowly as housewives, seafood processors, and market vendors—roles that obscure the deeper dimensions of their lives and work. These frameworks fail to recognise ILK and cultural-spiritual significance embedded in small-scale fishing practices. Promoting ILK requires fundamentally reconceptualising small-scale fishing and fisher identities—including the Chao Lay—as expressions of distinctive ways of life rooted in culture, traditional knowledge, and familial relationships. To operationalise this broader vision, policy must mandate comprehensive data collection on the socio-cultural dimensions of fishing livelihoods and ensuring that policy and planning decisions reflect the full complexity and value of small-scale fishing as a cultural and knowledge system, not merely an economic activity.

Policy Question 20:

How can policies that promote ILK help strengthen the sustainable management and conservation of resources at the national level while also enhancing quality of life?

Key Message 20: Policies that promote ILK will lead to participatory and sustainable management and conservation of ecosystems and biodiversity based on worldviews and in-depth understanding of nature of the local communities, and their quality of life will be enhanced because of national recognition of land and resources rights. *(Established but incomplete)*

Recommendations: Key Message 20

20.1 Implement co-management strategies built on existing customary conservation practices rather than imposing external regulations. Policymakers need to understand, acknowledge, and recognise conservation values and approaches already embedded in ILK. Policy frameworks must leverage existing customary practices through meaningful community involvement. By supporting various forms and methods of community-based co-management, government agencies can simultaneously strengthen cultural traditions and facilitate the development of community-led regulatory mechanisms that resonate with community values and practices. This collaborative framework not only enhances the legitimacy and effectiveness of conservation efforts but also ensures that management strategies are culturally appropriate.

20.2 Establish multi-sectoral governance mechanisms that center community voice in ecosystem management decisions, including ecosystem restoration through ILK and practices. Multi-sectoral governance mechanisms must be established to support community voice in ecosystem management decisions, particularly through weaving in ILK and customary governance practices. Such mechanisms should incorporate formal regulatory frameworks, including local ordinances drafted collaboratively by Local Administrative Organisations and community stakeholders. This multi-sectoral governance mechanisms ensure alignment across governance levels, together with alignment of dual purposes of maintaining ecosystems and biodiversity integrity while simultaneously enhancing the quality of life for local communities.

20.3 Transition from top-down conservation to locally-driven stewardship. Policy frameworks need a fundamental reorientation of ecosystem management from a centralised regulatory exercise into genuinely collaborative process where communities are recognised as primary stewards. Management systems must be designed to respect ILK, strengthen local actors, and ensure that conservation outcomes are both equitable and sustainable. Thailand's advancement of the LMMAs and OECMs framework exemplifies this transition. By enabling communities to assume stewardship roles, this decentralised model simultaneously relieves government burden, enhances effectiveness and accountability. Locally-driven stewardship is less costly and more sustainable, but policy support is needed in terms of appropriate institutional frameworks and resources.

To successfully implement these six policy recommendations, governments must demonstrate unwavering political commitment and decisive action. This is particularly crucial for government agencies tasked with ecosystem and biodiversity conservation, which must balance their environmental mandates with genuine respect for the rights and knowledge of ethnic and local communities. Rather than operating in isolation, each recommendation builds upon the others, creating a comprehensive and integrated framework that yields significantly more substantial and enduring results than piecemeal efforts.

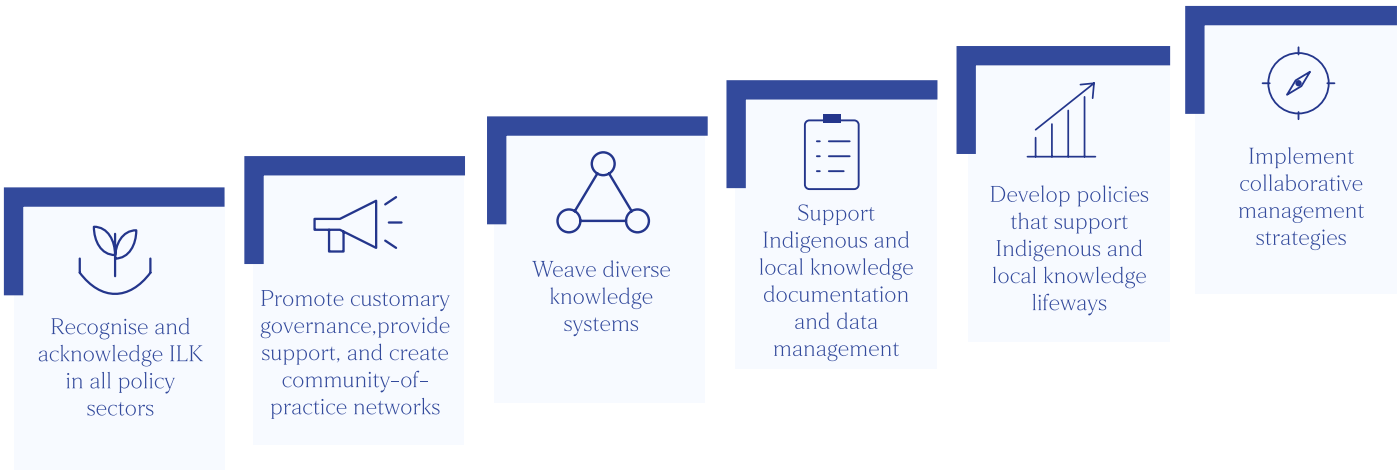

Figure 11: Diagram showing policy recommendations to support ILK

7 | Governance of Marine BES in Thailand

Thailand's marine and coastal ecosystems underpin national food security, economic development, and the well-being of millions of coastal residents. Effective governance of Marine BES is therefore critical not only for environmental sustainability but also for social and economic resilience. Overall, Thailand has established a strong formal governance architecture with high alignment to global biodiversity commitments. However, implementation effectiveness remains uneven due to persistent challenges in institutional coordination, enforcement capacity, spatial integration, and substantive stakeholder inclusion. The following key messages highlight priority strengths, gaps, and strategic actions to strengthen Marine BES governance in Thailand.

Policy Question 21:

What existing policies and institutional frameworks are relevant to Marine BES?

Key Message 21: Thailand demonstrates strong alignment between national policy frameworks and global biodiversity commitments for Marine BES, but implementation remains uneven across sectors and spatial scales. *(Well established)*

Thailand has established a strong and well-aligned policy architecture for Marine BES. Major national strategies—including the National Biodiversity Strategy and Action Plan (NBSAP), the National Economic and Social Development Plan, and the National Marine and Coastal Resources Management Policy and Plan—demonstrate a high degree of formal coherence with global commitments such as the CBD the SDGs, and the KMGBF. Collectively, these instruments embed Marine BES considerations within Thailand's broader development, climate, and blue economy agendas and provide an important strategic foundation for advancing marine conservation and the 30×30[3] target of the KMGBF.

Table 6: Alignment between Thailand's national policy framework and global biodiversity commitments

National Policy / Plan	Relevant SDGs	CBD / KMGBF	Multilateral Environmental Agreements*	Climate Alignment
20-Year National Strategy (2017–2036)	2, 6, 12, 13, 14, 15	✓	–	–
13th National Economic and Social Development Plan (2023–2027)	2, 6, 7, 11, 12, 13, 14, 15	✓	–	✓
National Environmental Quality Management Plan	6, 11, 12, 13	✓	–	✓
Climate Change Master Plan & National Adaptation Plan (NAP)	13	–	–	✓✓
National Biodiversity Strategy and Action Plan (2023–2027)	13, 14, 15	✓✓	✓✓	✓
National Marine and Coastal Resources Management Policy and Plan (2023–2027)	14	✓	✓	✓

Note: ✓ = explicit policy alignment; ✓✓ = primary or core alignment; – = limited or indirect linkage;
* Multilateral Environmental Agreements include the Ramsar Convention, CITES, and World Heritage Convention.

[3]TARGET 3: By 2030 Conserve 30% of Land, Waters and Seas (Source: The Convention on Biological Diversity, 2026).

Overall, Thailand demonstrates strong policy alignment with SDG 14 and biodiversity related goals, although the depth of operational integration varies across sectoral plans.

Strengths

At the policy design level, Thailand shows strong vertical alignment between international biodiversity commitments and national planning frameworks. Biodiversity and ecosystem services are increasingly mainstreamed beyond the environmental sector into national development and climate change strategies. The NBSAP (2023–2027) serves as a central coordinating instrument linking spatial conservation, sustainable use, and cross-sectoral integration. In parallel, the National Marine and Coastal Resources Management Policy and Plan provides sector-specific operational direction for coastal and marine ecosystems. Together, these policy instruments demonstrate clear political commitment and provide a comprehensive strategic platform for Marine BES governance.

Challenges

Despite strong strategic alignment, implementation effectiveness remains uneven across sectors and spatial scales. Biodiversity mainstreaming in key production sectors—including fisheries, tourism, energy, and coastal infrastructure—continues to rely heavily on project-based initiatives rather than fully institutionalised regulatory mechanisms. MSP, although widely recognised as the primary integration tool, remains weakly institutionalised with limited statutory authority and uneven uptake across provinces. In addition, legal recognition, monitoring standards, and long-term financing arrangements for OECMs remain underdeveloped. Together these governance gaps hinder effective implementation of national biodiversity commitments.

Recommendations: Key Message 21

21.1 Institutionalise MSP through the development of a national marine spatial plan led by DMCR, with formal integration into sectoral plans (fisheries, tourism, transport).

21.2 Operationalise NBSAP targets by linking them to sector-specific regulations, budget allocations, and performance indicators, coordinated by ONEP.

21.3 Establish a national monitoring framework for Marine BES, aligned with NBSAP indicators and implemented jointly by ONEP and relevant line agencies.

21.4 Develop a national OECM framework, including criteria, registry, and monitoring system, led by ONEP in collaboration with Department of National Parks, Wildlife and Plant Conservation (DNP) and DMCR.

21.5 Strengthen inter-agency coordination mechanisms under the National Biodiversity Committee to ensure cross-sectoral implementation.

Policy Question 22:

What are the roles and contributions of state and non-state actors—including government agencies, local communities, and civil society organisations—in the governance, integration, and mainstreaming of Marine BES across national and sub-national levels?

Key Message 22 (a): Thailand has developed a comprehensive and relatively mature legal framework for marine biodiversity governance; however, coherence across legal mandates and implementation effectiveness remain uneven. *(Established but incomplete)*

Thailand's marine governance is supported by an extensive body of environmental and sectoral legislation that collectively provides a strong legal foundation for the management of Marine BES. Core instruments—including the Promotion of Marine and Coastal Resources Management Act, the Royal Ordinance on Fisheries, the National Park Act, the Marine Interest Protection Act, and the Enhancement and Conservation of National Environmental Quality Act (ECNEQ Act)—establish regulatory authority across key marine and coastal sectors. The ongoing development of a unified Biodiversity Act, together with the proposed Climate Change Act, reflects Thailand's efforts to strengthen the legal framework required to address interconnected biodiversity loss, climate change, and sustainable ocean governance.

Strengths

Thailand has developed a broad and relatively mature legal framework covering marine conservation, fisheries management, environmental protection, and coastal resource governance. Existing legislation provides clear statutory mandates for key agencies and establishes formal mechanisms for regulation, enforcement, and protected area management. The Prime Minister's Regulation on Biodiversity Conservation (2020) and the draft Biodiversity Act signal continued policy attention to strengthening biodiversity governance. Collectively, these legal instruments provide an important regulatory envelope for advancing Marine BES conservation.

Challenges

Despite the breadth of the legal framework, coherence and implementation effectiveness remain uneven. The absence of an enacted Biodiversity Act continues to limit legal integration across biodiversity-related mandates. Overlapping authorities among sectoral laws create ambiguity in enforcement responsibilities, particularly in areas such as coastal development, pollution control, and marine protection. Enforcement capacity remains variable across agencies and provinces, and national compliance indicators and monitoring systems are not yet fully standardised. These structural constraints reduce regulatory efficiency and weaken the translation of legal mandates into consistent biodiversity outcomes.

Recommendations: Key Message 22(a)

22.1 Accelerate enactment of the Biodiversity Act and Climate Change Act, led by ONEP, to strengthen integrated governance.

22.2 Harmonise mandates across marine and coastal legislation, through a formal legal review coordinated by ONEP.

22.3 Develop national compliance and enforcement indicators, aligned with NBSAP monitoring frameworks.

22.4 Strengthen inter-agency enforcement coordination, particularly between DMCR, DOF, and DNP, through joint inspection protocols.

22.5 Enhance legal recognition of OECMs and integrated spatial management, through subsidiary regulations and ministerial notifications.

Key Message 22 (b): Thailand's multi-actor governance system provides a strong institutional foundation for Marine BES management, but institutional fragmentation and uneven coordination continue to constrain governance effectiveness. *(Established but incomplete)*

Marine BES governance in Thailand is supported by a diverse multi-actor institutional landscape spanning national agencies, sub-national authorities, civil society organisations, academia, and the private sector. This broad governance architecture creates multiple entry points for policy implementation and stakeholder engagement. However, coordination effectiveness and system integration remain uneven across agencies and governance levels.

Strengths

Thailand has established a multi-level institutional architecture for marine and coastal governance. Lead technical agencies—including DMCR, DNP, DOF, ONEP—operate alongside national coordination committees such as the National Biodiversity Committee and the National Marine and Coastal Resources Committee. Civil society organisations, NGOs, academic institutions, and the private sector increasingly contribute to community-based conservation, research, capacity building, and policy support. Together, this multi-actor system provides a strong institutional foundation for advancing Marine BES governance.

Challenges

Despite the presence of multiple actors and coordination platforms, institutional fragmentation continues to constrain governance effectiveness. Overlapping mandates and parallel approval processes create inefficiencies and delay decision-making across marine and coastal sectors. Coordination performance varies significantly across provinces and thematic areas, often depending on leadership continuity and resource availability. Marine and coastal data systems remain largely siloed across agencies, limiting interoperability, cumulative impact assessment, and evidence-based planning. In addition, decentralised responsibilities are not always matched with adequate technical capacity or operational budgets at the local level, further contributing to uneven implementation outcomes.

Recommendations: Key Message 22 (b)

22.6 Strengthen national coordination mechanisms, particularly the National Biodiversity Committee and Marine and Coastal Resources Committee, with clear mandates and performance monitoring frameworks (ONEP-led).

22.7 Develop an integrated national marine data platform, led by DMCR, with formal data-sharing protocols across agencies.

22.8 Clarify roles and responsibilities across governance levels, through a national coordination framework endorsed by ONEP.

22.9 Strengthen sub-national implementation capacity, including DMCR regional offices and provincial committees, through targeted technical and budget support.

22.10 Streamline approval processes across agencies, to reduce duplication and delays in marine governance decisions.

Policy Question 23:

Given the current state of marine and coastal governance in Thailand, what governance processes, institutional arrangements, and enabling conditions could be strengthened to enhance the effective, inclusive, and sustainable management of Marine BES?

Key Message 23 (a): Participatory mechanisms are well established in Thailand's marine governance framework, but stakeholder influence on decision-making remains limited, with participation largely consultative rather than substantive. *(Established but incomplete)*

Community and stakeholder participation is formally embedded in Thailand's marine and coastal governance framework and is widely recognised as a central enabling condition for effective Marine BES management. Legal provisions under the Promotion of Marine and Coastal Resources Management Act and the Royal Ordinance on Fisheries have created institutional platforms for stakeholder engagement at national and provincial levels. However, in practice, participation remains largely consultative, with limited influence over final decision-making processes.

Strengths

Thailand has established a relatively strong formal basis for participatory marine and coastal governance. More than 500 registered coastal community organisations and thousands of marine protection volunteers operate nationwide, providing a broad institutional platform for stakeholder engagement. Participatory provisions are embedded in key environmental and fisheries legislation, and provincial committees offer formal entry points for community representation. Civil society organisations, NGOs, and academic institutions play an important intermediary role by supporting community-based conservation, facilitating co-management initiatives, and strengthening local capacity. Together, these mechanisms demonstrate clear policy recognition of the importance of inclusive governance.

Challenges

Despite strong procedural provisions, the substantive influence of communities in decision-making remains uneven. In many cases, community representatives serve primarily in advisory roles, while committee structures continue to be dominated by administrative agencies. Gender equity and social inclusion are not yet systematically institutionalised, and women remain underrepresented in formal governance bodies despite their significant roles in fisheries livelihoods and coastal stewardship. ILK is widely applied in practice but remains weakly integrated into formal planning and regulatory processes. In addition, many co-management initiatives depend on short-term project funding and external support, limiting long-term institutional sustainability. These factors collectively contribute to participation that is formally recognised but substantively constrained.

Recommendations: Key Message 23 (a)

23.1 Mandate stakeholder representation in decision-making bodies, including provincial marine and fisheries committees, to enable shared decision-making.

23.2 Institutionalise gender-responsive governance, including consideration of representation targets or quotas where appropriate.

23.3 Integrate ILK into formal planning and monitoring frameworks, coordinated by ONEP and academic partners.

23.4 Establish long-term financing mechanisms for co-management, including dedicated budget lines and funding windows.

23.5 Strengthen intermediary roles of NGOs and academic institutions to support community engagement and capacity-building.

Key Message 23 (b): Thailand has established a comprehensive system of area-based conservation instruments for marine biodiversity; however, fragmented governance and incomplete spatial integration limit their overall effectiveness. *(Established but incomplete)*

Thailand has established a legally comprehensive system of area-based conservation instruments, including Marine Protected Areas (MPAs), Environmental Protected Areas (EPAs), Aquatic Animal Sanctuaries, and the emerging application of OECMs and LMMAs. These instruments collectively form the spatial backbone of national Marine BES governance and reflect Thailand's commitment to the KMGBF and its 30×30 target. However, institutional fragmentation and incomplete spatial integration continue to constrain overall effectiveness.

Strengths

Thailand's area-based conservation framework is supported by multiple sectoral laws and responsible agencies, providing broad legal coverage for marine and coastal biodiversity protection. The country has an established network of Marine National Parks, Environmental Protected Areas, and Aquatic Animal Sanctuaries, and is actively exploring the use of OECMs and LMMAs to complement formal protected areas. MSP is increasingly recognised at the policy level as a key mechanism for aligning conservation, fisheries management, navigation, tourism, and coastal development. Together, these developments demonstrate a strong national commitment to expanding spatial conservation coverage and improving ecosystem-based management.

Challenges

Despite this comprehensive framework, only a modest proportion of Thailand's marine area is currently under effective protection relative to the KMGBF 30×30 target. Governance responsibilities for MPAs and related instruments remain fragmented across multiple agencies, resulting in overlapping mandates and variable site-level performance. Monitoring and management effectiveness indicators are not yet fully standardised at the national level. Legal recognition and long-term financing arrangements for OECMs and LMMAs remain under development, creating uncertainty regarding their future contribution. In addition, MSP has not yet been fully institutionalised as a binding cross-sectoral planning tool, limiting its ability to function as the operational backbone for integrated marine governance.

Recommendations: Key Message 23 (b)

23.6 Institutionalise MSP as a legally supported cross-sectoral framework, through a national marine spatial plan led by DMCR.

23.7 Develop national criteria, registry, and monitoring systems for OECMs and LMMAs, coordinated by ONEP and DNP.

23.8 Standardise management effectiveness assessments across MPAs, including adoption of tools such as METT, led by DNP and DMCR.

23.9 Strengthen cross-agency coordination for marine zoning and spatial planning, through joint planning platforms.

23.10 Develop a national sustainable financing roadmap for area-based conservation, including public funding, trust funds, and private sector contributions.

8 | Scenarios for Thailand's Marine Ecosystems, Biodiversity and Ecosystem Services

Scenarios are tools which have been used in this NEA to explore plausible futures for Marine BES of Thailand under various conditions, helping stakeholders visualise the potential outcomes of different decisions. They are built directly on NEA findings by using the status and trends of marine ecosystems and identifying key drivers as a starting baseline. The approach combines exploratory scenarios, intervention (policy) scenarios, and a participatory, qualitative process. The scenarios towards 2050 are thus rooted in the past trends and current challenges of Thailand's Marine BES. The scenarios reflect a spectrum of choices in development orientation, governance, and stewardship. They help policymakers understand the long-term implications of different governance modes, development orientations, and social choices.

The scenarios were co-produced through a participatory process combining scientific evidence, ILK, expert review, and multi-stakeholder dialogue. This strengthens their credibility, relevance and legitimacy for policy use.

Insights and findings have been generated throughout the scenario's development process, with inclusive stakeholder participation and inclusion of stakeholder inputs in the study. This has led to the following key messages with recommendations responding to the policy questions set out by the NEA for policymakers and also for practitioners, regulators, researchers, agencies and institutions, to support coastal and marine sustainability in Thailand.

Policy Question 24:

What alternative futures for Thailand's coastal and marine ecosystems are plausible by 2050, and what trade-offs do they entail?

Key Message 24: Thailand faces three contrasting but plausible marine futures by 2050—Business-as-Usual, Blue Economy, and Nature-Positive—each involving different trade-offs across biodiversity, ecosystem services, livelihoods, equity, and climate resilience. *(Well established)*

Three contrasting but plausible futures for Thailand's coastal and marine ecosystems to 2050 were developed:

1 **Business-as-Usual (BAU)**–A continuation of current trends with incremental improvements, where governance remains fragmented, pressures from coastal development, fisheries, tourism and infrastructure persist, and many ecosystems continue to degrade despite local successes. This scenario highlights the systemic risks of inaction, including rising vulnerability of coastal communities to climate and disaster risks, livelihoods under uncertainty and climate change, and increasing fiscal and social costs over time.

2 **Blue Economy**–A pathway where Thailand expands ocean-based economic activities (such as sustainable fisheries and aquaculture, tourism, ports and shipping, and offshore energy) within clearer environmental safeguards, marine spatial planning and integrated coastal management. Ecosystem condition stabilises or improves in some areas compared to BAU, and new jobs and income are created, but full recovery in heavily pressured seascapes remains uncertain and equity concerns may persist if benefits are not widely or equitably shared.

3 **Nature-Positive (Blue Economy Plus)**–A more ambitious pathway that explicitly aims to halt and reverse biodiversity loss, restore key ecosystems (mangroves, seagrasses, coral reefs and other coastal habitats), and strengthen resilience and equity. It combines carefully governed Blue Economy growth with large-scale restoration, expanded protected and conserved areas (including OECMs), recognition of community rights and ILK, and sustained investment in ecosystem health. This scenario delivers the greatest long-term co-benefits for biodiversity, climate resilience, livelihoods and risk reduction, but requires stronger governance, political commitment and financing.

Recommendation: Key Message 24

Use the three scenarios as a policy stress-test framework for major marine decisions. Treat BAU as risk reference and require major plans and investments to make explicit their expected trade-offs between short-term growth, long-term ecosystem integrity, social equity, and climate and disaster resilience.

Table 7: Comparison aspects of 3 scenarios of marine ecosystems and their biodiversity ecosystem services of Thailand towards 2050

Aspect	Business-as-Usual (BAU)	Blue Economy	Nature-Positive (Blue Economy Plus)
Short description	Continuation of current trends with only incremental improvements and fragmented governance.	Expansion of ocean-based economic activities under clearer environmental safeguards, MSP and Integrated Coastal Zone Management (ICZM).	Ambitious pathway aiming to halt and reverse biodiversity loss while strengthening resilience and equity.
Ecosystem condition	Ongoing degradation of coral reefs, seagrasses, mangroves and other habitats in many areas; local successes remain isolated.	Ecosystem condition stabilises or improves in some use areas compared to BAU, but full recovery in heavily pressured seascapes is uncertain.	Net gains in extent and condition of key ecosystems through large-scale restoration and expanded protected and conserved areas (including OECMs).
Livelihoods and economy	Increasing vulnerability of coastal communities and small-scale fishers to job and income; higher long-term fiscal and social costs.	New jobs and income from fisheries, aquaculture, tourism, ports, shipping and offshore energy; benefits may be unevenly shared.	More resilient and diversified livelihoods based on healthy ecosystems; long-term economic benefits from risk reduction and ecosystem services.
Equity and communities	Benefits largely captured by powerful actors; growing inequalities and conflict risks.	Equity outcomes depend on safeguards; without them, there is risk of "blue-washing" and exclusion of small-scale users.	Strong emphasis on community rights, ILK, co-management and fair benefit sharing; social inclusion is a core objective.
Climate and disaster risk	Rising exposure and vulnerability to storms, erosion and flooding as natural buffers are degraded.	Some reduction in risk where safeguards and restoration accompany development, but residual risks remain.	Significant reduction of climate change and disaster risks through restored natural buffers and resilient coastal landscapes and seascapes.
Governance and finance	Fragmented mandates, weak enforcement and limited use of integrated planning; underinvestment in ecosystem health.	Stronger standards, MSP/ICZM and environmental safeguards are required; growing role for blue finance if well governed.	Requires strong, coherent governance, long-term policy commitment and scaled, aligned blue–green finance (e.g. blue bonds, biodiversity and blue carbon finance).
Overall policy signal	A risk scenario to be actively avoided, not a neutral reference pathway.	A transition pathway that can deliver better outcomes than BAU if standards and equity safeguards are robust.	A strategic national direction for a regenerative, resilient and equitable marine future, with the highest long-term co-benefits.

Policy Question 25:

Which development pathways best safeguard biodiversity, ecosystem services and coastal livelihoods under conditions of uncertainty and climate change?

Key Message 25: Different policy choices, governance reforms and investment decisions can lead to markedly different ecological, social and economic outcomes for Thailand's marine future. *(Established but incomplete)*

Taken together, the three scenarios demonstrate that Thailand's marine future is not pre-determined: different policy choices, governance reforms and investment decisions can lead to markedly different ecological, social and economic outcomes.

Recommendations: Key Message 25

25.1. Prioritise a Nature-Positive pathway where ecological degradation and climate risk are already high, because it provides the strongest safeguard for biodiversity, ecosystem services, and long-term resilience.

25.2 Use a well-governed Blue Economy pathway as a transitional or complementary route where strong safeguards, transparency, MSP, ICZM, and equitable benefit-sharing can be ensured.

25.3 BAU should not be pursued as a development option.

Policy Question 26:

Which "no-regret" actions are robust across all scenarios and can be implemented immediately?

Key Message 26: Regardless of preferred scenarios, Thailand should implement robust and cross-cutting actions which are beneficial under any plausible future. *(Well established)*

Despite their differences, the scenarios reveal a set of common and immediate policy implications and actions that are robust across futures.

Integrated marine and coastal governance is essential.

Fragmented mandates and uncoordinated sectoral decisions are a key driver of risk in all scenarios. Strengthening ICZM, MSP and cross-agency coordination is a no-regret priority.

Community rights, ILK and co-management underpin resilience.

All desirable futures rely on empowered coastal communities, secure and equitable access to resources, and the active use of ILK alongside other kinds of scientific information in decision-making.

Blue and green finance need to be scaled and better aligned.

Achieving either a strong Blue Economy or a Nature-Positive outcome requires sustained investment from public budgets and private finance, guided by clear environmental and social safeguards to avoid "blue-washing".

Data, monitoring and "signposts" are needed to steer adaptive pathways.

Regularly tracking key indicators of ecosystem health, livelihoods, equity and risk—and linking them to scenario "signposts" —can help Thailand adjust policies and investments over time to stay on a desired pathway.

Regional differentiation and sequencing are important.

Different coastal regions, sectors and communities may need different transition routes and speeds, provided that they remain within a coherent national framework that keeps Thailand on track to reach its biodiversity, climate change, and sustainable development goals.

Recommendations: Key Message 26

26.1 ONEP / MNRE, DMCR, DOF and the Marine Department should establish a standing cross-agency mechanism to align ICZM, MSP and coastal sector planning.

26.2 DMCR, provincial authorities and coastal community networks should strengthen co-management, community rights and ILK inclusion in monitoring and local planning.

26.3 NESDC, MOF, BEDO and financial actors should develop safeguarded blue-green finance pipelines for restoration, community livelihoods and resilient marine industries.

26.4 DMCR with national data platforms and research institutions should establish a scenario signpost and monitoring system, reviewed every 3–5 years.

Policy Question 27:

How can insights from the scenarios guide and stress-test policies and investments linked to Thailand's NBSAP, the KMGBF, the SDGs, the BCG economy and emerging Blue Economy strategies?

Key Message 27: Insights from the scenarios provide a strategic bridge for translating scientific evidence and stakeholder views into Thailand's national and global policy pathways. *(Well established)*

The scenarios are not only tools to envision possible futures for Thailand's Marine BES but also instruments to guide the country toward achieving its national and international biodiversity and sustainable development commitments. By explicitly linking scenario outcomes to Thailand's 5th National Biodiversity Strategy and Action Plan (NBSAP, 2023–2030), the KMGBF, and the 2030 Agenda for Sustainable Development (i.e. the SDGs), the scenarios demonstrate its relevance for policy implementation at multiple levels.

The scenarios therefore provide a strategic bridge: they translate scientific evidence and participatory visions into policy pathways that directly support Thailand's NBSAP delivery, fulfill KMGBF global targets, and contribute to SDG progress. The adaptive sequencing of scenarios moving from conservation-led recovery (2025–2030) to scaling a sustainable Blue Economy (2030–2040) and consolidating integrated resilience thereafter mirrors Thailand's own stepwise commitments under the NBSAP and KMGBF. This ensures that the NEA is not an abstract foresight exercise but a practical policy instrument to monitor, guide, and accelerate national implementation toward 2030 and 2050 biodiversity milestones.

Table 8: Comparative alignment of Thailand's NEA scenarios with policy frameworks (2025–2050)

NEA Scenario	5th NBSAP (2023–2030)	KMGBF Targets (2030)	SDGs	Thailand's BCG Economy Policy & Blue Economy Strategy
 Business-as-Usual (BAU)	Risks undermining most targets, esp. T1–T4 (conservation), T5–T7 (sustainable use), T8–T12 (mainstreaming, finance, capacity).	Fails KMGBF T1–T3 (area-based), T7 (pollution), T8 (climate), T10 (fisheries); undermines T14–23 on mainstreaming and participation.	Negative impacts on SDG 14, 15, 13, and equity-focused SDGs (1, 10).	Threatens biodiversity capital; weakens food, health, and tourism sectors under BCG; undermines sustainability of marine industries under Blue Economy.
 Blue Economy	Advances Strategy 2 targets: T5–T7 (bio based livelihoods, sustainable aquaculture/fisheries/ tourism, ABS). Supports Strategy 3: T8–T12 (mainstreaming, finance, capacity, legal tools).	Advances T9–T13 (sustainable use, fisheries, tourism), T14–T15 (mainstreaming, business disclosure), T18–T19 (finance), T20–T23 (capacity, knowledge, gender).	Aligns with SDG 14.7, 8.2, 9.4, 12.6/12.7, 13. Can create trade-offs with SDGs 14, 15 and 10 if safeguards are weak, ecological impacts are underestimated, or benefits are concentrated among powerful actors.	Directly operationalizes BCG (bio-based industries, sustainable tourism, health innovation, bioenergy) and Blue Economy (green ports, MSP, eco-certification, blue bonds). comparable caution notes for distributional risks and implementation costs.
 Nature-Positive (Blue Economy Plus)	Strongly supports Strategy 1 targets: T1–T4 (protected areas, restoration, resilience, IAS control). Also contributes to Strategy 3 (mainstreaming, capacity).	Advances T1–T3 (30×30, restoration), T7–T8 (pollution/climate), T11 (nature's contributions), T21–T22 (ILK, participation).	Aligns with SDG 14.2, 14.5, 15.1, 15.5, 13.1. May involve short-term trade-offs with growth and employment objectives unless paired with livelihood diversification, compensation, and just-transition support.	Safeguards biodiversity base of BCG sectors (food, health, tourism); anchors Blue Economy strategy with healthy ecosystems and community stewardship.
 Integrated Sequenced Pathway (> Blue Economy >Nature-Positive> Integration by 2050)	Provides holistic alignment across all 12 NBSAP targets by sequencing early conservation with later sustainable growth. Can be aligned with Thailand's near-term biodiversity priorities and longer-term sustainable development goals.	Delivers a comprehensive contribution across KMGBF Targets 1–23.	Supports SDG 13, 14, 15 directly; spillovers to SDG 8, 9, 12.	Offers the most realistic strategy to deliver both BCG transformation and Blue Economy scaling while safeguarding biodiversity.

Confidence levels for the Chapter 8 key messages were assessed using the IPBES qualitative four-box model. Because the scenario assessment is based mainly on qualitative scenario analysis, expert judgement, stakeholder deliberation, ILK, and synthesis of evidence from Chapters 1–7, likelihood terms were not applied. The confidence terms reflect the level of agreement among evidence sources and the quality, quantity, consistency, and traceability of supporting evidence. Overall, the Chapter 8 key messages are assessed as either Well established or Established but incomplete; none are assessed as Inconclusive or Unresolved (Table 9).

Table 9: Evident judgement and rationale to support confident levels of Chapter 8 Key Messages

SPM key messages	Recommended confidence term	Evidence judgement	Rationale
 **Key Message 1.** Thailand faces three contrasting but plausible coastal and marine futures by 2050—BAU, Blue Economy, and Nature-Positive—each involving different trade-offs.	Well established	High agreement; multiple evidence streams	The message is strongly supported by the scenario methodology, the use of Chapters 1–7 as baseline evidence, stakeholder workshops, expert review, and the final consolidation into three archetypes. The Chapter explicitly states that scenarios were grounded in Chapters 1–7, stakeholder knowledge, and a participatory qualitative process. The SPM itself clearly presents the three scenarios and their trade-offs.
 **Key Message 2.** Different policy choices, governance reforms and investment decisions can lead to markedly different ecological, social and economic outcomes.	Established but incomplete	High agreement; evidence is consistent but mainly qualitative	The direction of difference among BAU, Blue Economy, and Nature-Positive is strongly supported by Chapter 8 comparative tables, pathway narratives, impact heatmaps, and policy analysis. However, the magnitude, timing, and certainty of 2050 outcomes depend on future implementation, climate change, finance, enforcement, and social acceptance. Because the finding is not backed by quantitative modelling or probabilistic estimation, it should be rated Established but incomplete, not "Well established".
 **Key Message 3.** Regardless of preferred scenarios, Thailand should implement robust and cross-cutting "no-regret" actions beneficial under any plausible future.	Well established	High agreement; evidence repeated across scenarios	This message is strongly supported because the same enabling actions recur across all scenario pathways: integrated governance, MSP/ICZM, community rights, ILK, co-management, blue-green finance, data systems, and monitoring signposts. Chapter 7 explicitly identifies cross-cutting policy insights and common priorities across all futures. The SPM also lists the no-regret actions directly.
 **Key Message 4.** Insights from the scenarios provide a strategic bridge for translating scientific evidence and stakeholder views into Thailand's national and global policy pathways.	Well established	High agreement; strong policy traceability	The finding is well supported because Chapter 7 contains a dedicated policy-alignment section linking scenarios to the 5th NBSAP, KMGBF, SDGs, BCG economy, and Blue Economy strategy. It also explains that the scenarios are practical policy instruments for monitoring, guiding, and accelerating implementation. The SPM's policy-alignment table reinforces this linkage.

Recommendations: Key Message 27

27.1 Policymakers should examine the NEA scenarios exercise as a policy instrument in to help identify preferred plausible marine futures for Thailand to achieve national and international biodiversity targets and sustainability goals. Also, the scenarios can help policy decision-makers to monitor, guide and accelerate Thailand's progress of implementation on marine biodiversity actions.

27.2 Embed scenario-based stress-testing into the next review cycles of Thailand's NBSAP, marine and coastal resource planning, BCG implementation, Blue Economy strategy development, and provincial coastal plans. ONEP and NESDC should lead the policy integration, while sector agencies can use the three scenarios to test whether proposed investments reinforce BAU risks, support safeguarded blue growth, or move Thailand toward a nature-positive transition.

9 | Pilot Coastal Landscapes in Transition: Trat and Phuket

Pilot ecosystem assessments were conducted in Trat and Phuket, two contrasting coastal landscapes that reflect broader national dynamics of ecological change, economic development, and governance challenges. Using a trialogue approach—integrating scientific knowledge, policy perspectives, and ILK—the pilots provide grounded insights into how biodiversity loss, livelihood transitions, and institutional responses interact in practice. These place-based assessments strengthen the relevance of the Thailand NEA by linking national findings to real-world coastal systems and lived experiences.

Policy Question 28:

How can Thailand manage coastal development pathways to balance economic growth, ecosystem integrity, and community well-being?

Key Message 28: Coastal development pathways must align with ecological limits and community resilience. *(Well established)*

Coastal systems in Trat and Phuket are undergoing rapid transitions, with increasing pressures from tourism, infrastructure, and land-based activities. Current development pathways often fail to account for ecological carrying capacity and long-term sustainability, leading to cumulative impacts on ecosystems and livelihoods.

Recommendations: Key Message 28

28.1 Trat: Strengthen zoning and management of nearshore fishing grounds and critical habitats (mangroves and seagrass), while reducing land-based pressures from agriculture, sedimentation, and coastal development.

28.2 Phuket: Integrate ecological carrying capacity into tourism and coastal development planning, including stricter regulation of infrastructure expansion (e.g., marina developments) and limits on development in ecologically sensitive areas.

28.3 National level: Embed nature-positive and ecosystem-based approaches into coastal development policies, ensuring that economic planning incorporates ecological limits, cumulative impacts, and long-term resilience.

Policy Question 29:

How can land–sea interactions and cumulative impacts be more effectively managed?

Key Message 29: Land–sea interactions and cumulative impacts require integrated governance approaches. *(Well established)*

Ecosystem degradation is driven by interconnected pressures across sectors, including tourism, agriculture, and coastal development. Fragmented governance systems limit the ability to address these cumulative impacts effectively.

Recommendations: Key Message 29

29.1 Trat: Strengthen integrated watershed–coastal management, addressing sedimentation, nutrient runoff, and agricultural impacts on seagrass, mangroves, and fisheries productivity.

29.2 Phuket: Apply integrated coastal and marine spatial planning that explicitly accounts for cumulative impacts of tourism, urbanisation, and infrastructure (e.g., marinas) on coral reefs and nearshore ecosystems.

29.3 National level: institutionalise land–sea integration frameworks, including cumulative impact assessment requirements in MSP, ICZM, and EIA processes, and improve cross-sector coordination mechanisms.

Policy Question 30:

How can ILK (ILK) be strengthened and integrated into coastal governance?

Key Message 30: ILK is essential but increasingly under pressure. *(Established but incomplete)*

ILK provides critical insights into ecosystem dynamics and supports sustainable resource management. However, it is declining due to socio-economic changes and is often not adequately recognised in formal governance systems. In Phuket, communities such as Ao Kung face increasing pressure from development, highlighting the need to safeguard both knowledge and resource access.

Recommendations: Key Message 30

30.1 Trat: Support community-based fisheries and mangrove management systems, including documentation and transfer of ILK across generations.

30.2 Phuket (e.g. Ao Kung): Formally recognise community stewardship and ILK, ensuring that development decisions (e.g., marina proposals) incorporate local knowledge and safeguard traditional resource access.

30.3 National level: Adopt multiple evidence-based approaches by integrating ILK into national monitoring, assessment, and planning frameworks, with clear guidelines for implementation.

Policy Question 31:

How can governance systems address fragmentation, power imbalances, and limited community agency?

Key Message 31: Governance fragmentation and power imbalances limit effective and equitable outcomes. *(Established but incomplete)*

Overlapping mandates, weak enforcement, and limited coordination reduce the effectiveness of coastal management. Communities often have limited influence over decisions, particularly in areas experiencing rapid economic development.

Recommendations: Key Message 31

31.1 Trat: Strengthen local co-management mechanisms and improve coordination among fisheries, forestry, and coastal management agencies.

31.2 Phuket: Establish transparent and participatory decision-making processes, particularly for coastal development approvals, to balance private sector influence and community rights.

31.3 National level: Reform governance frameworks to enhance policy coherence, enforcement, and accountability, and scale up inclusive models such as LMMAs and OECMs.

Policy Question 32:

How can pilot landscapes support the implementation of NEA findings and inform real-world decision-making?

Key Message 32: Pilot landscapes provide a pathway for translating NEA findings into action. *(Established but incomplete)*

The Trat and Phuket pilots demonstrate how integrated assessments can inform real-world decisions, including zoning, tourism management, fisheries governance, and ecosystem restoration. They provide a platform for testing and scaling nature-positive solutions.

Recommendations: Key Message 32

32.1 Trat: Use NEA findings to inform provincial coastal zoning, fisheries management plans, and ecosystem restoration priorities, particularly for mangroves and seagrass systems.

32.2 Phuket: Apply NEA evidence to guide spatial planning, tourism strategies, and EIA processes, including decisions on infrastructure such as marina developments and coastal tourism expansion.

32.3 National level: Designate pilot sites as NEA implementation hubs, linking national policy (e.g., NBSAP, 30×30 target, MSP) with local planning and scaling lessons across provinces.

The experiences from Trat and Phuket show that the transition toward sustainable coastal development in Thailand is not only a technical challenge but also a governance and societal one. By integrating science, policy, and local knowledge, and by aligning development with ecological limits, Thailand has the opportunity to move toward a nature-positive and resilient coastal future.

10 | Conclusion: The Way Forward

Thailand's marine and coastal ecosystems are central to national prosperity but are under increasing pressure from unsustainable development pathways. Current governance, knowledge systems, and investment levels are insufficient to address these challenges.

A transition toward a nature-positive, resilient, and equitable future requires:

- integrated and inclusive knowledge systems,
- strengthened governance and institutional coordination,
- scaled and diversified investment, and
- effective translation of knowledge into policy and planning.

The NEA provides a critical foundation to support this transition its impact will depend on how effectively it is embedded into Thailand's decision-making systems.

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