Food and Agriculture Organization of the United Nations

The Indonesian Seas Large Marine Ecosystem Transboundary Diagnostic Analysis

A brief

Source: IW learn & GEF. n.d. Indonesian Sea (LME). In: *IWlearn*. [Cited on 11 March 2024]. https://iwlearn.net/iw-projects/basins/lmes/indonesian-sea

Background to the Indonesian Seas Large Marine Ecosystem (ISLME)

- One of 66 Large Marine Ecosystems (LME) globally. It is shared by Indonesia and Timor-Leste, providing ecosystem benefits for the well-being of approximately 185 million people.
- Bordered by the major islands of Sumatra (southeast coast), Java (north coast), Bali, Borneo/Kalimantan (south and east coast), Sulawesi, Moluccas, Irian Jaya (westernmost south coast) and the Lesser Sunda Islands chain from Lombok to Timor, and by many smaller islands.
- Situated at the heart of the Coral Triangle north and south of the equator, it is geologically complex and with considerable tectonic activity and is a global centre of marine biodiversity with important fishing grounds.
- An area of important oil and gas resources, major shipping routes (archipelagic sea lanes), and with a high level of coastal and marine tourism.
- Composed of several smaller seas, such as Java Sea, Bali Sea, Flores Sea, Makassar Strait, Banda Sea, Halmahera Sea, Molucca Sea, Savu Sea, and Ombai-Wetar Strait.
- Characterized oceanographically by the Indonesian Throughflow (ITF), linking the Pacific and Indian oceans, and causing unique hydrodynamics with numerous localized upwellings and reversing currents.
- ISLME climate is governed by the seasonally reversing monsoons, and climate phenomena such as the El Niño/Southern Oscillation (ENSO), Indian Ocean Dipole (IOD), and Pacific Decadal Oscillation (PDO), with high sea surface temperatures, rainfall, and humidity.

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The Indonesian Seas Large Marine Ecosystem in numbers

- About 2.32 million km^2 (Indonesia 98 percent, Timor-Leste 2 percent); shelf area (<200 m depth) of 580 000 km^2.
- More than 55 000 km coastline (466 km in Timor-Leste).
- Annual rainfall: 2 000 mm – 4 000 mm; humidity: 75 percent – 85 percent.
- Over 2 500 fish species, over 500 species of corals, 47 species of mangroves and 13 species of seagrasses.
- 11 258 km^2 of coral reefs, 11 782 km^2 of mangrove areas, and 5 200 km^2 of seagrass beds.
- Seven species of marine turtle; dugong, and more than one third of all species of whales and dolphins on earth including the endangered Blue Whale (*Balaenoptera musculus*), aside from other endangered, threatened and protected (ETP) species, among them sharks and rays.
- Total annual fish catch estimated at 3.5 million tonnes.
- Total number of fishing boats operating: >1 000 larger vessels size >30 GT; >500 000 smaller vessels.
- Total annual seaweed culture volume: >9 million tonnes (wet weight); also shrimp and milkfish farming, among other commodities.
- 185 million coastal people highly dependent on coastal and marine resources and industries including fisheries, aquaculture, oil and gas production, transportation.

The Indonesian Seas Large Marine Ecosystem Project — key information

Project Code GCP/RAS/289/GFF; implementation period: 2018 to 2023; budget USD 4 million

The Food and Agriculture Organization of the United Nations, with funding from the Global Environment Facility (GEF), is implementing the Enabling transboundary cooperation for sustainable management of the Indonesian Seas project, which was designed to strengthen regional cooperation and support the effective and sustainable management of the ISLME region.

Conducted in collaboration with the Ministry of Marine Affairs and Fisheries (MMAF) of Indonesia and the Ministry of Agriculture, Livestock, Fisheries and Forestry (MALFF) of Timor-Leste, the ISLME Project covers three key components: (i) identifying and addressing threats to the marine environment including unsustainable fisheries; (ii) strengthening capacity for regional and subregional cooperation in marine resources management; and (iii) coordinating with regional information networks, monitoring of project impacts, and disseminating and exchanging information. A key objective is to undertake the agreed-upon and endorsed Transboundary Diagnostic Analysis (TDA) and Strategic Action Programme (SAP) for the ISLME region.

Additional project objectives are: capacity development and support for integrated coastal management through marine and coastal spatial planning at seven pilot sites; demonstrated local action through implementation of the ecosystem approach to fisheries management (EAFM) and the ecosystem approach to aquaculture (EAA) at seven pilot sites along with habitat enhancement; and participation with regional and global partners in the International Waters Learning Exchange and Resource Network (IW:LEARN) for sharing knowledge and experience on International Waters (IW) and Large Marine Ecosystem (LME) issues.

Aquaculture facilities in West Nusa Tenggara, Indonesia

Transboundary Diagnostic Analysis

The Transboundary Diagnostic Analysis (TDA) was conducted with the strong involvement of the National Scientific Advisory Groups (NSAGs), a panel of national technical experts and key stakeholders in both countries. After completion of two thematic study reports, and the economic valuation of ecosystem services, a causal chain analysis (CCA) was carried out using the following steps:

(i) identify environmental issues with significant impacts across national borders through thorough data analysis, stakeholder interviews and literature review;
(ii) develop a conceptual model of the environmental issues and their root causes by identifying the key drivers of the issues and how they are interconnected;
(iii) develop a causal chain for each identified issue;
(iv) validate the causal chains with stakeholder involvement to ensure accuracy of the environmental issues and their root causes; and
(v) identify proposed priority interventions to address the root causes of the environmental issues, such as policy changes, infrastructure improvements, capacity development, knowledge management, or other interventions.

Various anthropogenic factors, driven by population growth, economic pressures, and climate change (as both cause and outcome), have become growing threats to ISLME resources sustainability. From the rigorous CCA, the following five priority environmental concerns (PECs) have been identified. These concerns necessitate effective management with improved governance and strong stakeholder involvement; sufficient resource allocation with investments in knowledge generation, capacity development, availability of reliable data, technological adoption, and research to address the complexities of these interconnected issues.

The five priority environmental concerns (PECs)

PEC 1: Declining productivity and sustainability of ISLME fishery and aquaculture

SECTORS – artisanal and small-scale fisheries, industrial fisheries, aquaculture at all scales

CATEGORIES – coral reef fisheries, reef gleaning, offshore fisheries, Illegal, unreported and unregulated (IUU) fishing, seaweed farms, offshore caged culture, coastal pond culture

IMPACTS

ENVIRONMENT

- Decline in pelagic, invertebrate, reef fish, and other local fish stocks, also non-target species.
- Decline in reef biodiversity, ecosystem health and water quality.
- Reduced fisheries production and smaller-sized fish.
- Change in fish population structure.
- Degradation and loss of marine habitats, particularly benthic habitats from impacts of fishing gears and fishing activities.
- Loss of coastal habitat and nutrient pollution from coastal land and water-based aquaculture.
- Shading effects on seagrasses from poorly managed seaweed culture.
- Spread of diseases, introduced feral species and threats to local species from introduced cultured species.

SOCIOECONOMIC

- Lower catches, and declining profitability of fishing, and high operational costs to fish further offshore.
- IUU-associated organized criminal activities.
- Reduced production, increased losses, and higher operating costs for aquaculture.
- Pristine coastal scenery and its economic values are negatively affected.
- Negative impacts on coastal subsistence communities, traditional harvesting, reef gleaning, and culture/customary practices.
- Reduction in livelihoods/family income, decline in national and seafood revenue.
- Increased household poverty, food insecurity, malnutrition.
- Diverging perspectives and potential conflicts among local fishers, reef users, and other coastal-marine users.
- Emigration from rural and coastal communities.

IMMEDIATE CAUSES

- Inefficient management of domestic fisheries.
- Overcapacity and overfishing; high fishing pressure in most fishing grounds including commercial and small-scale fishers (SSF).
- IUU fishing and destructive fishing practices, capture of juvenile and immature fishes.
- High level of fisheries bycatch and discards.
- High demand for marine fish as feeds and fishmeal for aquaculture.
- Poor on-farm aquaculture practices.
- Insufficient regulation of aquaculture and inadequate attention to the environment and ecology and subsequent conflicts.

UNDERLYING CAUSES

GOVERNANCE

- Insufficient regulatory capacity for aquaculture and capture fisheries at all levels.
- Limited effectiveness of improvement in compliance, enforcement, monitoring, surveillance, and reporting.
- Future aquaculture production growth targets not aligned with sustainable development principles.
- IUU fishing by domestic commercial and SSF vessels.
- IUU activity of foreign vessels and vessels operating under foreign beneficial ownership.
- The prevalence and fragmentation of rights and the decentralized governance systems lead to gaps or overlaps in the regulatory and management regimes for coastal and marine resources, especially fisheries.
- The approach to management of the fisheries and aquaculture subsectors is inadequately framed in environmental, governance and socioeconomic terms.

SOCIOECONOMIC

- Limited development of fisheries value chains, financial and human resources.
- Harmful incentives and poorly targeted fuel subsidies.
- Inadequate incorporation of aquaculture in fishery management plans.
- Significant numbers and widespread distribution of artisanal, subsistence, and small-scale fishers.
- Aquaculture that conflicts with other users of water / land areas and local versus external investor conflicts.

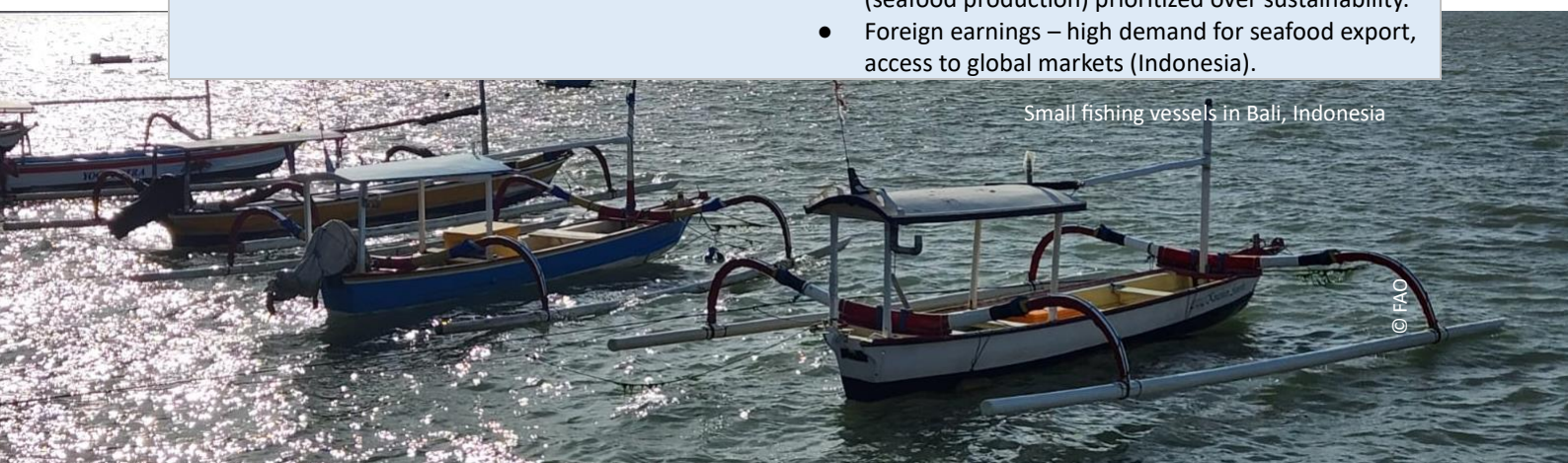
ROOT CAUSES

GOVERNANCE

- Archipelagic geography challenges of huge coastline and fragmentation of systems.
- Overlapping legal and institutional frameworks at all levels.
- Unclear property rights, land and marine tenure.
- Inadequate decentralized and intersectoral planning at all levels.
- Insufficient political will for stronger regulation of the sector.
- Low priority of sustainable fisheries in national and marine policymaking, including the blue economy.
- Cultural and traditional practices in support of sustainable fisheries and aquaculture management not well analysed and recognized.

SOCIOECONOMIC

- Population growth, pressure for food, employment and housing.
- High proportion of the population living in the coastal zone dependent on coastal resources for livelihoods.
- National food security, high levels of domestic seafood demand (Indonesia) for national food security.
- Limited availability of alternative coastal and rural livelihoods options.
- High levels of poverty, low levels of education/literacy.
- Limited environmental awareness and environmental responsibility.
- Economic development and revenue maximization (seafood production) prioritized over sustainability.
- Foreign earnings – high demand for seafood export, access to global markets (Indonesia).



Small fishing vessels in Bali, Indonesia

PEC 2: Degradation and loss of marine habitats

SECTORS – coastal development, agriculture, aquaculture, fisheries, industry, mining, marine tourism

HABITATS – coral reefs, seagrasses, mangroves, soft sediments and beaches, seamounts, pelagic and demersal habitats

IMPACTS

ENVIRONMENT

- Coastal habitat degradation, especially loss of critical habitats.
- Decline of ecosystem health and reduction of ecosystem services; marine biodiversity decline.
- Decline of marine living resources and key species including ETP species dependent on these habitats.

SOCIOECONOMIC

- Reduced fulfilment of food and livelihoods needs.
- Loss of coastal resources (including coastal protection offered by healthy habitats).
- Emigration because of negative effects on livelihoods dependent on marine resources.
- Reduced tourist attraction (loss of potential marine wildlife tourism).

IMMEDIATE CAUSES

- Progressive development within coastal area (housing, tourism, fuelwood, building materials, urbanization, industry) disregarding ecosystem sustainability.
- Unregulated coastal habitat and resource use activities such as destructive fishing practices and overfishing predominantly by small-scale fishers.
- Changing land use (aquaculture, palm oil, agriculture, grazing livestock, salt production, mining).
- Increasing shipping and maritime transport (ports, shipping lanes, building materials, road construction).
- Destructive fishing practices.

UNDERLYING CAUSES

GOVERNANCE

- Predominantly production-based approach ignoring ecosystem based management (including marine protected areas (MPAs), mangrove management).
- Weak regulatory and enforcement capacity.
- Insufficient capacity to use and implement coastal spatial management.
- Limited regulatory capacity at local level to conserve or protect critical habitats.
- Policy focuses on restoration rather than conservation.
- Insufficient environmental impact assessment capacity and implementation for larger-scale development.
- Limited local government capacity in marine habitat management.

SOCIOECONOMIC

- Insufficient financial support for coastal management effort by local communities.
- Insufficient education effort in public awareness of the environment.
- Inadequate capacity development effort for conservation skills of coastal community.

ROOT CAUSES

GOVERNANCE

- Short-term development policy does not require incorporation of long-term considerations for environmental sustainability and maintenance of integrity of ecosystem services.
- Policy and responsibility overlap between institutions.
- Divergence in planning and executing of adaptive management at all levels (e.g. conservation zoning and fisheries zoning not synchronized).
- Legal uncertainty over resource use, development, and protection.
- Insufficient government understanding of ecosystem services.

SOCIOECONOMIC

- Short-term demand for livelihoods and services of natural resource exploitation.
- High dependency on coastal resources for national food security and livelihoods.
- Large coastal population and anthropogenic stressors.

PEC 3: Marine and land-based pollution

SECTORS – industries, maritime transport, agriculture and forestry, mining, tourism, and recreation, offshore energy, fisheries and aquaculture, urbanization

CATEGORIES – marine debris and plastics, sediments, sewage, and nutrients, heavy metals and contaminants, oil spills, invasive marine species

IMPACTS

ENVIRONMENT

- Decline in water quality.
- Decline in environmental quality driven by land-based nutrient sources (e.g. harmful algal blooms (HAB), high coastal turbidity).
- Increased marine contaminant impacts on marine life: acute (toxicity) and chronic (e.g. growth, reproductive health).
- Increased bioaccumulation in the food chain (toxicants, plastics).
- Increased marine debris from multiple sources (land-based and marine-based activity) endanger marine life: e.g. ingestion, entanglements in discarded fishing gear.

SOCIOECONOMIC

- Contaminated seafood, threats to human health.
- Cost of treating illnesses.
- Aesthetic impacts reduce visual amenities and economic value of coastal areas.
- Reduced marine tourism potential for coastal communities (diving, sport and game fishing, marine wildlife tourism).
- Loss of foreign exchange earnings.
- Cost of environmental clean-up, wildlife rescue.
- Increased monitoring, surveillance, and enforcement costs.

IMMEDIATE CAUSES

- Point and non-point land-based sources of nutrients and pollutants (industrial, mining, and urban waste).
- Increased flooding (freshwater, pollutants, etc.) and domestic waste, debris, plastics entering the ocean (riverine inputs), sediment loads from soil erosion.
- Atmospheric deposition (e.g. greenhouse gases, sulphur dioxide or acid rain, lead, organic chemicals).
- Use of antibiotics and chemicals in fishing and aquaculture practices, chemical fertilizers, and pesticides (agricultural runoff).
- Marine debris – solid waste from shipping and fishing industries including discarded fishing gears.
- Marine fouling, unauthorized discharges, and accidental spillages (marine pests, ballast water, fuel/oil, sewage).

UNDERLYING CAUSES

GOVERNANCE

- Inadequate waste and wastewater treatment, control, disposal, and management of coastal urban developments.
- Inadequate monitoring, regulation, and management of small-scale polluting activities (e.g. artisanal mining, aquaculture, recreation).
- Inadequate marine pollution monitoring.
- Deficiency in environmental impact assessments.
- Insufficient integrated coastal management, poor planning and coordination in coastal development.
- Criteria for development approvals not well defined including that of licensing potentially polluting activities.
- Lack of watershed management.

SOCIOECONOMIC

- Insufficient investment, policies, programmes to implement best practices for reducing excess nutrients (from all sources).
- Growing and intensive seafood demand (fisheries, aquaculture), maritime transport sectors and growing oil/gas sector.
- Insufficient biosecurity and quarantine facilities at ports, and waste disposal facilities (solid waste, including fishing debris).
- Limited financial and human resources (particularly at local district, province level).
- Improper land use, poor catchment, and agricultural practices.

Coral reef ecosystem in north coast of Timor-Leste

ROOT CAUSES

GOVERNANCE

- Inadequate, decentralized and intersectoral planning at all levels.
- Ineffective translation of political will into implementation.
- Less priority given to environment and habitat conservation.
- Insufficient appreciation and valuation of ecosystem services (in decision-making).
- Low environmental awareness and responsibility; poor application of precautionary principle, unsustainable development models.

SOCIOECONOMIC

- High proportion of population living in the coastal zone, making it vulnerable to anthropogenic impacts.
- Major dependence on maritime shipping, infrastructure and transport, and coastal industries.
- National energy security – rapidly growing energy sector, particularly coal, offshore oil/gas.
- Generation of export income from production of industrial products that have poorly controlled pollution impacts.
- Suboptimal nature of habitual behaviour in waste reduction and disposal.

PEC 4: Decline of biodiversity and key species

SECTORS – fisheries, marine tourism, maritime transport

CATEGORIES – coral reefs, sharks and rays, sea turtles, whales and dolphins, dugongs, crocodiles

IMPACTS

ENVIRONMENT

- Decline in marine biodiversity and species diversity, including high-value fish, invertebrates, sharks and rays, pelagic fish, coral species, marine mammals, and marine reptiles.
- Decline and loss of critical habitat of key marine species.
- Human and vessel disturbance to marine wildlife, affecting behaviour, feeding, nursing, and reproduction.
- Negative impacts on the health and function of marine ecosystems because of the loss of higher-order predators and the spread of introduced marine species (displacing native species).
- Introduction and spread of marine pests, diseases [as a result of shipping ballast water, aquaculture introductions and escapes].
- Contamination of seafood by various industrial, agriculture, and aquaculture pollutants.

SOCIOECONOMIC

- Negative impacts on local coastal communities including increased poverty, food insecurity, displacement of fishermen, loss of livelihoods and employment, and decline in economic status.
- Loss of cultural totems and traditions (turtles in Bali, crocodiles in Timor-Leste), including traditional harvesting and hunting, and the decline and loss of existing and potential marine ecotourism assets and value.
- Illegal activities, including transboundary fishing and illegal wildlife trade (shark fin, turtles shell, manta ray gills, dugong tusks).
- Impacts on human health (eating contaminated seafood).
- Human–crocodile conflicts in certain areas (Timor-Leste).

IMMEDIATE CAUSES

- Unsustainable and destructive fisheries practices (overfishing, bycatch, and IUU fishing).
- Removal of keystone ecosystems species, leading to proliferation of other species.
- Legal and illegal trade of live reef fish, marine aquarium species, and traditional medicines.
- Declining water quality and increasing marine pollution, affecting especially coral ecosystem health.
- Inadequate management of critical habitats and key marine species.

Mangrove forest in West Nusa Tenggara, Indonesia

UNDERLYING CAUSES

GOVERNANCE

- Weak regulatory capacity and law enforcement of marine species protection and conservation.
- Limited site-based conservation, critical habitat protection, and waste management.
- Insufficient information about critical habitats.
- Insufficient standardized monitoring, information generation and sharing (e.g. on the Indonesian Throughflow (ITF).
- Difficulties in regulating trade in CITES listed ETP species.

SOCIOECONOMIC

- Inadequate support for community-based conservation efforts (e.g. locally managed marine areas).
- Limited resources and inadequate public awareness of impact of demand and trade in ETP species products.
- High local cultural demand for ETP species resources (e.g. shark fins and turtle eggs).

ROOT CAUSES

GOVERNANCE

- High vulnerability and risk to the coastal zone and marine environment.
- Ineffective governance and legal frameworks and weak political will to address biodiversity issues.
- Inadequate environmental awareness and unsustainable development.
- Archipelagic geography and high population in coastal areas.
- Insufficient understanding of the relation between ITF and marine biodiversity.

SOCIOECONOMIC

- High dependency on coastal resources, prevalence of coastal subsistence communities.
- Lack of alternative coastal and rural livelihoods.
- Pressure for food, employment, and housing in the coastal zone.
- High levels of poverty and low levels of education/literacy.

PEC 5: Climate change impacts

SECTORS – Energy, agriculture, mining, industry, maritime transport, aquaculture, fisheries, marine tourism

CATEGORIES – sea level rise, ocean warming, ocean acidification, oceanographic change, seasonal variability, storms, and storm surges

IMPACTS

ENVIRONMENT

- Coastal degradation and islands sinking: loss of habitats, wetlands, beaches, and coral reefs, leading to impacts on biodiversity, fisheries, and critical habitats.
- Increased riverine flooding and landslides because of deforestation and poor catchment practices.
- Reduced freshwater resources: increased saltwater intrusion, salinization, and flooding leading to loss of freshwater resources.
- Climate-driven temperature changes: altered marine fauna and flora distribution, temperature-dependent sex determination (altered sex ratio of fish and reptiles), and reduced ocean productivity (algal blooms).
- Ocean warming related shifts in distribution of fish populations and in growth and productivity of fish; also, acute events of coral bleaching.
- Impacts on shellfish populations: decline and loss as a result of ocean acidification.

SOCIOECONOMIC

- Economic impacts: loss of foreign exchange and domestic earnings from seafood and tourism because of the effect on fish resources and key marine habitats.
- Increased operational costs for fishing in increasingly distant fishing grounds.
- Impacts on local coastal communities: increased poverty, food insecurity, malnutrition, loss of livelihoods, employment, emigration, and cash income.
- Negative impacts on traditional practices and culture.
- Inundation and flooding leading to damage and loss of infrastructure and access: affecting coastal settlements, roads, agricultural land, and transportation infrastructure.
- Impacts on coastal agricultural and aquaculture production.
- Increased risks and dangers for fishermen: decreased fishing time, unpredictable weather, and

sea safety concerns leading to increased maritime accidents.
- Increased water and food insecurity: loss of freshwater resources and increased reliance on fishing during drought, as well as increased costs for accessing food and water on remote, small islands.

IMMEDIATE CAUSES

- Insufficient implementation of climate-smart, low-carbon, and climate-resilient approaches as well as EAFM.
- Climate variability (increased temperature and temperature variability, greater heat stress, prolonged droughts).
- Changes in precipitation patterns (more intense rainfall events, riverine flooding, and droughts).
- Extreme weather events (increased frequency and intensity of extreme weather events; strong winds, storms, storm surges, and cyclones).
- Changes in ocean conditions (ocean warming; increased sea surface temperatures, hypoxia, change in oceanographic processes).
- Ocean acidification and sea level rise (increasing coastal inundation, saltwater intrusion, reduced calcification.

UNDERLYING CAUSES

GOVERNANCE

- Inadequate protection and governance of marine habitats.
- Inadequate climate risk monitoring, predictive modelling, and adaptation planning.
- Insufficient integration of climate change in fisheries and habitat management planning.
- Loss of seagrass, mangroves and other forests leading to decline in natural carbon storage.
- Inadequate research and dissemination of information on greeenhouse gases and other climate related issues.

SOCIOECONOMIC

- High coastal population density, with high vulnerability and limited adaptive capacity to cope with climate change impacts.
- Reduced climate change resilience of coastal ecosystems.
- Harmful incentives and poorly targeted subsidies encourage development that is vulnerable to climate variability.
- Insufficient support for nature-based climate solutions and incentives (e.g. mangrove/seagrass conservation and restoration).
- Limited investment, market instruments, and incentives for renewable energy.
- Limited financial and human resources available.

ROOT CAUSES

GOVERNANCE

- Archipelagic geography challenges (e.g. insufficient mangrove conservation and general habitat management).
- Ineffective governance and legal frameworks.
- Insufficient implementation of coordinated intersectoral planning (e.g. one stop services).
- Modest environmental awareness, appreciation, and responsibility.
- Global threat of increased carbon emission which is not controlled.

SOCIOECONOMIC

- High dependency on coastal resources.
- Economic development and revenue maximization prioritized over sustainability.
- Population growth and pressure for resources.
- Limited infrastructure and economic diversification.
- Global and national phenomena (e.g. increase of greenhouse gases emissions and deforestation).

Socioeconomic characteristics

- Coastal communities rely heavily on the ISLME resources from capture fisheries, aquaculture, and fish processing as the primary source of income and income diversification.
- At least 42 percent of the people engaged in aquaculture and capture fisheries activities comprises women.
- Fisheries is predominantly small scale or artisanal (95 percent in Indonesia and 100 percent in Timor-Leste).
- Most fishing trips are made by small-scale fishers, going out and returning on a daily basis, using small motorized or non-motorized boats.
- Traditional communities in both countries have customary fisheries management practices in a bid to protect fisheries and marine resources in their respective villages/areas.

Value of ecosystem services

The ecosystem services valuation carried out for the ISLME in 2020 (Antony and Mumby, 2021)[1] using available secondary data, estimated the total gross production value (GVP) at more than USD 20 billion annually, with the largest part coming from fisheries and aquaculture (the best-known use of marine ecosystem services) and marine tourism (approximately 10 percent). Pure ecosystem services values were also computed by removing from the market price the values of human supply-chain inputs to approximate the pure ecosystem contribution, and this amounts to almost USD 5 billion annually.

A PEMSEA (2018)[2] report showed that the Indonesian Seas support more than USD 180 billion of economic activities annually and can stimulate increased growth, jobs, food security, and reductions in the current account deficit if ecosystem health is protected for present and future generations. The World Bank (2019)[3] in its report "Indonesia economic quarterly: ocean of opportunity", computed a gross value added (GVA) of the ocean economy in Indonesia of almost USD 300 billion, but this value includes all of Indonesian territory, with high contributions from offshore oil and gas, manufacturing, and marine construction. The estimated Indonesian GVA for fisheries alone – almost USD 30 billion – is comparable to the value derived from the ISLME, USD 20 billion.

Governance and legal, institutional and policy settings

- In Indonesia, 21 provinces with 209 districts or municipalities are located along the coastline and comprise five major Fisheries Management Areas (FMA) FMA 712, FMA 713, FMA 714, FMA 715, and part of FMA 573.
- In Timor-Leste, there are eight municipalities, among them the capital City of Dili.
- Indonesia has adopted the EAFM and the EAA, with their guiding principles based on the Code of Conduct for Responsible Fisheries (CCRF) and ecosystem-based management for sustainable development. Timor-Leste with some capacity building already done, is ready to move forward with EAFM and EAA.
- There is a total of more than 100 marine protected areas (MPAs) of various sizes in the ISLME region, many of them not managed effectively.
- Both countries are party to or adhere to numerous International Conventions and Agreements: e.g. UN Convention on the Law of the Sea, UN Fish Stocks Agreement, Agreement on Port State

[1] **Antony, G. & Mumby, P.J.** 2021. Value of ecosystem services provided by the Indonesian Seas Large Marine Ecosystem. "Enabling transboundary cooperation for sustainable management of the Indonesian Seas Large Marine Ecosystem (ISLME)" project (GCP/RAS/289/GFF).

[2] **PEMSEA**. 2018. PEMSEA annual report 2018: PEMSEA in action. https://www.pemsea.org/sites/default/files/2023-12/PEMSEA_Annual_Report_2018_20190628_compressed_0.pdf

[3] **World Bank.** 2019**.** Indonesia economic quarterly: oceans of opportunity. The World Bank, Washington, D.C. [Cited 19 August 2023]. https://openknowledge.worldbank.org/bitstream/handle/10986/31993/Indonesia-Economic-Quarterly-Oceans-of-Opportunity.pdf?sequence=1&isAllowed=y

Measures, Convention on International Trade in Endangered Species of Wild Fauna and Flora, UN Convention on Biological Diversity, UN Convention on Migratory Species, International Convention for the Prevention of Pollution from Ships and have translated these into national initiatives, e.g. Blue Economy or Blue Agenda. Indonesia leads an 11 country Regional Plan of Action (RPOA) on combating IUU fishing.

- Both countries are collaborating in regional initiatives for the conservation and protection of marine ecosystems and resources, e.g. Partnerships in Environmental Management for the Seas of East Asia; Southeast Asian Fisheries Development Center, Coral Triangle Initiative on Coral Reefs, Fisheries and Food Security, and are members of various regional fisheries management organizations.
- Both countries have ocean policies and fisheries and marine conservation laws in place (Table 1).

Table 1. Laws and regulations on marine and coastal resources management

Laws and regulations in Indonesia	Title
Law No. 45/2009	Fisheries
Law Number 11/2020	Job Creation
Law Number 27 Year 2007	Management of Coastal and Small Islands
Law No. 22/1999	Autonomy Law
Law No. 23/2014	Local Government
Government Regulation No. 27/2021	Marine Affairs and Fisheries
MMAF Regulation No. 18/2014	Fisheries Management Area and its Boundaries.
MMAF Regulation No. 2/2023	Types and Tariffs of Non-Tax State Revenues in the Fisheries and Marine Sectors
MMAF Regulation No. 37/2023	Fisheries Data
MMAF Decree No. 33/2021	Logbook, Surveillance Onboard Fishing Vessels and Fish Carrying Vessels, Inspection, Verification and Fishing Vessel Crew Management
MMAF Decree No. 19/2022	Estimated Fisheries Resources Potentials
MMAF Decree No. 87/2021	Fishing Vessel Productivity
MMAF Decree No. 22/2021	Formulation of Fisheries Management Plan and Fisheries Management Council/Institution
MMAF Decree No. 11/2023	Quota-Based Fisheries
MMAF Decree No. 48/2020	Organization and Mandate of MMAF
MMAF Decree No. 18/2021	Fishing Gears and Supporting Fishing Gears
MMAF Decree No. 10/2021	Business Activity Standard
MMAF Decree No. 79/2016	Fisheries Management Plan in 712
MMAF Decree No. 80/2016	Fisheries Management Plan in 713
MMAF Decree No. 81/2016	Fisheries Management Plan in 714
MMAF Decree No. 82/2016	Fisheries Management Plan in 715
MMAF Decree No. 77/2016	Fisheries Management Plan in 573

Laws and regulations in Timor-Leste	Title
Decree Law No. 6/2020	Biodiversity Protection
Decree Law No. 6/2004	Fisheries and Aquaculture
Decree Law No. 19/2009	Penal Code
Ministerial Diploma No. No. 04/115/GM/IV/2005	The list of protected aquatic species
Government Resolution No. 8/2007	Protection of marine and terrestrial areas
Decree Law no. 5/2016	Creating the National System of Protected Areas
Government Decree Law No. 21/2008	Implementation of Satellite System for Monitoring Fishing Vessels "SIMOCEP"
Ministerial Order No. 01/03GM/I/2005	Definition of Fishing Zone
Law 26/2012	Environmental Base Law
Ministerial Order No. 05/116/GM/IV/2005	Minimum Size and Weight Species to be Captured

Ministerial Order No. 5/GM/I/2015	Aquatic Nature Reserve in Batugade Coastal Area in Balibó Sub District, Bobonaro District
Ministerial Order No. 6/GM/I/2015	Aquatic Nature Reserve in Maumeta-Vila Coastal Area in Atauro Sub District, Dili District
Decree Law No. 4/2016	Council for Final Delimitation of Maritime Boundaries
National Ocean Policy	Blue Economy and marine habitat conservation
Decree Law No. 36/2022	Environmental licence

Stakeholders

Various organizations, agencies and associations are involved in the management of the ISLME region. Continuous efforts have been made to foster meaningful engagement of coastal and fisheries community-based stakeholders, such as small-scale fishers, women's, and youth groups. The following stakeholders have various roles to play, including as donor and funding agencies, as implementing partners, promoting capacity development, institutional strengthening, and information and knowledge generation through research/study, often requiring an integrated, multisectoral approach such as for EAFM. The regional stakeholders help ensure coordination and sharing of expertise and experience to and from the ISLME Project will be maintained. The national and subnational (provincial, district, subdistrict and community level) stakeholders are key to ensure effective design, implementation and monitoring of management measures and other initiatives. With the ISLME project's support, these stakeholders also empower and work together with resource users and coastal people to achieve objectives and targets towards sustainable development of the ISLME.

International organizations: Implementing agencies and multilateral agencies such as FAO and other UN agencies including the World Bank and the Asian Development Bank.
Bilateral agencies or arrangements related to specific countries: Various donor country development partners and international non-governmental organizations (INGOs).
Regional stakeholders: Multicountry arrangements and plans to support joint actions on shared ecosystem or resource management.
National agencies: Various ministries and coordinating ministries and associated agencies of the Government of Indonesia and the Government of Timor-Leste with MMAF and MAF as the technical ministries.
Provincial stakeholders: Provincial and subprovincial government agencies associated with marine ecosystems and fisheries in the 21 provinces of Indonesia covered in the ISLME. The districts and municipalities of the north coast of Timor-Leste and the associated government agencies.
Universities and higher education centres: Universities and higher education centres in Indonesia and Timor-Leste with faculty of marine sciences and fisheries as well as and learning centres for EAFM.
Others: Other private sector for profit and non-profit agencies, civil society organizations, fisher and fishery associations, fishing and maritime industries enterprises.

The way forward: setting priorities towards progress

The TDA findings serve as a scientific basis for the development of the ISLME Strategic Action Programme (SAP) detailing concrete initiatives with clear timeframe, baseline, and targets to achieve through a series of intensive consultations with the fisheries and marine stakeholders at the regional and national- and subnational-level forums. The SAP will further be translated into the National Action Plans (NAPs) for both Indonesia and Timor-Leste to guide the implementation of priority actions to be conducted with strong involvement of all stakeholders.

The SAP and NAPs will document the commitment to sustainable management, allowing joint efforts for planning, budgeting and investment, implementation and monitoring to maintain, conserve and enhance the long-term value of ecosystem services that the ISLME provides for both countries.

Achieving SDG

Despite limitations and challenges, efforts to better manage the ISLME region have been continuously improved in recent years, aiming toward the conservation and sustainable use of the oceans, seas and marine resources for sustainable development. Specific initiatives have been designed and conducted to reduce marine pollution, protect and restore ecosystems, reduce ocean acidification, foster sustainable fishing, conserve coastal and marine areas, design subsidies to promote responsible fishing practices and enhance the economic benefits from sustainable use of marine resources. Investments have been made in scientific knowledge, research, and technological adoption. Special attention is given to support, empower and engage SSF. National policies are also aimed at better adoption, implementation, and enforcement of the international law of the sea.

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