ATSEA

Arafura and Timor Seas Ecosystem Action

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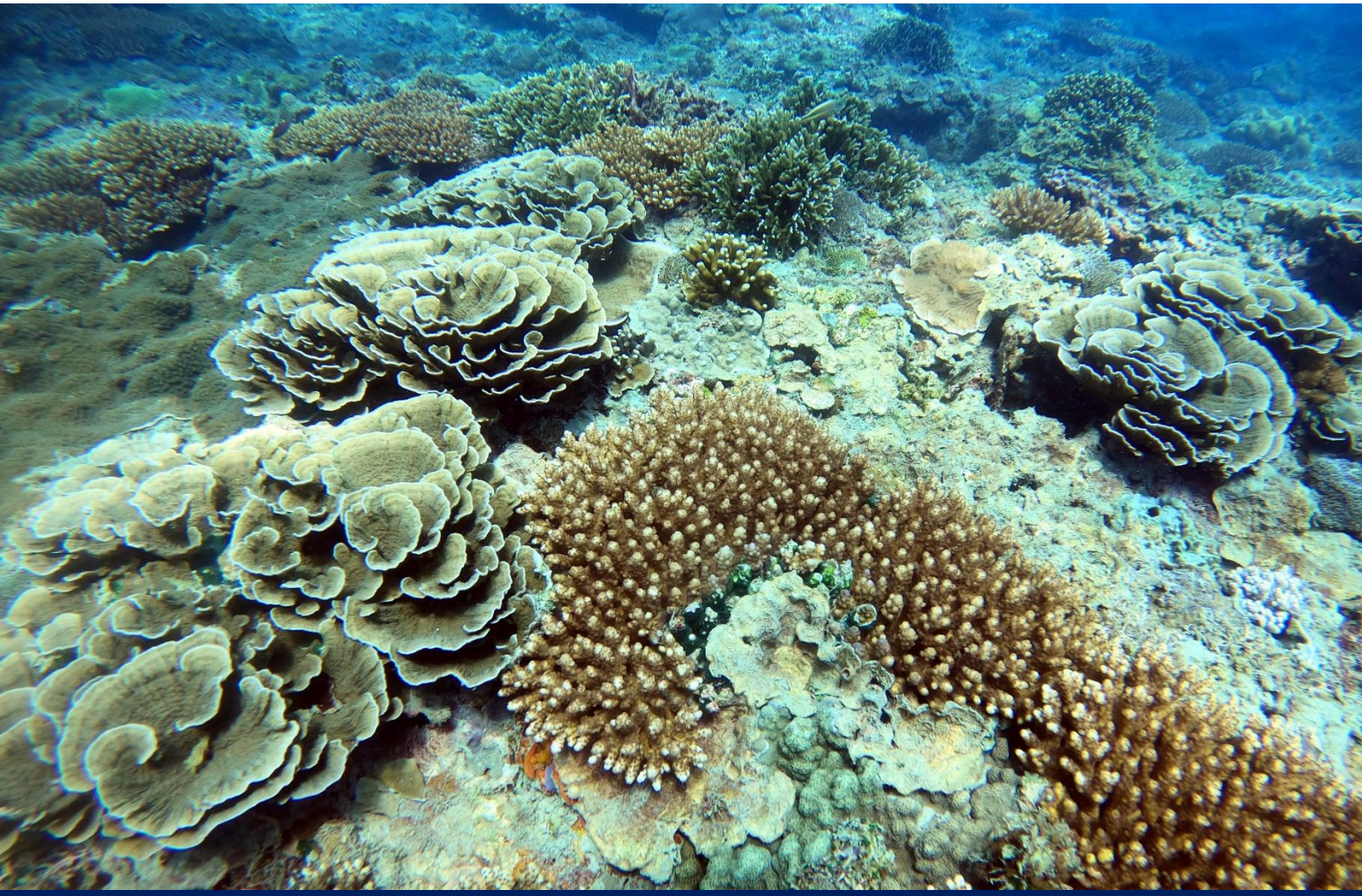

TIMOR-LESTE COUNTRY SYNTHESIS REPORT

2022

This report was prepared by the Arafura and Timor Seas Ecosystem Action Phase II (ATSEA-2) Project

2022

TIMOR-LESTE COUNTRY SYNTHESIS REPORT

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Suggested Citation:
Abilio da Fonseca, Mário Marques Cabral, Walter Oliveira Soares (2023), Timor-Leste Country Synthesis Report. Report to the Arafura and Timor Seas Ecosystem Action Phase 2 (ATSEA-2) Project, Bali, Indonesia, 178pp.

Published by:
ATSEA-2 Regional Project Management Unit
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Denpasar 80224, Bali, Indonesia
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Cover Image: Manufahi Underwater by Marthen, CTC

Printed in Denpasar, Bali, Indonesia

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AIMS	Aid International Management System
AIS	Archipelagic and Island States
ATP	Aid Transparency Portal
ATS	Arafura and Timor Seas
ATSEA-2	Arafura and Timor Seas Ecosystem Approach-Phase Two
BE	Blue economy
CAFI	Council for Administration of Infrastructure Fund
CBOs	Community-Based Organizations
CCA	Causal chain analysis
CCI-TL	Chamber of Commerce and Industry of Timor-Leste
CGI	Coastal Governance Index
CI	Conservation International
CoM	Council of Ministers
CONSANTIL	Concelho Nacional Seguransa Aihan no Nutrisaun
CPUE	Catch Per Unit Effort
CSR	Country Synthesis Report
CTI	Coral Triangle Initiative
DO	Dissolved Oxygen
DPSIR	Pressure state, impacts and responses
EEZ	Exclusive Economic Zone
EITI	Extractive Industries Transparency Initiative
EIU	Economist intelligence unit
FAO	Food and Agriculture Organization
FDI	Foreign Direct Investment
GDP	Gross Domestic Product
GIFT	Genetically Improved Farmed Tilapia
GoTL	Government of Timor-Leste
GPS	Global positioning system
GSB	Government state budget
HABs	Harmful algae blooms
ICM	Integrated Coastal Management
IRI	Index of relative importance
JPDA	Joint Petroleum Development Area
LME	Large Marine Ecosystem
LMMA	Locally Managed Marine Area
MAF	Ministry of Agriculture and Fisheries
MECAE	Coordinating Minister for Economic Affairs
MoF	Ministry of Finance
MPA	Marine Protected Areas
MSWG	Multi-stakeholder Working Group
NAP	National Adaptation Plan
NGOs	Non-Governmental Organizations
NKSNP	Nino Konis Santana National Park
NMA	National Maritime Authority
NOP	National Oceans Policy
NSW	National single window
PACCSAP	Pacific Climate Change Strategic Adaptation Planning
PEMSEA	Partnerships in Environmental Management for the Seas of East Asia
PIANGO	Pacific Islands Association of Non-governmental Organizations
PIDF	Pacific Island Development Forum

PIPSO	Pacific Islands Private Sector Organization
PNDS	National program for village development
PNG	Papua New Guinea
PPP	Public private partnership
RCA	Root causes analysis
SDGs	Sustainable Development Goals
SDP	Strategic Development Plan
SNAs	System of National Accounts
TL	Timor-Leste
TVET	Technical and Vocational Education and Training
UN	United Nations
UNDP	United Nations Development Programme
USAID	United States Agency for International Development
VGF	Viability Gap Funding

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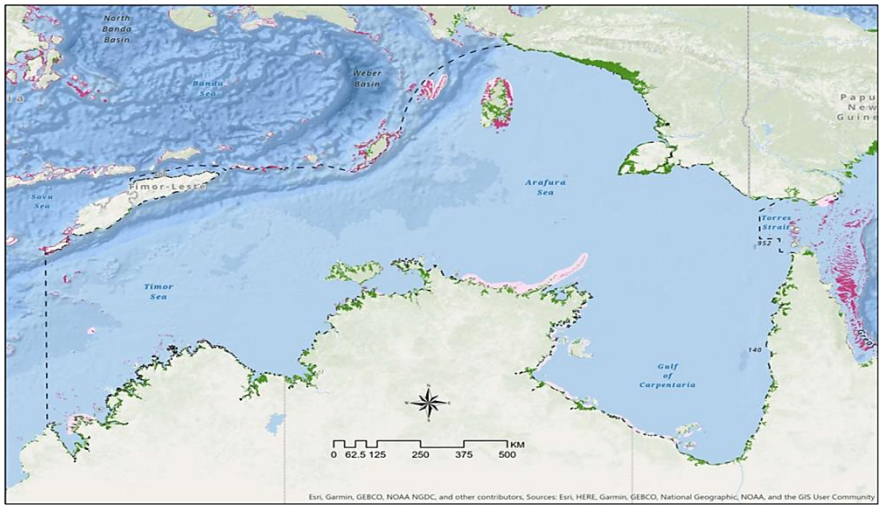
CHAPTER 1. INTRODUCTION

1.1 Background to the ATS Region, ATSEA-2 and ATS TDA-SAP

The Arafura and Timor Seas (ATS) region is bounded by four littoral countries which include Australia, Indonesia, Papua New Guinea and Timor-Leste (see Figure 1). The ATS region covers more than 170 million ha and contains important coastal ecosystems such as coral reefs (shallow and deep), seagrass and mangroves. Shallow coral reefs and seagrass are widely distributed in clearer waters, while mangroves are mostly distributed from the coast of Papua and Papua New Guinea to the north coast of Australia (Johnson et al., 2021) (see Figure 2). Deep reefs are generally associated with sea mounts and are another important habitat, along with pelagic or open ocean habitats. Habitat and ecosystem services in the Timor Seas region greatly contribute to the livelihoods of people living in the ATS Region. Choesin et. al. (2021) estimated that the total annual value of marine capture fisheries in the ATS Region was roughly USD 743 million, while the annual value of all ecosystem services contributed to the economies of littoral countries (using 2016-2020 data) is approximately USD 7.3 billion.

Source: ATSEA-1, 2012

Figure 1 – Map showing four littoral countries



Source: Johnson, et. al., 2021

Note: Important coastal ecosystems of the ATS region; dark pink=coral reefs, light pink=seagrass, green=mangroves.

Figure 2 – Mangrove distribution alongside of the ATS region

Timor-Leste Sub-region

The Timor-Leste sub-region includes waters of Timor-Leste to the south and east and the shallow continental Timor Sea (50–120 m depth). The shelf on the southern coast is wide and relatively shallow, with gentler slopes than the northern coast. The southern coastal plains are wide, and as a result, support many deltas, floodplains, lagoons and mangrove forests. Long stretches of sandy beach with strong waves and surf are common on the southern coast. As a result, the nearshore waters there are turbid most of the time. The southern coast is located toward the west of the ATS, an offshore sub-region characterised by deeper waters - containing slope, rise and abyssal habitats - and several distinct geomorphic features, such as the submarine valleys of the Timor Trough. The trough is an 850 km long valley (2–15 km wide, maximum depth 3,200 m) that extends between the island of Timor and the Sahul Shelf (Alongi, 2011).

Threats to the ATS region

The marine environment in the ATS region is under threat and in significant decline, primarily because of overharvesting and other direct and indirect impacts of anthropogenic stresses including climate change. The Reefs at Risk project identified Indonesian reefs as having the largest area of threatened coral reefs in the ATS region, with overfishing and destructive fishing pressures driving much of the threat, followed by watershed-based pollution and coastal development (Burke et al. 2012). A global study of primary productivity and fisheries in Large Marine Ecosystems under future climate change scenarios projected the greatest declines in potential fish production in the Indo-Pacific, which includes the ATS region (Blanchard et al., 2012).

Fisheries in the ATS region are a particularly complex and productive socio-economic sector, with multiple actors, target species and technologies involved. The main characteristics of depletion of shared ATS transboundary stocks by fishery were assessed as part of the ATS transboundary diagnostic analysis in 2012 (Arafura and Timor Seas Ecosystem Action Program, 2012). The analysis under ATSEA-1 found that the combined pressures of climate change, unsustainable harvesting, destructive fishing practices, Illegal, Unreported, Unregulated (IUU) fishing and bycatch are significantly impacting marine species in the ATS region - particularly

globally threatened coastal marine megafauna including migratory, rare, and threatened species of turtles, dugongs, seabirds/shorebirds, sea snakes, cetaceans, sharks and rays. Fisheries in the Indonesian Sea Large Marine Ecosystem (ISLME) are 88% fully exploited and 12% overexploited, while in the Northern Australian LME, 78% of fisheries are considered fully exploited and 18% overexploited (Sherman, 2014). Marine pollution is also a threat to ecosystems in the region, with major sources comprising marine debris, marine-based pollution from oil and gas activities, land-based runoff from coastal development (Brodie et al., 2019), and waste from fishing and shipping vessels.

ATSEA-2 and ATS TDA and SAP Updating

Considering the significant threats to the marine environment, resources and socioeconomic wellbeing of people in the ATS region, the Arafura Timor Seas Ecosystem Action (ATSEA) Program has been promoting collaboration and cooperation among the four littoral countries to foster a stronger understanding of marine environmental issues, challenges and opportunities, particularly transboundary issues in the region that require collective action among the four countries. The foundations for the collaboration were established through the adoption of the first 10-year ATS Strategic Action Programme (SAP) through a Ministerial Declaration in 2014. The first ATS SAP was developed to provide ATS countries with a common framework for addressing the priority transboundary issues that were identified in the initial Transboundary Diagnostic Analysis (TDA) for the ATS region, which was conducted in 2011 under the first phase of GEF/UNDP project support for the ATSEA program.

Ten years hence, considering progress from the implementation of the initial SAP and various developments in the ATS region, the GEF/UNDP/PEMSEA Project on Implementation of the Arafura and Timor Seas Regional and National Strategic Action Programs (ATSEA-2), the second phase of the ATSEA Program, is supporting an update of the ATS TDA in order to identify priority transboundary issues that should be the focus of SAP for 2024-2034.

1.2 Role of National Marine Ecosystem Diagnostic Analysis Report

The ATSEA-2 Project is implementing the Transboundary Diagnostic Analysis (TDAs) and Strategic Action Programme (SAP) updating process through country and regional level assessments. The country assessment captures essential data and different information relating to marine and coastal resources and identifies areas of concern that will feed into the regional TDAs, SAP, and supporting National Action Programs (NAPs) for Timor-Leste and other littoral countries.

The collection and assessment of data regarding marine and coastal environments is Timor-Leste's national contribution to the development of a regional collaborative program among the four littoral countries in the ATS region, which will be facilitated by the ATSEA-2 Project, under the Global Environmental Facility (GEF) TDA and SAP process. These activities were funded by the GEF and jointly implemented with the support of UNDP and PEMSEA.

1.3 Methodology and Approach

Preparation of the Timor-Leste Country Synthesis Report (CSR) involved the conduct of literature review; the collection of existing secondary and empirical data from various agencies and institutions including academia (published and unpublished); and consultation with key experts and stakeholders at the national, district and village level in order to consolidate and summarize available information on the status of the marine and coastal areas and resources, and identify key knowledge gaps that required primary data collection within the Timor-Leste area of the ATS region. Review of the CSR and inputs from key stakeholders were later facilitated through a multi-sectoral TDA-SAP National Working Group (NWG).

The confirmed core data gaps were collected through field observation in five project sites. To facilitate data collection on the ground structured questionnaires, both for key informants and households, were developed to guide the interview process. Field tools such as tape recorders, cameras, maps and GPS were used alongside questionnaires.

Sites visit was conducted in five project sites (Lautem in Valu and Lore beach, Viqueque in Beaço/Adarai, Manatuto in Natarbora, Manufahi in Betano and Covalima in Suai Loro) from 4 to 27 August 2022, after consultation with local authorities and fisheries officers in each project site. Enumerators were hired to facilitate data collection through interview and direct observation. Fisher representatives were interviewed, including women and girls, to record or verify women participation in marine and coastal resources management and fishing activities.

Besides organising individual meetings with key informants and fisher representatives, the team also organised Focus Group Discussions (FGD) and mini workshops in each project site to capture ideas and relevant feedback on the data and information being collected. The FGDs were organised in consideration of gender representation, to ensure that women's voices can be included in decision-making and data-gathering processes.

Approximately 25 people (fisher representatives and key informants) from each project site were interviewed. In each site, interviews were conducted both at the household level and village office (*Sede Suco*), followed by a mini workshop as part of the validation process.

CHAPTER 2. BIOPHYSICAL PROFILE

Timor-Leste is situated within the Indo-West Pacific faunal community (Alongi et al., 2011). Timor-Leste is also part of the Indo-Australian region, which in terms of biodiversity, is recognised as being the richest faunal area worldwide. Many genera and fish species are consistently present across the region (Alongi et al., 2011), and it is a biologically diverse nucleus of coral reefs, spanning across Indonesia, Papua New Guinea and Timor-Leste. The Timor-Leste reef fish fauna also shares a very similar zoogeographic composition with that of the island of Raja Ampat, Indonesia. Approximately 60% of species have wide-ranging distributions in the Indo-Pacific region. Another 20% of species have a more restricted distribution that is confined to the Indo-Australian Archipelago, of which Timor-Leste forms an integral component (Alongi et al., 2011).

Fish species and larval life are significantly related to geographic distribution. Very little evidence of strict endemism has been found among Timor-Leste reef fish, which is understandable considering the proximity to Indonesia's Lesser Sunda Islands, and the strong currents that facilitate connectivity among them. The endemic fishes of Lesser Sunda have also been recorded in Timor-Leste, providing strong support for the inclusion of Timor-Leste in the Lesser Sunda Eco-Region (Alongi et al., 2011).

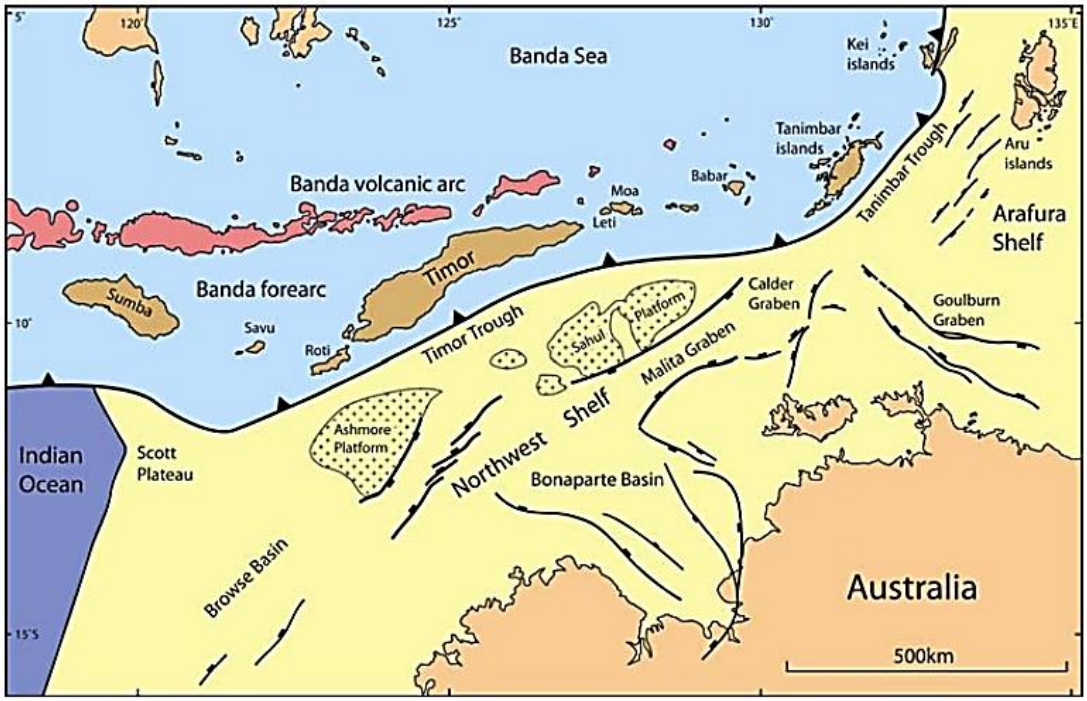
The marine and coastal waters of Timor-Leste comprise a rich variety of fish and non-fish species. A marine survey conducted in 2012 found seven potentially new marine species and extremely high concentrations of biodiversity with 734 fish species and 360 species of coral recorded (The Asian Development Bank, 2014).

Timor-Leste experiences a high degree of land-sea connectivity and globally significant marine ecosystems (Edyvane et al., 2009), including around 350 coral species which is more than 70% of the total number of species described worldwide (Foale, Adhury, Alino, & Allison, 2013). Timor-Leste also has huge diversity of fish, invertebrates that are regularly caught by local/traditional fishers for cash and for domestic consumption (Edyvane et al., 2009 and Mills et al., 2013).

2.1 Physical Setting

2.1.1 Description of the ATS waters (*country*) – including seafloor and geographical/hydrographical features (map)

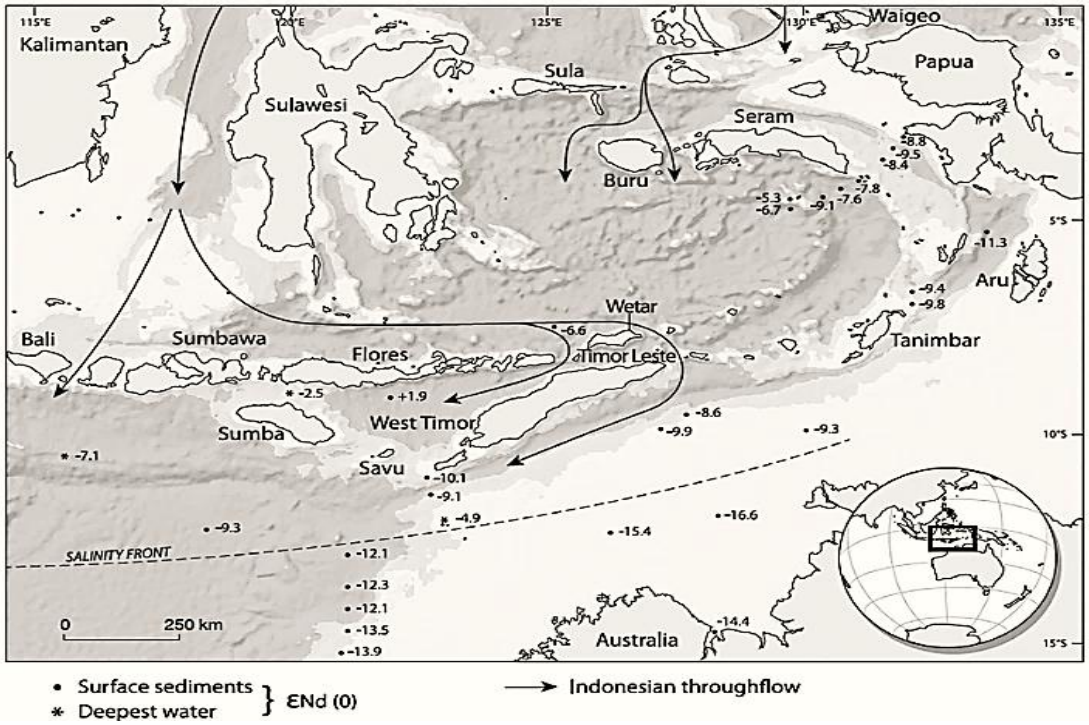
The small islands configuration of Savu, Rote, Timor, Babar, Moa, Leti, Tanimbar, and Kei located in the Arafura and Timor Seas and across the southern and eastern Banda non-volcanic arc (Figure 3) were settled during the Neogene zone from the collision between the Banda Island arc and the formerly passive northwestern continental margin of Australia. The Australian plate was exposed in the fold and thrust belt in the collision complex. And now the Timor Island seafloor has been spreading to the north of Australia (FOSI, 2012). The island of Timor plate is a micro plate in Southeast Asia that has been moving to the northern side at about 44mm/year. The Australian Plate is subducting under the southern edge of Timor Plate and its surrounding islands, and at the same time there is a small divergent boundary on the eastern edge of the plate, while on the other hand, the Banda Sea Plate to the north has a convergent boundary *[https://en.wikipedia.org/wiki/Timor_Plate]*.



Source: FOSI, 2012

Figure 3 – Tectonic setting of the southern and eastern Banda arc

The Timor Sea is in the Indian Ocean, bounded by the island of Timor to the north, by Australia to the south, and by the Arafura Sea to the east. The coverage area is approximately 610,000 km^2 with a maximum width of 480 kilometres. The Timor Sea is relatively shallow with a maximum depth of 3,300 metres and average depth of 406 metres. It is influenced by the monsoon belt and southeast trade winds, and tropical cyclones sometimes originate and pass through the Timor Sea. The area is also subjected to the Timor Current which flows from the south to west between Australia and the Indonesian Archipelago. This current pattern pushes water mass from the Pacific Ocean to the Indian Ocean. Meanwhile, the Arafura Sea is categorised as a marginal sea of the western Pacific Ocean that is located between Australia and Papua New Guinea. The sea covers around 650,000 km^2 with a maximum length of 1,290 kilometres from north to south and a maximum width of 560 kilometres, with depths ranging from 50 to 80 meters. This location is an important linkage to the Pacific Ocean and Indian Ocean [*https://www.worldatlas.com/seas/timor-sea.html*]. The west of Papua New Guinea is an important area related to the Indonesian throughflow which affects the surface sediment transport across the Arafura and Timor Seas (Figure 4).



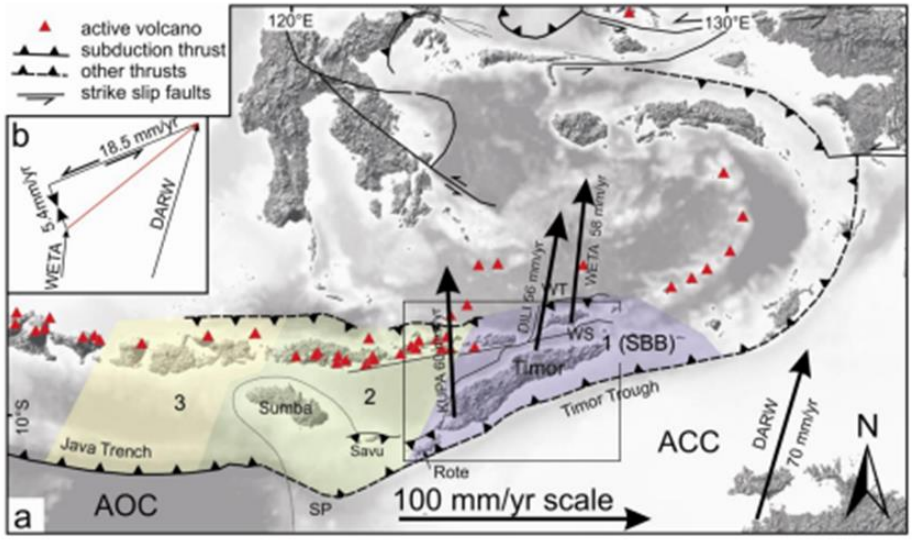
Source: Alongi et al., 2013

Figure 4 – Indonesian throughflow affected the surface sediment across the Arafura and Timor Seas

The coastal morphology of Timor-Leste's southern and northern coasts demonstrate contrast. The southern coast is characterised by a continental shelf, which is wide and gently sloping. In addition, it has wide coastal plains which are characterised by floodplains, lagoons, river deltas and mangrove swamps (Boggs et al., 2009). On the southern coast, the exposed waters, adjacent to the Timor-Sea, are rougher, shallower and more turbid compared to those on the north coast. This has 'resulted in long stretches of sandy beach with heavy and/or strong waves and surf' (Sandlund et al., 2001). Conversely, coastal morphology on the northern coast is rocky and steep along the shoreline. The continental shelf is narrow, and coastal plains have a high profile. Moreover, the littoral zone is very narrow. The floor is dropping off sharply into a 3 km-deep marine trench (Edyvane et al., 2009). The northern coast has deeper waters that are adjacent to the Banda Sea. The wet season in Timor-Leste is relatively short (4-5 months) per year. According to Boggs et al. (2009) almost all vegetation along the northern coast is of arid woodland type. Many species of soft corals and seagrass meadows are abundant on the north coast (Edyvane et al., 2009).

2.1.2 Geology, bathymetry, coastal processes

The geology of Timor-Leste comprises the relative motion vectors of Sunda Shelf to the eastern Java Trench (Wetar-WETA, Kupang-KUPA and Dili-DILI) and Darwin-DARW (Duffy, 2012). According to Duffy, (2012), there are coupling zones ranging from 1 (maximum coupling of South Banda Block-SBB) to 3 (minimum coupling of eastern Java Trench, Wetar Trust-WETA, Wetar Suture-WS, Australian Continental Crust-ACC, Australian Ocean Crust-AOC, and Scott Plateau-SP). There is a ~20mm of differential movement between Darwin and Wetar into trough-normal shortening of ~5.4mm/year. And it is trough-parallel left-lateral shear components of ~18.5mm/year as presented in Figure 5.



Source: Duffy, 2012

Figure 5 – Tectonic setting of Timor and the Banda arc

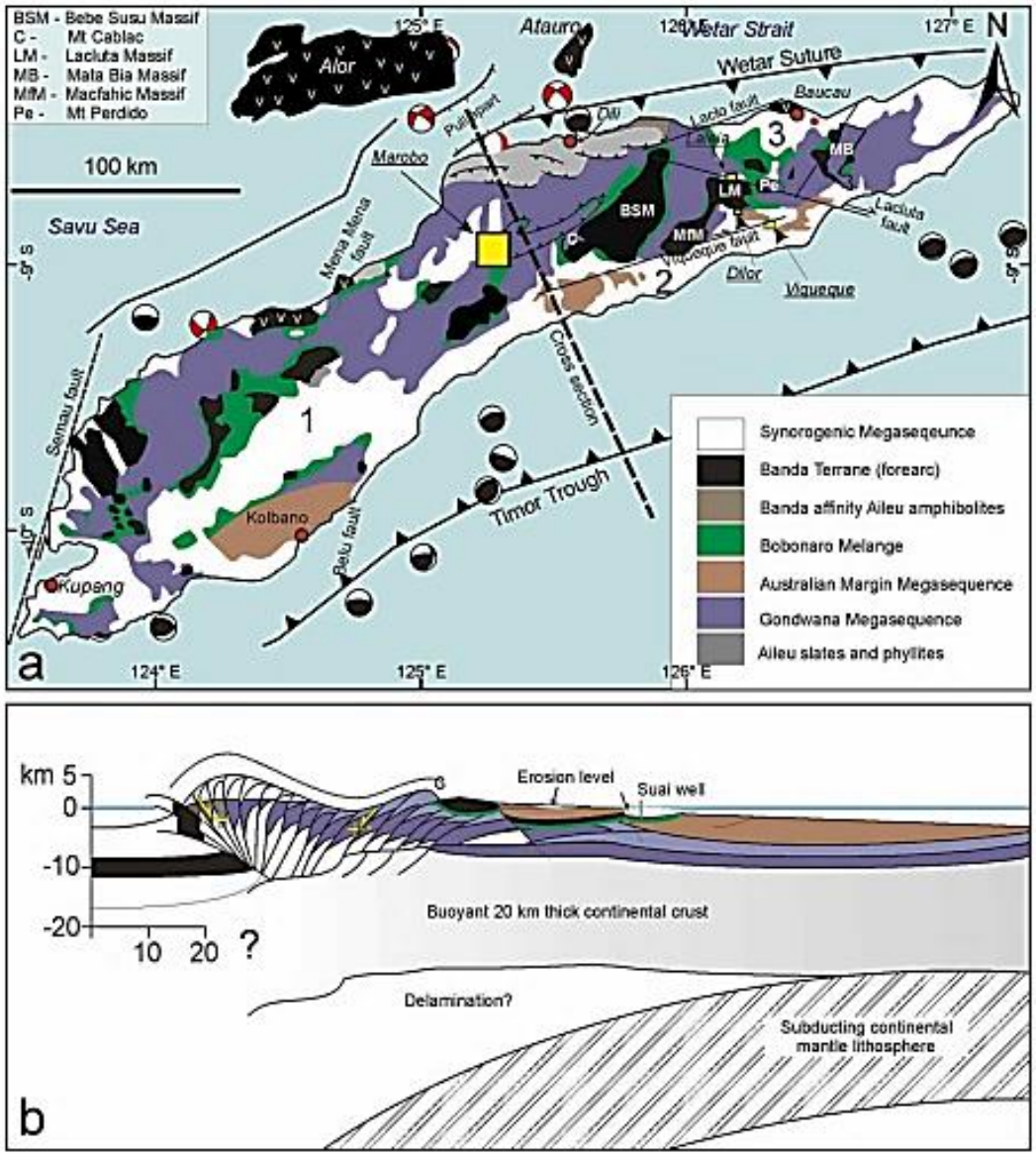
Coastal process and alteration in Timor-Leste mostly occur in areas of surf, breaking waves and intensive glint for benthic habitat areas (NOAA, 2017) with the estimation of total depth of 120 km, stretching to the surrounding areas of Atauro Island 15.1 km^2, Oecusse 19.3 km^2 and north-south shores 85.6 km^2 (Table 1). A mapped habitat dataset from the shallow coastal seafloor (0-20m) of Timor-Leste grouped the area into 8 habitat types as follows: 1) hard substrate, 2) soft substrate, 3) seagrass, 4) mangrove, 5) macroalgae, 6) intertidal, 7) emergent rocks, and 8) lagoon (NOAA, 2017).

Table 1 – Summary of the satellite-derived bathymetry and habitat classification

Region	Derived Bathymetry (km^2)	Benthic Habitat (km^2)	Hard Substrate (km^2)	Soft Substrate (km^2)	Seagrass (km^2)	Mangrove (km^2)	Macroalgae (km^2)	Intertidal (km^2)	Emergent Rocks (km^2)	Lagoon (km^2)	Unknown (km^2)
Atauro Island	15.1	13.1	7.1	3.6	2.4	0.1	–	–	–	–	7.7
Oecusse	19.3	12.6	3.8	6.8	2.0	< 0.1	–	–	–	–	16.8
North Shore	85.6	76.9	35.1	16.3	10.5	2.7	6.2	3.3	0.5	2.3	249.1
South Shore	–	32.7	14.3	15.3	3.0	0.1	–	–	–	–	120.0
Total	**120.0**	**135.3**	**60.3**	**41.9**	**17.9**	**2.9**	**6.2**	**3.3**	**0.5**	**2.3**	**393.6**

Source: PIFSC, 2017

There are three main synorogenic (recrystallisation of metamorphic rock) basins laid on the central basin of western Timor, and southern and northeastern Timor-Leste (Figure 6).



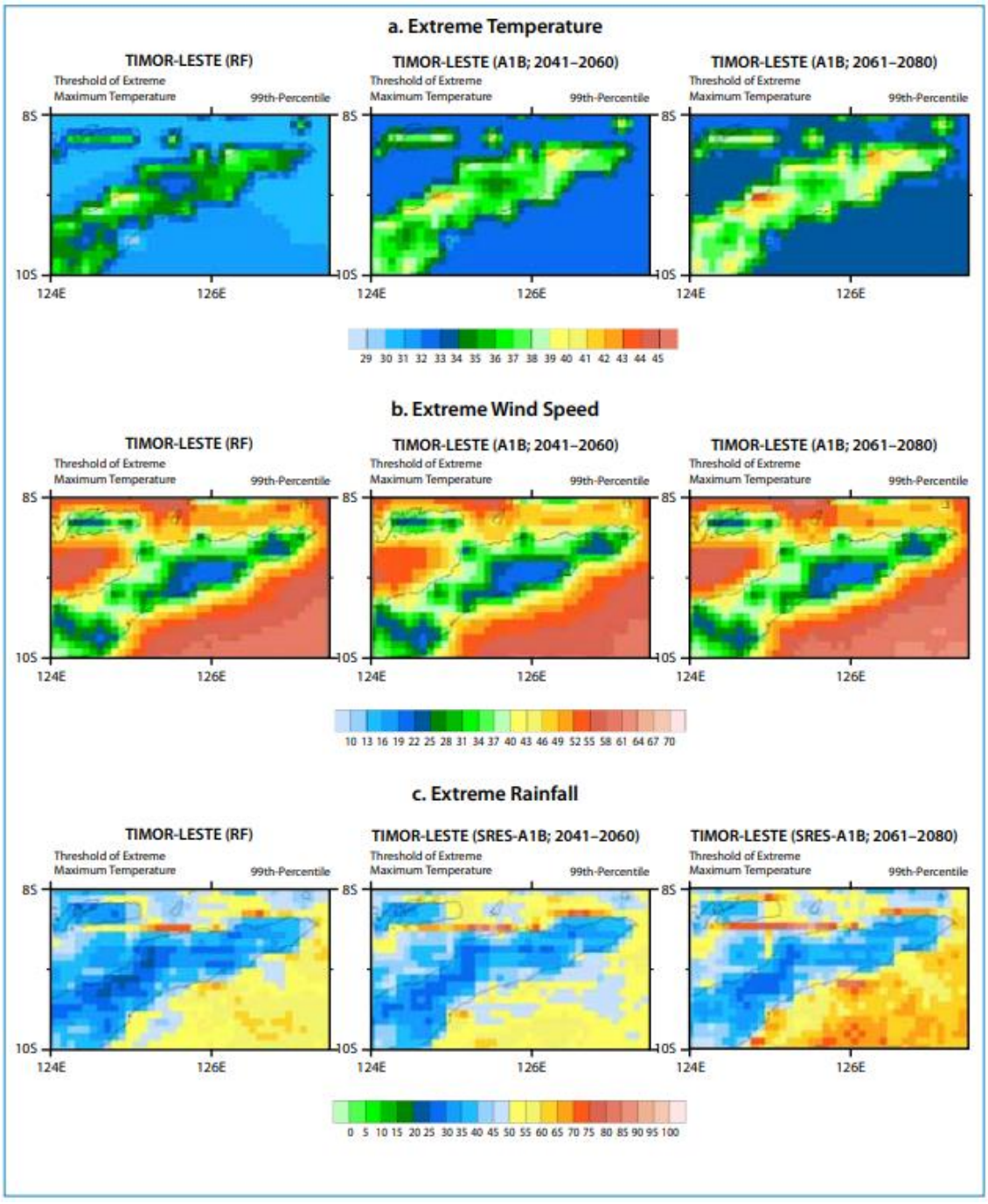
Source: Duffy, 2012

Figure 6 – Map of Timor geological sketch and its terrine distribution

2.1.3 Climate and climate drivers

Timor-Leste experiences extreme temperature, wind speed and rainfall due to its geographical position in Asia and the Pacific. By 2070, Timor-Leste is projected to experience a temperature rise on average of more than 2.5°C. The Government of Timor-Leste, recognising the strong interdependence of climate change adaptation and the developments envisioned in the strategic development plan, issued the Dili Declaration on climate change adaptation as part of Intended Nationally Determined Contributions (INDC) under the UNFCCC framework.

Under the baseline climate scenario by 2070 (Figure 7), there will be a rising temperature ranging from 29°C around the coast of Covalima (southern part) to 40°C on the coast of Bobonaro (northern part). There would be an increase of extreme temperature over time up to the year 2070, followed by extreme wind speed patterns on the ocean of around 64 km/h. The warmest area would continue to be in Bobonaro, with temperatures potentially reaching levels that could bring tropical storms. The rainfall is projected to be around 72 mm/day, the driest in comparison to most Pacific countries (ADB, 2013).



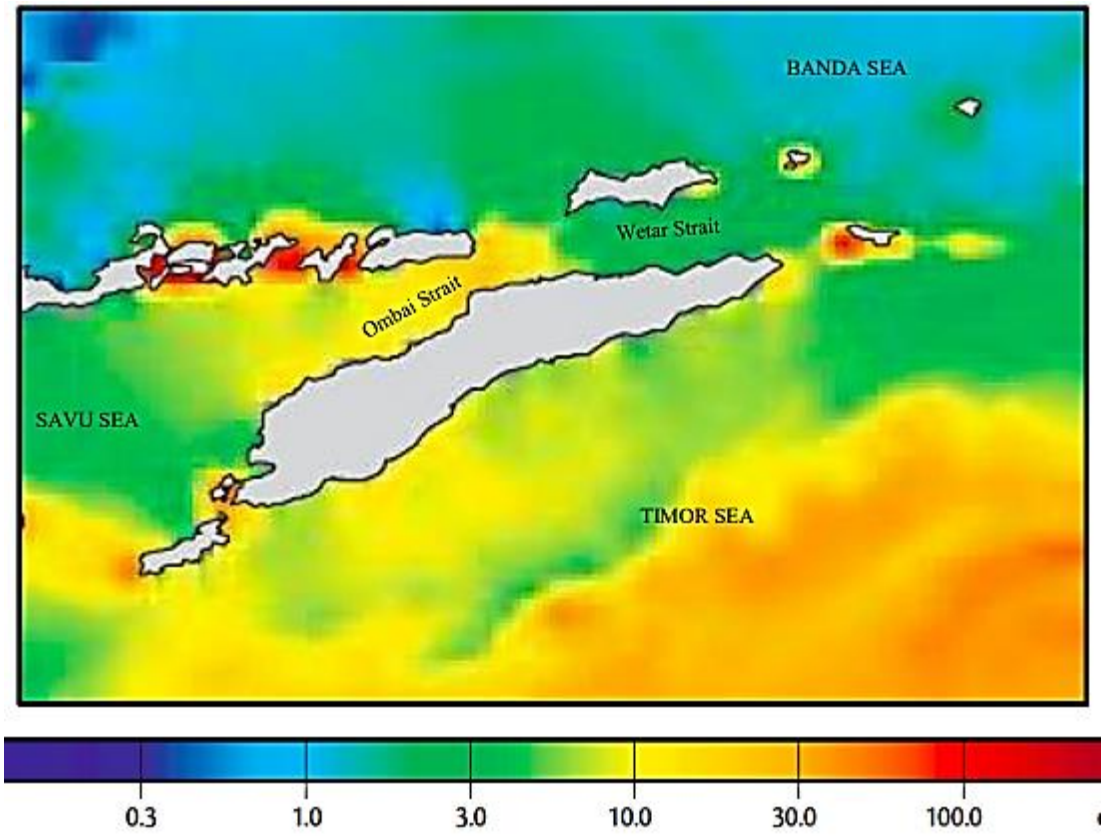
Source: ADB, 2013

Figure 7 – Extreme temperature, wind speed and rainfall projections in Timor-Leste

Informed by those scenarios, the Asia Development Bank (ADB) (2013) recommended adaptation options in coastal areas of Pacific countries, including Timor-Leste to: i) Undertake climate-proofing of critical infrastructure; ii) Adjust current coastal zoning regulations taking into consideration future land coverage and coastal inundation; iii) Strengthen institutional ability to implement land-zoning restrictions; iv) Incorporate future coastal-inundation coverage with local flood-risk analysis when doing land-use planning; v) Develop plans in coastal management incorporating coral-reef conservation and protection; vi) Enhance the existing early-warning system to include coastal inundation management schemes; and vii) Plan temporary or permanent migration strategies for rising sea levels, intensified typhoons and higher tides.

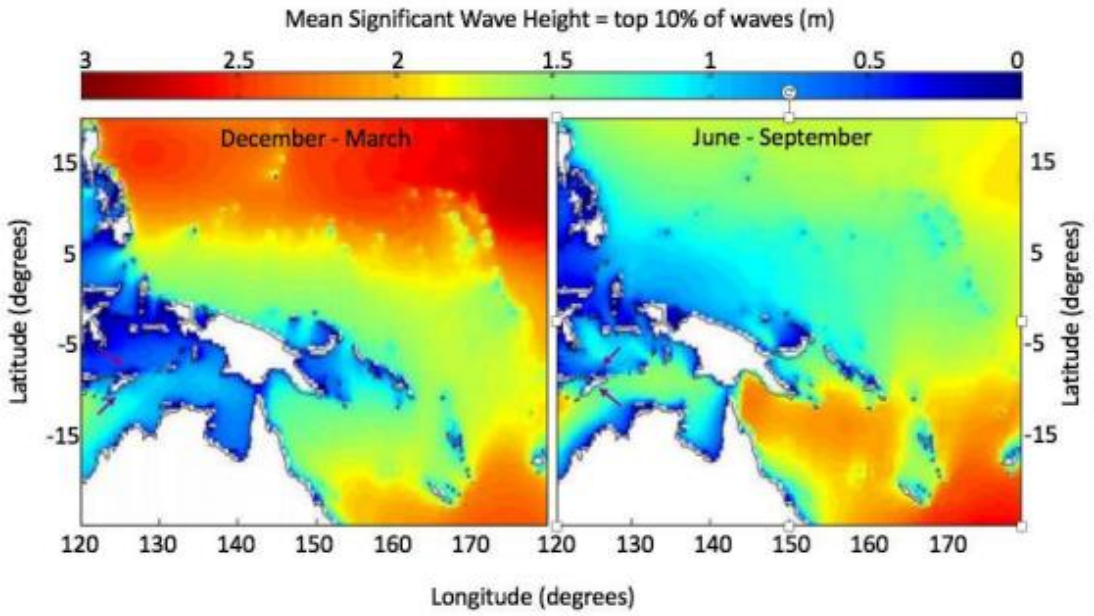
2.1.4 Ocean currents, processes, productivity and circulation

Ocean and coastal environments of Timor Islands and its surroundings show that the tidal currents formed in Ombai Strait are up to 30 cm/s in between Bobonaro, Liquiça, Dili and the Alor Archipelago as being indicated in the yellow/orange spectrum in the Ombai Strait (Figure 8). Further to the east, in the Wetar Strait, coastal tidal currents fall below 10 cm/s but further toward the south-eastern tip of Timor-Leste, they approach 20 - 30 cm/s (UNDP, 2017).



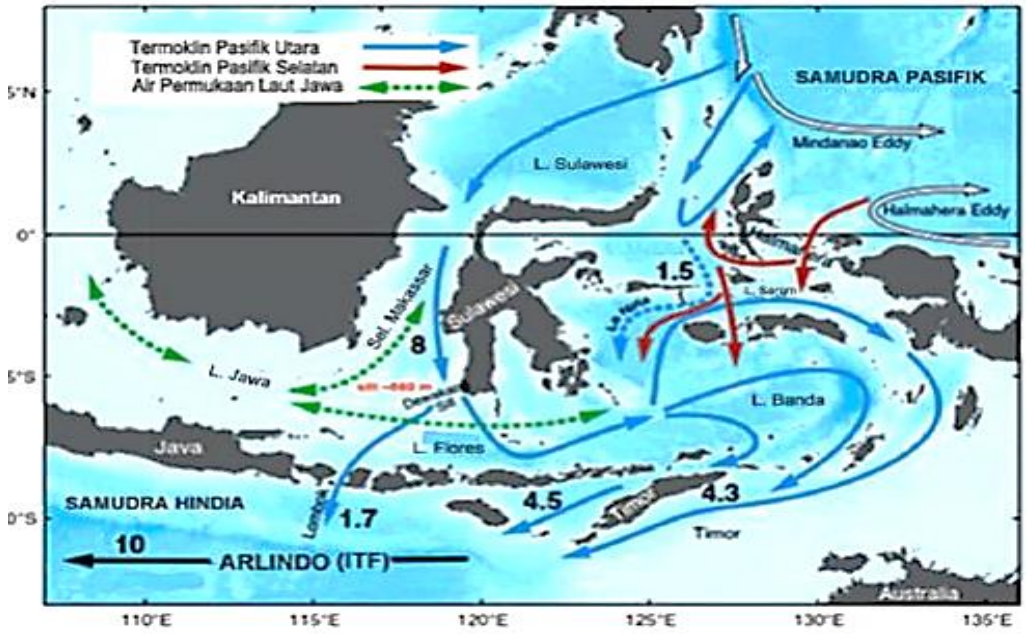
Source: UNDP, 2017
Figure 8 – Tidal current performing in Ombai and Wetar straits

On the southern shorelines, predicted significant wave height, which represents the wind wave height of the top 10% of waves, reaches approximately 1 m from the South-west during December to March. During the period from April to June, wave height reaches up to 1.5 m from the South. Extreme storm driven wind waves reach between 2 and 3 m on the southern shores. On the northern shores predicted significant wave heights during December to March fall below 0.5 m from the north-west *[https://www.cawcr.gov.au/publications/technicalreports.php].* From June to September, significant wave heights also fall below 0.5 m but come from the north-east (Figure 9).



Source: UNDP, 2017
Figure 9 – Maps of predicted wave climates over the region

Figure 10 shows the Indonesian Through Flow (ITF) passing through Ombai Strait in front of Atauro Island from the Mindanao Eddy that circulates the current of the Pacific Ocean from Sulawesi Sea to Ombai Strait before passing through Savu Sea with a sea water volume transport of 7-10Sv (1Sv (Sverdrup) = 10^6 m^3/sec) in October to March each year as the upwelling and down-welling dynamic which has an abundance of chlorophyl-a. The ITF has a significant effect on Timor-Leste's coastal and marine ecosystems and more broadly, on the Lesser Sunda Eco-Region also. It occurs alongside the north coast of Timor-Leste, thus providing a rich feeding habitat for the resident and migratory marine megafauna such as whales, dugongs, turtles and manta rays (Edyvane, 2018).



Source: UNDP, 2017

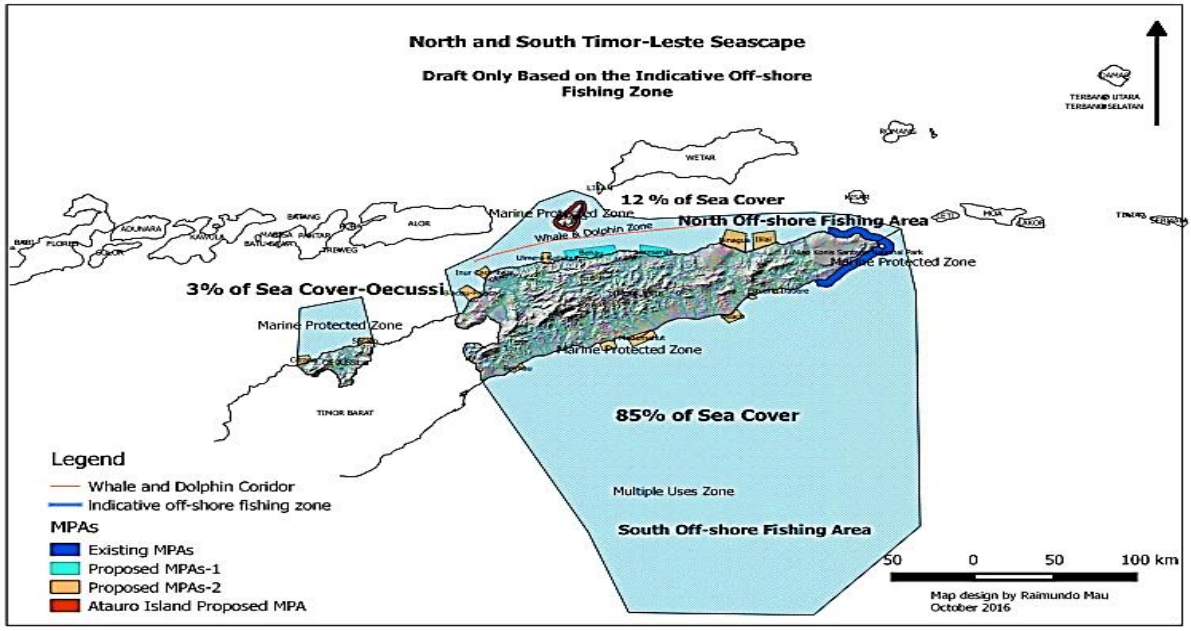
Figure 10 – Indonesia through flow of north-west pacific thermoclines and Java Sea surface waters

2.2 Biological Setting

2.2.1 Biogeography – including seascapes, regional patterns and ecological connectivity

The bathymetry and oceanography of the ATS region, characterised by shallow continental shelves and semi-enclosed gulfs, have resulted in strong connectivity between oceanographic and ecological processes such as the movements of larvae, pelagic and migratory species. This means that species and fish stocks are shared between jurisdictions, e.g., offshore demersal snapper fisheries for *Lutjanus malabaricus*, *L. erythropterus* and *L. argentimaculatus* (Blaber et al., 2005), and globally significant populations of migratory protected species are found throughout the ATS region (Alongi et al., 2011). The Arafura Sea plays an important role as feeding and nursery ground for migratory species such as dugongs, cetaceans, sawfishes, elasmobranchs, as well as nesting for turtles and other birds (Klain et al., 2007).

The seascape is defined as a large, multiple-use marine area that are demarcated scientifically and strategically in which government authorities, private organisations, and other stakeholders cooperate to conserve the diversity and abundance of marine life, and to promote human well-being (Atkinson et al., 2011). The spatial mapping of Timor-Leste's seascape comprises nearly 3%, 12%, and 85% of fishing zones that cover respectively the Oecusse, north coast and south coast waters (Figure 11).



Source: Timor-Leste's Country Report to SOM-12 CTI, 2016
Figure 11 – Seascape mapping of Timor-Leste's northern and southern fishing zones

Timor-Leste contains several globally significant ecosystems, such as mangroves, rainforest, wetlands, and other marine ecosystems, and endemic species with an estimated 41,000 plant species (Country Partnership Strategy, Timor-Leste, 2016-2020). Timor-Leste has already declared some protected areas (46), both marine and terrestrial. The marine and coastal biodiversity is part of the Coral Triangle which covers Indonesia, Papua New Guinea, the Philippines, Malaysia and Solomon Islands. The Coral Triangle is home to many species of fish and non-fish species such as whales, sharks and manta rays. The Coral Triangle region sustains around 120 million people including approximately 600,000 Timorese people (UNDP, 2023).

2.2.2 Coastal ecosystems, reef scapes and habitats (coral reefs, seagrasses and mangroves)

Timor-Leste is mostly dominated by fringing reefs. These coral reefs are strong and persist under climate pressure or coastal environments typically on the northern coast. These fringing reefs are mostly found in river mouths such as in Behau (Manatuto) and Watubou in Liquiça. Tomascik et al., (1997) have classified Timor-Leste's fringing reefs as an oceanic fringing reef which is very similar to the fringing reefs of Sulawesi and Flores of Indonesia. These reefs are mostly growing well on the northern coast. According to Audley-Charkes, (2004), these corals are also 'characterised by karst geology and uplifted ancient coral reefs'. These coral reefs are living together with seagrass meadows on the northern coast.

Boggs et al. (2009) produced a viable map of Timor-Leste's corals, confirming that shallow coral reefs in Timor-Leste occupy an area of approx. 3,000 ha, particularly on the northern coast. In addition, they also attempted to map a potential of more than 60,000 ha of coral habitat in deeper waters on the northern coast as well. Boggs and his team (2009) have affirmed that, on the deep water most of corals found tend to be encrusting and enlarge their surface area to optimise exposure to light from the sun. There are also various sponges and whip corals found at that depth.

Acropora is the large group of reef-crest hard corals in fringing reefs and dominant on the northern coast. These corals are mainly Heliopora, Millepora, Xenia including Briarium. Conversely, sponges, hydroids, and algae groups including ascidians and montipora corals are dominant on the southern coast (Boggs et al., 2009). Different corals (hard and soft) across Timor-Leste are presented in Table 2.

Table 2 – Corals and their areas of cover across the country

District	Sites (#)	Hard coral % (SE)	Soft coral % (SE)	CCA % (SE)	Macroalgae % (SE)	Turf algae % (SE)	Sand % (SE)	Benthic Substrate Ratio
Oecusse	16	17.2 (3.0)	13.7 (3.9)	0.7 (0.3)	1.8 (0.5)	47.9 (4.6)	12.2 (2.5)	**0.9**
Bobonaro	16	14.0 (2.5)	17.8 (3.8)	2.4 (0.7)	1.5 (0.7)	54.5 (4.3)	4.7 (1.8)	**0.8**
Liquica	26	10.7 (1.6)	22.9 (3.6)	1.8 (0.7)	2.4 (0.6)	46.7 (4.7)	9.0 (1.6)	**1.4**
Atauro	22	20.5 (2.0)	10.7 (1.9)	7.7 (1.4)	5.2 (0.9)	39.8 (4.0)	4.4 (1.7)	**1.2**
Dili	14	13.2 (1.3)	24.0 (3.5)	4.6 (0.8)	2.1 (0.6)	35.4 (4.8)	13.6 (2.7)	**1.5**
Manatuto	13	17.0 (3.6)	8.9 (2.1)	2.9 (1.0)	2.2 (1.0)	51.8 (4.6)	8.7 (3.6)	**0.7**
Baucau	13	10.4 (1.8)	13.8 (4.4)	2.8 (0.7)	1.9 (0.6)	51.3 (5.0)	10.3 (3.9)	**0.7**
Lautem	19	20.3 (2.1)	6.0 (1.3)	7.2 (1.4)	9.2 (3.4)	43.7 (4.3)	7.1 (2.1)	**0.8**

Source: Boggs et al, 2009

Some of Timor-Leste's corals are under threat not only from climate change impacts, but also black diseases which have been found on the southern coast, and around Jaco Island (Ayling et al., 2009; CTI-TLs, 2012). It is still unclear what factors were causing the black diseases. Ayling et al., (2009) and CTI-TLs (2012) describe that the corals on the southern coast as being less developed. It was suggested that run-off was the main limiting factor for coral development, as Timor-Leste's catchment areas have a high rate of sediments, typically on the southern coast. Given that many large rivers are also located on the southern coast, this is thought to contribute to a greater sediment yield.

The long rainy season (6-9 months per year) on the southern coast is significantly contributing to flash flooding and erosion on the sloped lands, which transports more sediment toward coastal and coral areas. There are many data and knowledge gaps regarding the extent of coral reefs on the southern coast.

Apart from coral reefs, wetlands are also part of Timor-Leste's coastal ecosystem. Wetlands containing mangroves and other associated trees are growing well on both the southern and northern coasts of the country. The mangroves are essential, not only for coastal protection (erosion and sea level rise), but also carbon capture storage as part of climate change mitigation. The coastal wetlands in Timor-Leste containing mangroves are presented in Table 3.

Table 3 – Area and types of coastal wetlands in Timor-Leste

Site No.	Site	Municipality	Coastal Wetlands Containing Mangroves
76	Oecussi swamp	Oecusse	Mangrove lined floodplain and short grass
8	Lake Be Malae (part of IBA)	Bobonaro	Shallow saline lake, estuary
17	Lake Maubara	Liquica	Shallow saline lake
7	Tibar aquaculture	Liquica	Mudflats, mangroves, fishponds
1	Tasitulo (IBA)	Dili	Saline lakes, mudflats, beach
21	Areia Brance beach (part of IBA)	Dili	Mangrove, mudflats, beaches
23	Hera	Dili	Mangrove, mudflats, sandflats
6	Manatuto mudflats	Manatuto	Mudflats, mangrove, fishponds
87	Manatuto Lake/ mangroves	Manatuto	Saline mudflats
2	Seical Estuary	Baucau	mangroves, mudflats
4	Lake Laga	Baucau	Saline lake, beach
10	Lore coast (part of IBA)	Lautem	Beach, exposed reef
22	Lake Modo Mahut (part of IBA)	Manufahi	Freshwater lake
83	Lake Welada (part of IBA)	Manufahi	Freshwater lake, mangrove-lined
84	Lake Welenas (part of IBA)	Manufahi	Freshwater lake, mangrove-lined
86	Lake Naan Kuro	Manatuto	Saline coastal lagoon, mangrove-lined

Source: Grantham et al, 2011 and Andrefouet et al., 2006.

Timor-Leste's coastal habitat has been mapped to segregate seagrasses, mangrove and coral reefs (see Figure 12). The map demonstrates the composition of the population of mangrove areas, and coral reefs along Timor-Leste's coastline (including Atauro Island and Oecusse). The bold line shows mangrove and coral reef areas. Coral reefs are more developed on the northern coast than southern coast, due to smaller loads of sedimentation, and a shorter rainy season contributing to sediment transport from land to coral reef ecosystems (Ayling et al., 2009 and CTI-TLs, 2012).

To support the presence of marine biodiversity and species richness, Timor-Leste has flagged 12 priority sites of marine biodiversity. Most of these sites tend to be located on the northern coast (Table 4). See Figure 12 for their geographical distribution.

Table 4 – Priority marine key biodiversity areas and candidates identified across Timor-Leste

KBA Code	KBA Name	Municpality	Area (Ha)	KBA Status	Protected Area Status
TLS002	Perairan Nino Konis Santana	Lautem	60,256	Confirmed	Yes
TLS004	Raumoco	Lautem	2,036	Confirmed	No
TLS008	Perairan Irabere–Iliomar	Viqueque & Lautem	2,489	Candidate	No
TLS011	Kaibada	Baucau	571	Confirmed	No
TLS012	Perairan Subaun	Dili and Manatuto	10,654	Confirmed	No
TLS019	Perairan Sungai Klere	Manufahi & Manatuto	31,643	Candidate	No
TLS023	Perairan Areia Branca no Dolok Oan	Dili	2,384	Confirmed	No
TLS025	Perairan Atauro	Dili	10,542	Confirmed	No
TLS026	Perairan Tasitolu	Dili	1,208	Confirmed	No
TLS030	Perairan Maubara	Liquica	3,624	Candidate	No
TLS031	Perairan Be Malae	Bobonara	2,945	Candidate	No
TLS034	Perairan Tilomar	Covalima	1,200	Candidate	No
Total Area (Marine KBAs)			129,552 (ha)		

Source: CEFF, 2014
Note: Perairan=water

Source: PIFSC, 2017
Figure 12 – Map of coastal habitat mapping

2.2.3 Pelagic ecosystems

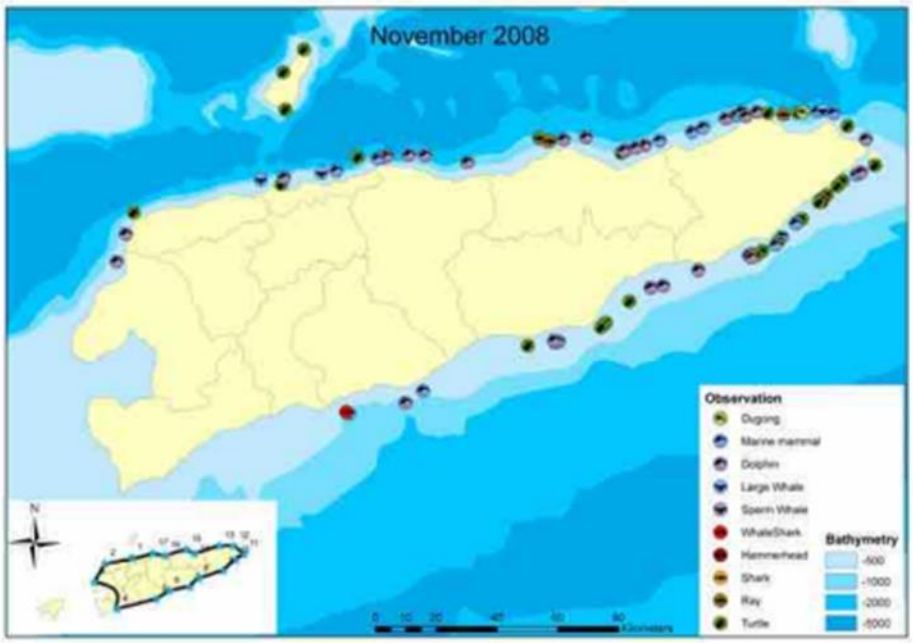
Pelagic ecosystems are essential for marine megafauna, which are biologically important, but also significant in the context of marine eco-tourism. Pelagic ecosystems are highly dependent on primary production, which sustains zooplankton, micronekton, and large nekton fauna, supporting higher trophic levels in the food chain. Timor-Leste's waters mix with the adjacent waters in Ombai Strait - recognised scientifically as a site of upwelling and carbon sinks. This phenomenon is causing the abundance of megafauna migration observed in Timor-Leste territorial waters between both Ombai and Wetar Straits.

During an initial survey of marine megafauna around Timor-Leste's waters in 2008, high levels of diversity and abundance were recorded during aerial surveys - including small marine mammals (dolphins, dugongs, and small whales), large whales, whale sharks, sharks, rays and turtles in November (Table 5). Most of the dolphins and smaller whales were identified to species level during boat surveys. This data and the combined aerial survey revealed a total of thirteen different species of cetaceans (Figure 13).

Table 5 – Total abundance of marine megafauna and others observed during aerial survey around 2 nautical miles offshore along the coast of Timor-Leste (2008)

Date	April 21	May 27	June 17	July 16	August 13	September 24	November 5
Dolphin	200	5	120	165	230	350	1300
Small marine mammal	1	20	35	25	20	3	190
Dugong			1				5
Manta ray *(Manta birostris)*							5
Ray				1	1	1	9
Shark			3	1			
Hammerhead shark (*Sphyrna spp.*)			1				1
Whale shark (*Rhincodon typus*)		1	1				1
Sperm whale (*Physeter macrocephalus*)			1				
Blue whale (*Balaenoptera musculus*)						2	3
Sei whale (*Balaenoptera borealis*)							2
Large whale		1		1			1
Turtle	7	9	22	7	9	2	44

Source: Dethmers et al., 2009



Source: Dethmers et al., 2009

Figure 13 – The abundance of megafauna in Timor-Leste waters in November 2008

Pelagic ecosystem research on Timor-Leste's cetacean inventory was conducted by Conservation International from 1 to 5 November 2016. The survey revealed a total of 11 cetacean species found around Dili, Tibar and Atauro Island. Results found that during 42 hours observation, there were 11 species (Table 6) of cetaceans (6 species of dolphins, and 5 species of whales) with an estimated 2,287 individuals, 25 pods (2-500 individuals), and super pods formation as a combination species found (more than 3 species).

Table 6 – Cetacean inventory survey in November 2016

No.	Species name (English and scientific)	Figure
1.	Spinner dolphin (*Stenella longirostris)*	
2.	Pygmy spinner dolphin (*Stenella longirostris roseiventris)*	
3.	Pantropical Spotted dolphin (*Stenella attenuata*)	

4.	Risso's Dolphin (*Grampus griseus*)	
5.	Fraser's Dolphin (*Lagenodelphis hosei*)	
6.	Bottlenose dolphin (*Tursiops truncatus*)	
7.	Melon headed whale (*Peponocephala electra*)	
8.	Cuvier's Beaked whale (*Ziphius cavirostris*)	
9.	Pygmy Killer whale (*Feresa attenuata*)	
10.	Pygmy Blue whale (*Balaenoptera musculus brevicauda)*	
11.	Short, finned Pilot whale (*Globicephala marcrorhynchus*)	

Continuation of Table 6

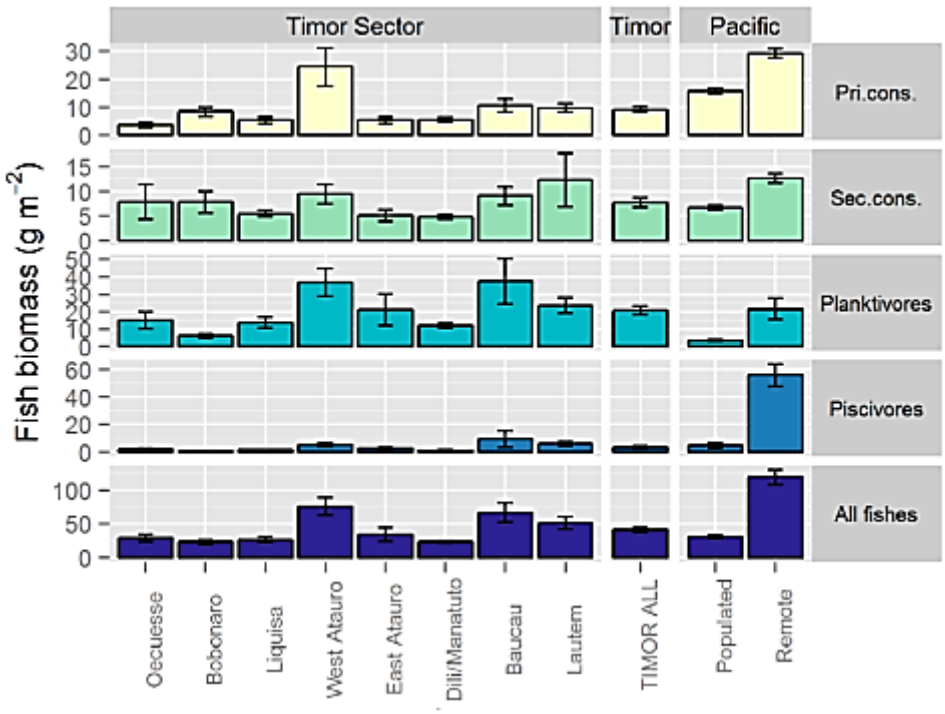
Common name	Scientific name	Indonesian name	IUCN status
blue whale	*Balaenoptera musculus*	Paus biru	EN
sperm whale	*Physeter macrocephalus*	Paus sperma	VU
sei whale	*Balaenoptera borealis*	Paus sei	EN
or Bryde's whale	*Balaenoptera brydei*	Paus Bryde	DD
short-finned pilot whale	*Globicephala macrorhynchus*	Paus sirip pendek	DD
false killer whale	*Pseudorca crassidens*	Paus pembunuh palsu	DD
pygmy killer whale	*Feresa attenuate*	Paus pembunuh kerdil	DD
melon-headed whale	*Peponocephala electra*	Paus kepala semangka	LC
Cuvier's beaked whale	*Ziphius cavirostris*	Paus paruh Cuvier	LC
rough-toothed dolphin	*Steno bredanensis*	Lumba-lumba gigi kasar	LC
Rissos's dolphin	*Grampus griseus*	Lumba-lumba abu-abu	LC
Spotted dolphin	*Stenella attenuate*	Lumba-lumba totol	LC
spinner dolphin	*Stenella longirostris*	Lumba-lumba paruh panjang	DD
Fraser's dolphin	*Lagenodelphis hosei*	Lumba-lumba Fraser	LC

IUCN Red List:
EN = Endangered *VU = Vulnerable* *DD = Data Deficient LC = Least Concern*
Source: Olive, 2016

2.2.4 Marine resources (including fisheries resources)

The United States National Oceanic and Atmospheric Administration (NOAA) in close collaboration with the Government of Timor-Leste conducted marine surveys from 2012 to 2016 through a partnership agreement with the United States Agency for International Development (USAID) Timor-Leste Mission, and the Government of Timor-Leste, particularly with the Ministry of Agriculture and Fisheries (MAF). The survey results revealed the following:

i) The average fish species richness for all sectors was extremely high in Timor-Leste (averaging 57 species per site) compared to any other Pacific region that NOAA-CREP surveyed (Figure 14).
ii) Small-bodied fish biomass in Timor-Leste was similar to other remote, unpopulated areas in the Pacific islands, while medium- and large-bodied fish biomass (including species important as fishery targets) was comparable to values from other human-populated areas in the Pacific.
iii) Fish biomass was greatest in West Atauro, comparable to other remote areas in the Pacific, suggesting that West Atauro fish assemblages are relatively unimpacted by human activities and/or this is an area of high productivity.
iv) The surgeonfish family had the highest biomass, accounting for 20% of the total fish biomass.
v) Benthic cover and hard coral cover averaged 15.6% among the eight survey districts. Hard and soft corals as well as crustose coralline algae were more dominant than turf and macroalgae in Atauro, Liquica, and Manatuto municipalities, suggesting favourable reef structure and integrity. In the remaining survey sectors, turf and macroalgae were more dominant than coral and crustose coralline algae, suggesting unhealthy reef systems.
vi) Live hard coral cover reached 40% within the recently designated Nino Konis Santana National Park (NKSNP) and 38% in the Belio Barrier Reef complex, reflecting some of the highest quality reefs in the country.
vii) A diverse number of crustaceans have been found in the biodiversity assessments conducted using autonomous reef monitoring structures (ARMS), including important fishery targets, such as shrimp, crab, and lobster, with the highest mean cryptobiota diversity at the Biaucou and Tutuala sites.



Source: PIFSC, 2017
Figure 14 – Timor-Leste's average reef fish biomass by fish trophic group

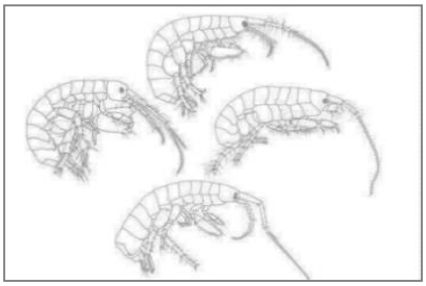
2.2.5 Marine biodiversity – including species richness, endemism, etc.

Marine biodiversity of Timor-Leste revealed the richness and endemism as being presented by Cabral (2019) during the International Conference on Marine Science and Aquaculture (ICOMSA) hosted by the University Sabah Malaysia. Two new marine species were identified in Timor-Leste as follows: i) *Helcogramma atauroensis*, a new species of triplefin from Atauro Island, Timor-Leste (Teleostei: Tripterygiidae) – Journal of the ocean science foundation Vol. 26 (2017), and ii) *Eviota santanai*, a new dwarfgoby from Timor-Leste (Telestoi: Gobiidae) – Zootaxo 3741 (4): 593-600 (2013) see Figure 15.

Some crustaceans of Ampithoidae & Maeridae Amphipods were also found in Timor-Leste (Crustacea: Paracaridae) – Records of the Australian Museum 67 (3): 83-108). The 4 species included: *Amphitoe atauro*, *Elasmopus tibarensis*, *Linguimaera christorei*, and *Quadrimaera metinaro*). Additionally, Tunicates were recorded (Tanjungides A & B) as new antitumoral bromoindole derived compounds from Diazona cf formosa-Tanjung Liarua & Torodoro (Timor Island).

Helcogramma atauroensis (Photo M.V. Erdmann)

Eviota santanai (Photo by M.V. Erdmann)



Samples of *Aphitoe sp; Elasmopus sp*

Figure 15 – Example of some new species identified in Timor-Leste

In 2017, PIFSC (NOAA-Pacific Islands Fisheries Science Center) conducted a marine benthic survey at 6 sites, mostly located on the northern coast of Timor-Leste (Table 7). It revealed that Atauro Island has the healthiest composition of benthic substrate types (hard coral, soft coral, CCA, macroalgae and turf algae).

Table 7 – Average percent cover (standard error) of the reef benthos and benthic substrate ratio (hard and soft coral and CCA/turf and macroalgae by Municipality

District	Sites (#)	Hard coral % (SE)	Soft coral % (SE)	CCA % (SE)	Macroalgae % (SE)	Turf algae % (SE)	Sand % (SE)	Benthic Substrate Ratio
Oecusse	16	17.2 (3.0)	13.7 (3.9)	0.7 (0.3)	1.8 (0.5)	47.9 (4.6)	12.2 (2.5)	0.9
Bobonaro	16	14.0 (2.5)	17.8 (3.8)	2.4 (0.7)	1.5 (0.7)	54.5 (4.3)	4.7 (1.8)	0.8
Liquica	26	10.7 (1.6)	22.9 (3.6)	1.8 (0.7)	2.4 (0.6)	46.7 (4.7)	9.0 (1.6)	1.4
Atauro	22	20.5 (2.0)	10.7 (1.9)	7.7 (1.4)	5.2 (0.9)	39.8 (4.0)	4.4 (1.7)	1.2
Dili	14	13.2 (1.3)	24.0 (3.5)	4.6 (0.8)	2.1 (0.6)	35.4 (4.8)	13.6 (2.7)	1.5
Manatuto	13	17.0 (3.6)	8.9 (2.1)	2.9 (1.0)	2.2 (1.0)	51.8 (4.6)	8.7 (3.6)	0.7
Baucau	13	10.4 (1.8)	13.8 (4.4)	2.8 (0.7)	1.9 (0.6)	51.3 (5.0)	10.3 (3.9)	0.7
Lautem	19	20.3 (2.1)	6.0 (1.3)	7.2 (1.4)	9.2 (3.4)	43.7 (4.3)	7.1 (2.1)	0.8

A rapid marine assessment conducted by Conservation International (CI) Timor-Leste in 2012 concluded that there were 739 species (234 genera, 61 families) of reef fish. The assessment revealed that around 70% of 5 diving sites contained the highest fish diversity ever recorded, such as in Atauro Island (293 species), Loikere (271 species), Ete Asa Lepek (259 species), West of Jaco Island (249 species), and Tenu (243 species). From these research findings, CI Timor-Leste (2016) recommended to the Government of Timor-Leste that they develop an MPA network by finalising the zonation system of NKSNP. They also suggested that the network include a series of "No-Take Zones" in areas around Com and Jaco Island (Lautem Municipality), and the creation of an additional MPA focused on Atauro Island (Atauro Municipality) as part of a marine tourism master plan. This occurred concurrently with World Ocean Day, celebrated on 8 June 2020, where

the Government of Timor-Leste through the USAID-Tourism for All (TfA) Project launched the Ombai-Wetar Strait Hope Spot [*https://missionblue.org*]. The Hope Spot is an international recognition of Timor-Leste's 'blue hope', supporting the empowerment of local communities around the world in recognition of their efforts to protect the ocean.

Meanwhile, in a second marine rapid assessment in 2016, the same senior scientists from Conservation International (Gerald Allen and Mark Erdmann) and their team conducted a survey around Atauro Island marine ecosystems. They found that there were 652 species of reef fish, with a total of 57 families and 210 genera recorded. The assessment identified 261 species not previously recorded on Atauro Island, and 71 species not previously recorded inside Greater Timor Region. The results from this assessment brought the overall total for Timor-Leste reef fish to 894 species, and overall total for Greater Timor Region to 1,036 species. In addition, the surveying scientists noted that there was an exceptionally rich composition of reef-associated fauna with a total of 317 species in Berau Bay, representing the third highest diversity index ever recorded at a site globally.

2.2.6 Key marine species, rare, threatened, endangered and vulnerable species (including invertebrates, fish, turtles, rays/sharks, cetaceans)

Marine turtles are considered "keystone species," meaning they are a vital element of their habitat and impact other species. When a keystone species is removed from a habitat, the natural order is upset, which has a variety of consequences for other flora and fauna. For coastal communities worldwide, marine turtles play a significant cultural role. They are revered or considered ancestors by many indigenous cultures. Through turtle-watching eco-tourism, they are also a substantial source of revenue for coastal communities. Based on some research findings, marine turtle ecotourism has the potential to create more income than selling marine turtle products (eggs, meat and shells), making the creatures worth more alive (and conserved) than dead.

Endangered species of marine turtles based on the NBSAP in Timor-Leste are presented in Table 8 and **Error! Reference source not found.**. Currently the Government of Timor-Leste has been pro-actively promoting the conservation of marine turtles through various activities.

Table 8 – Endangered species of turtles in Timor-Leste

Common name	Species	Genus	Family	Conservation status*)
Oliver Ridley	*Lepidochelys olivacea*	*Lepidochelys*	Chelonidae	Vulnerable
Loggerhead	*Caretta caretta*	*Caretta*	Chelonidae	Endangered
Hawksbill	*Eretmochelys imbricata*	*Eretmochelys*	Chelonidae	Critically endangered
Green	*Chelonia mydas*	*Chelonia*	Chelonidae	Endangered
Leatherback	*Dermochelys coriacea*	*Dermochelys*	Dermochelyidae	Critically endangered

***) Global (IUCN Ver. 3.1)**

Note: Number 5 species, 5 genus and 2 families

Figure 16 – List of endangered species of turtles

No	English names	Scientific names	Status	Figure
1	Green turtle	Chelonia mydas	Endangered (CITES)	
2	Hawksbill turtle	Eretmochelys imbricate	Critically Endangered	
3	Leatherback turtle	Dermochelys coriacea	Critically Endangered	
No	English names	Scientific names	Satus	Figure
4	Loggerhead turtle	Carreta carreta	Endangered	
5	Olive turtle	Lepidochelys olivacea	Vulnerable, Endangered (CITES)	

***) Global (IUCN Ver. 3.1)**

CHAPTER 3. SOCIO-ECONOMIC PROFILE

3.1 Socio-Economic Setting (including trends)

3.1.1 Government administration

The administration system in Timor-Leste has been centralised since 2002. However, since 2017, the central government has been transitioning toward a model of decentralised service delivery. The principal aim is to improve service delivery and provide more power to local government, to enhance the participation of all local authorities in solving the problems faced by their people, while also promoting local development (Program of the Eighth Constitutional Government, 2017).

The decentralised service delivery is supported by a Public Administration. It aims to meet public interests such as respecting the rights and legitimate interests of all citizens and other governmental institutions. In addition, the Public Administration has a mandate to reduce or avoid complex bureaucratisation and secure the participation of all related institutions in its effective management. This administration system is supported by laws and regulations, although the Special Administrative Region has its own regulatory power (including financial and budgetary autonomy as articulated in the Law number 3/2014, article 9 and 10).

The Public Administration is underneath the Ministry of State Administration. This Ministry plays an important role in managing and overseeing development and governance issues, not only at a national level, but also at municipality and village levels. The hierarchy and administrative division are illustrated in Figure 17. The head of municipalities must report and respond to the Ministry of State Administration, while directors and heads of departments at the municipality level are under the head of their municipality's authority. All programs, including annual budgetary planning, should be submitted to the office of Municipal Administrator for further review and approval. For example, each Fisheries department at the municipality level cannot submit their annual budget program to the office of National Directorate of Fisheries, as they would need to submit to the office of Municipal Administrator first.

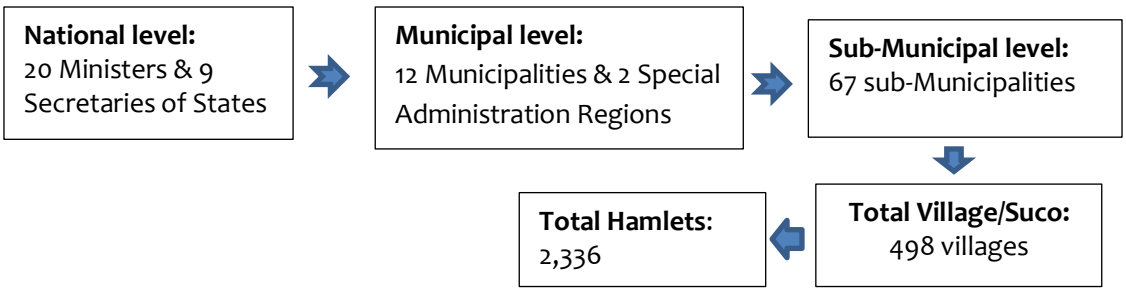


Figure 17 – Hierarchy level and administration division from top-down

The implementation of programs in each department or directorate at the municipality level is accountable and reported to the head of Municipality. Their budget expenditures must also be reported to the head of the municipality. The budget preparation process is presented in Figure 18. All departments at municipality level should prepare their annual budget to be discussed and approved by the head of the Municipality. After approval, the head of Municipality will present it to the budget review committee through the Ministry of State Administration. This is part of the decentralisation model.

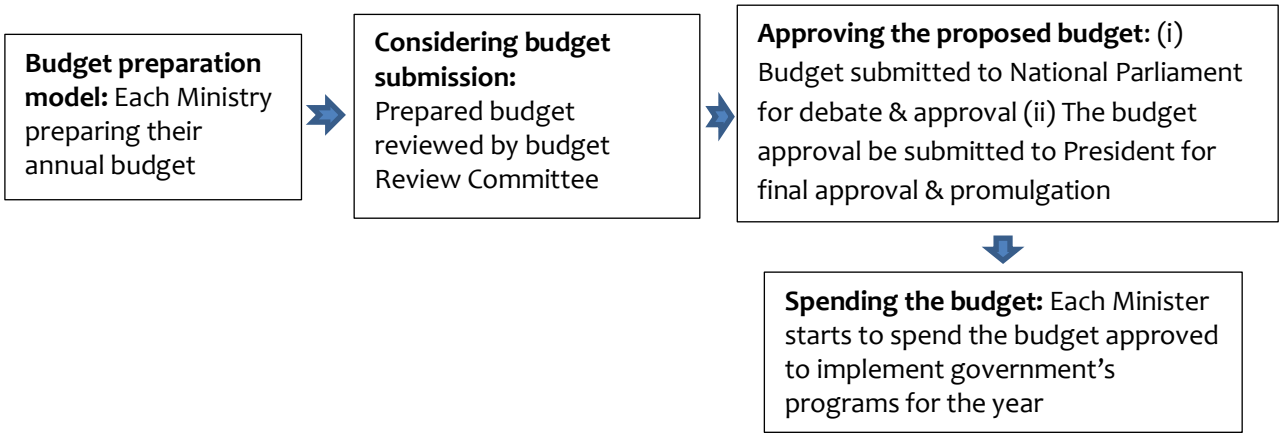


Figure 18 – Budget process for an annual program implementation plan of the government includes budget preparation, budget review, budget submission to the parliament/president for approval and budget spending

The decentralisation process is also enabling democratic participation that ultimately, can also foster the development and participation of private sectors in contributing to local level development processes (Municipality, Administrative Post, and Village/Hamlet levels). This is also part of an integrated approach to secure sustainable development. The program of the Eighth Constitutional Government (2017) highlights the National Planning Framework and Territorial Planning as a key tool in supporting Policies of Administrative Decentralization and local autonomy. This framework and territorial planning are essential in securing sustainable, balanced and equitable development in Timor-Leste.

The Program of the Eighth Constitutional Government's (2017) priorities and municipality development plans should align with the National Strategic Development Plan 2011-2030 and other regional and international policy frameworks (for example, the Sustainable Development Goals), to facilitate robust and sustainable municipal investment plans and budgets. The budget approval will occur through joint ministerial diplomas, to be executed at the local level, where the local administration and other officials are responsible for implementation.

The Program of the Eighth Constitutional Government (2017) will end in early 2023. While most programs and initiatives developed by the actual government look reasonable, unfortunately, they don't work effectively at municipality, administrative post and village levels, mainly due to a lack of knowledge and skills. Most of the local staff (at municipality and administrative level) do not have the capacity to perform services that have been assigned. Therefore, almost all state budgets allocated are not completely executed or expensed.

Overall, government administration both at national and municipality level is still relatively weak, which is primarily related to human capital, legal gaps and weak enforcement capabilities. For example, national legislation to protect natural resources (e.g., Article 61 and 139) are covered by laws and regulations (Decree Law No. 5/2016 on the National Protected Area System), however, these laws and regulations are not implemented effectively. Aside from the above-mentioned issues, these laws and regulations are not always compatible with local socio-economic circumstances. Where local communities rely on subsistence activities and engage in activities such as cutting trees and hunting wild animals, they are usually unable to buy meat for consumption and materials for house construction, leaving them with little alternative.

Some laws and policies are still in draft form and therefore not enforceable. The National Ocean Policy was developed in 2017 and it is ready to present to the council of ministers, but there has been no further action. To serve as another example, the central and local government has promoted Integrated Coastal Management to deal with marine and coastal resources, in Atauro Island, Manatuto (Ma'abat on the northern coast and Barique on the southern coast) and Liquiça. The principal aim is to empower coastal communities, through collaborative management arrangements. However, the capacity of the coastal communities is relatively low, and this the major barrier to realising community driven marine and coastal resources management. Compounding the situation, is the lack of people available to train, educate, and empower coastal communities in the fisheries and environment sector.

Further barriers to marine and coastal resources management, and climate change adaptation and mitigation measures are more related to weak institutional coordination among government agencies, NGOs and development partners. Many government institutions are focused on their own programs and not mainstreaming their work into existing works that are interlinked across sectors and departments in each ministry. Consequently, overlapping mandates and duplication of programs are spread across almost all ministries. For example, unclear administration arrangements are associated with mangrove management. The Directorate of Forestry is responsible for forests in both terrestrial and marine areas, while coastal protected areas are also under the Directorate of Fisheries' responsibility, and at the same time biodiversity conservation falls under the State Secretary for Environment. Many other examples can be found within government institutions.

Extending more responsibility and authority to lower levels of administration (Municipal and Sub-Districts) has been promoted since the Sixth Constitutional Government (2015-2017). However, the capacity gaps between national and municipality levels remain substantial. Tasks attributed to local government institutions to manage marine and coastal resources have not taken place according to envisaged decentralisation arrangements. Shifting toward a decentralised system in relation to marine and coastal resources management requires community level ICM programs that holistically incorporate all relevant coastal activities. This approach encourages the sharing of responsibilities, knowledge, resources, and benefits.

A lack of financial support from the government has become a limiting factor in being able to manage marine and coastal resources effectively and sustainably. The central government does not allocate sufficient budget, and so, many fisheries resource management actions are implemented by NGOs and development partners without proper consultation of coastal communities, as affirmed by local communities during the consultation on the southern coast.

Overall, insufficient resources are being allocated toward the management of marine and coastal areas across the country, especially the 19 declared marine protected areas and ~4 LMMAs. Among those, NKSNP is the only Park that has been physically demarcated. Due to weak law enforcement and socioeconomic incompatibility, exploitation within the National Park (NKSNP) continues to take place. There is little intervention from National Park managers, forest guards, or coastal rangers.

3.1.2 Population, demography

The total population of Timor-Leste is 1.3 million people with a median age of 17.4 years. The overall population density in Timor-Leste is 89 per km^2 or 230 people per mi^2 (Directorate General of Statistic Timor-Leste, 2022). Most of the population (74%) are under the age of 35. These statistics indicate that Timor-Leste is the 15th youngest nation in the world (UNDP, 2018). The ratio between men and women is 50.54 and 49.46 respectively. The fertility rate is still relatively high at 4.1 children per woman (Directorate of Statistic, Ministry of Finance, 2020). This high fertility directly impacts women's and children's health and facilitates the engagement of women in unpaid work. This situation occurs on both the northern and southern coast. There are 11 sub-districts situated on the southern coast in coastal areas. Those sub-districts are occupied by 42,580 households with a total population of around 218,138 people (see Table 9).

Table 9 – Total population on the southern coast sub-districts

No	Municipalities	Post-Administrative	Villages	Hamlets	Total Households	Total Population
1	Lautem	Tutuala	Tutuala	Vero	706	3,662
				Ioru		
				Pitileti		
		Lospalos	Lore 1	Vailara	5,620	29,925
				Horolata		
				Maluru		
				Titilari		
		Iliomar	Iliomar	Iliomar 1	1,628	6,528
				Iliomar 2		
				Aelebere		
Sub-Total					**7,954**	**40,115**
2	Viqueque	Viqueque	Fatudere	Aidilalita	5,637	28,322
				Culale		
		Uatu-Carbau	Uatucarabau	Uani uma	1,489	7,897
				Irabin de baixo		
Sub-Total					**7,126**	**36,219**
3	Manatuto	Barique	Aubeon	Bubur-laran	1,186	6,166
				Wecadi		
Sub-Total					**1,186**	**6,166**
4	Manufahi	Same	Betano	Selihassan	6,536	34,885
				Lalica		
				Bemetan		
				Loro		
		Alas	Alas	Uma berloic	1,624	9,547
		Fatuberlio	Fatuberlio	Mahaquidan	1,487	8,498
Sub-Total					**9,647**	**52,930**
5	Ainaro	Ainaro	Cassa	Lailima	3,124	17,685
				Civil		

				Queça-Mau		
Sub-Total					**3,124**	**17,685**
6	Covalima	Suai	Suai-Loro	Acar-Laran	5,384	26,565
				Mane-Icun		
				Loro		
				Lo'o		
		Tilomar	Tilomar	Beiseuc	2,144	9,967
				Lalawa		
				Maudemo		
				Casabauc		
		Zumalai	Zumalai	Raemea	3,643	16,159
				Tashilin		
Sub-Total					**11,171**	**52,691**
TOTAL					**40,208**	**205,806**

Source: Timor-Leste Population and Housing Census, 2022

3.1.3 Language, religion, culture, and social structure

Cultural values and social norms have a great influence on gender roles in Timor-Leste. Men have more rights than women in many aspects, such as in decision making and the control of resources. Cultural practices perpetuating gender inequality have also included bride price and polygamy. Men and women are working hand-by-hand particularly in rural areas to manage agricultural production, raising livestock and fisheries. The women share the role of managing post-harvest both agricultural and fisheries products and then sell them both at local market and at household level.

Timor-Leste has many ethnic groups. Most Timorese peoples are Austronesian (Malayo-Polynesian) and Papuan, and there is a small population of Chinese living in Timor-Leste. The different groups in Timor-Leste are linguistically diverse and around 34 dialects are being spoken across the country. The nation's official languages are Tetum and Portuguese, with Bahasa Indonesia and English used as business languages. Most people speak Tetum, Galole, Mambae and Kemak.

In terms of religion almost all Timorese people practise Catholicism, which plays a significant role in shaping social norms and gender roles, also substantially affecting women's reproductive rights, especially in relation to contraception. Table 10 presents the composition of different religions in Timor-Leste.

Table 10 – Religion composition in Timor-Leste, 2022

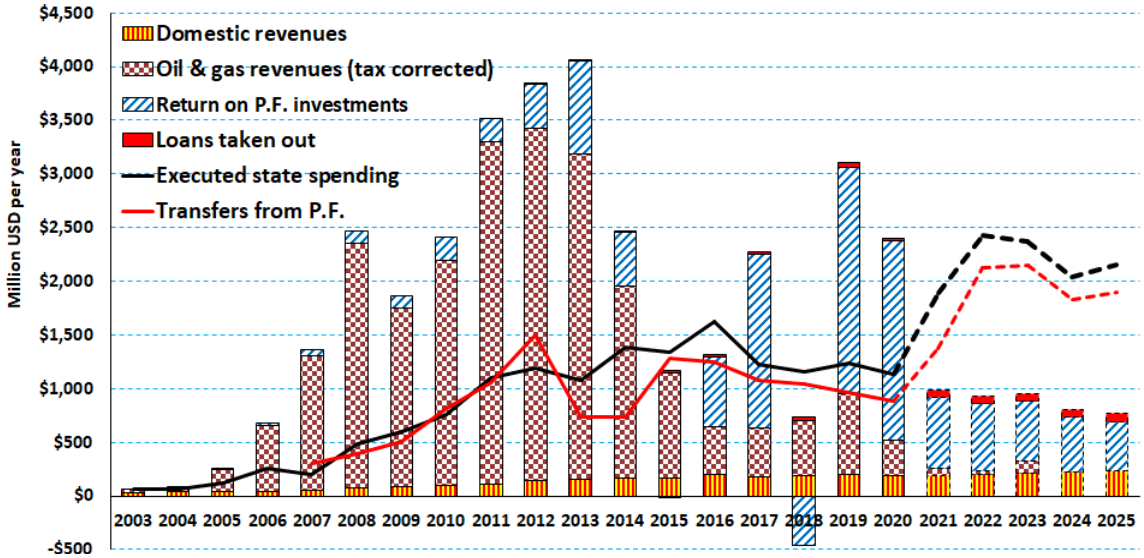
Gender	Total	Religion						
		Catholicism	Protestantism/ Evangelicalism	Islam	Buddhism	Hinduism	Traditional	Other
Total population	1,340,434	1,334,133	26,272	3,217	560	272	918	3,08

Men	678,087	678,087	12,132	1,103	336	141	483	2,000
Women	662,347	662,347	14,140	2,114	224	131	435	1,082

Source: Population and Housing Census, 2022

3.1.4 Economies, social and economic indicators

The government of Timor-Leste established a petroleum fund in 2005. It aims at prudently managing oil and gas resources typically on the southern coast. The oil and gas' revenues are being used to support national reconstruction e.g., schools, bridges, roads, and human development among others. The petroleum fund at the end of 2021 stood at USD~19 billion. It is expected that withdrawals will be more in the near future due to high population growth which requires more attention in terms of education, health conditions, job creation and opportunities and living standard. Figure 19 shows the petroleum fund and other different income sources for the state.



Sources: MoF (2021c, Budget Book 1, and previous years).
Note: In a few cases, collected revenues were returned to oil companies in subsequent years to repay over-assessed or over-estimated taxes.
Figure 19 – Petroleum fund and total income flows to the state and the prediction for next three years

"The red-and-white checked segments show the oil and gas revenues Timor-Leste has received each year, which include royalties, profit oil taxes and corporate taxes. About 93% of this has come from the still-active Bayu-Undan offshore oil and gas field, with most of the rest from the Kitan oil field which produced from 2011 to 2015. Projections from 2021 onward are from state budget documents, based in turn on information provided by oil companies" (Scheiner, 2021).

Figure 19 demonstrates that even though petroleum revenues rose rapidly until 2012, they have since fallen to one-tenth of their peak. It is predicted to continue to decline. The state has received 99% of the revenue it is expected to receive from the nearly depleted Bayu-Undan, although revenues are expected to increase marginally in 2023 due to the taxes upon decommissioning that field. The additional well that the operator (Santos) will drill in Bayu-Undan is expected to generate significant revenue for the state (Scheiner, 2021).

The non-oil and gas sectors, such as agriculture, fisheries, livestock, and tourism, contribute less than 1% to national GDP or state budget (National State of Oceans and Coasts report, PEMSEA and Ministry of Agriculture and Fisheries Timor-Leste, 2019). Very little state budget is allocated to support fisheries development. Overall budget allocated to MAF has decreased from 2016 to 2020 compared with other key ministries, as stipulated in Figure 35. In rural areas most of the communities are engaging in subsistence agriculture. Fisheries and animal husbandry can also provide significant sources of income. Most rural communities e.g., Tutuala, Lore, Natarbora and Betano are primarily engaged in fishing, hunting (wild animals e.g., monkey, pig, cuscus and deer), and collecting firewood for cash. Additional livelihood activities involve the collection of honey and palm vine, and the harvest of materials such as bamboo and palm leaves for house roofing. Women and girls are more involved in fish and crops post-harvest activities and maintenance, for example, drying fish and maize and selling them at local markets or at the household level.

Most of the population (~67%) in Timor-Leste is living on the northern coast, with many communities living close to coastal areas and depending heavily on marine and coastal resources as a source of cash and food security. Subsequently, the contribution of fisheries and eco-tourism to livelihoods is highest on the northern coast (Boggs et al., 2009). On the southern coast, subsistence fishers also rely on marine and coastal resources for household income and food security. They mainly operate within the Nino Konis Santana National Park (NKSNP), with fishing efforts typically focused near Valu Beach, Jaco Island and Lore. Fishing efforts on the southern coast are slowly increasing. Although these places are less populated, the local and foreign visitors to Jaco Island and Valu Beach support the creation of cash income and job opportunities. It is expected that with the establishment of robust infrastructure such as roads, clean water, and improved electricity access, these localities on the southern coast will experience increased rates of tourism.

Natarbora (Barique), alongside Betano and Suai, with substantial support from the government and development partners (UNDP, FAO and MercyCorps etc.) are implementing food security and climate change programs. They aim to restore the agricultural sector, alleviate poverty, and improve nutrition, ecosystem-based fisheries management, and Integrated Coastal Management to strengthen the resilience of the coastal communities. The government has also facilitated coastal people (primarily in Betano and Suai) to provide Roadside Park food to local visitors. Their main products provided are *ikan saboko* (fish baked with palm leaves), *ketupat* (white rice wrapped in woven young coconut leaves in a diamond shape), and white vine from palm. This is a positive opportunity for coastal communities to diversify their livelihoods.

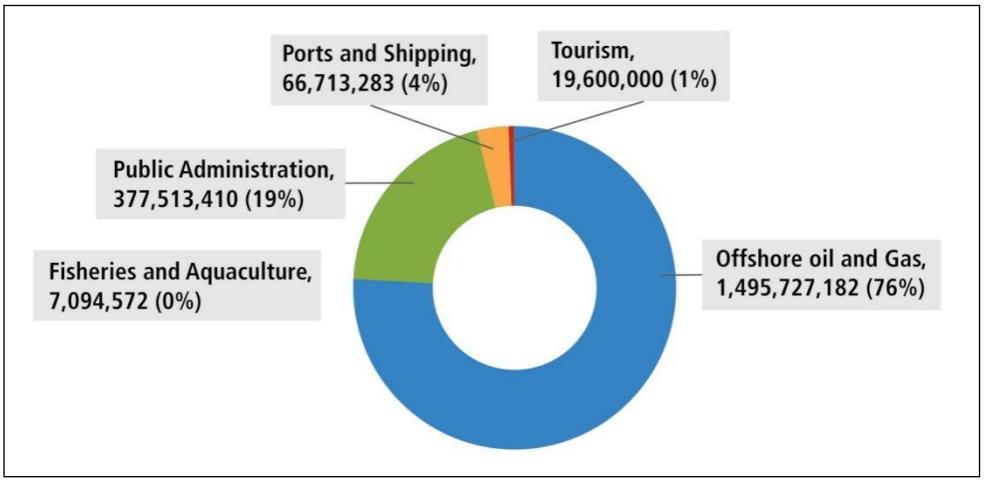
In Timor-Leste sources of coastal economy are generally derived from fisheries, aquaculture, oil and gas exploitation, mining, and tourism sectors. Marine and coastal ecosystems provide a broad range of natural assets that support the wellbeing of coastal communities. The National State of Oceans and Coasts 2018: Blue Economy Growth of Timor-Leste (PEMSEA and Ministry of Agriculture and Fisheries Timor-Leste, 2019) describes the coastal economy as the sum of:

1. "The economic activities which rely on the marine and coastal resources;
2. Natural assets, goods, and services of marine and coastal ecosystems upon which people are relying on for income diversification, livelihoods, recreation, food security; and
3. Ports, shipping, and transportation for commercial and non-commercial trade"

The report also demonstrated how the marine and coastal economy can be measured using the System of National Accounts (SNA). The measurement is set out below:

1. "*Ocean-based activities*, such as fisheries, marine tourism, shipping, oil and gas, ocean energy",
2. "*Ocean-related activities*:
    a. those that use products from the ocean (e.g., seafood processing, marine biotechnology, salt);
    b. produce products and services for the ocean-based activities (e.g., ports, ship building, communication, maritime insurance);
    c. marine education, and research and development; and
    d. government agencies with direct maritime responsibilities (e.g., navy, coast guard, marine environmental protection, etc.)"

The contribution from marine and coastal economy to Timor-Leste's GDP is described in Figure 20 below.



Source: National State of Oceans and Coasts 2018, Blue Economy Growth of Timor-Leste (PEMSEA and Ministry of Agriculture and Fisheries Timor-Leste, 2019)

Figure 20 – Gross value added of ocean-based economic activities in 2015 (USD)

3.1.5 Education, employment, income, and poverty

The education system in Timor-Leste offers formal education starting from Administrative Post, Municipality to National level. The education services delivered consist of pre-school education, primary school, secondary school, and tertiary education. There is also technical vocational education available at institutions such as Agriculture Senior High School, Fisheries Senior High School, and Veterinary High School. These education services are delivered through a total of 1,426 public schools and 385 private schools (UNICEF, 2020).

The main challenge for the education sector in Timor-Leste is enhancing the quality of education delivered. Historically, they were recruited after the post-referendum (1999), but most did not obtain a formal teaching qualification and so their teaching skills are not always adequate, but there is no other option as after the Indonesian government left the country so did their qualified teachers. That said, the government is committed to improving the quality of education in all its

forms to ensure that all boys and girls have the same rights, opportunities, and access to formal and non-formal education.

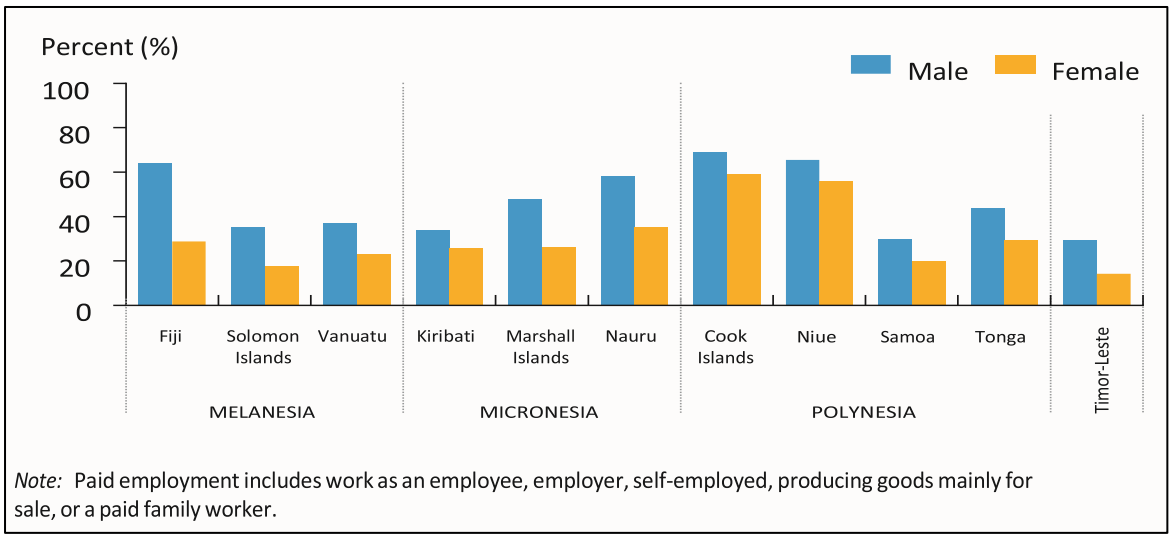
The Government of Timor-Leste has made a significant effort to increase the quality of education to improve the health, skills, and employability of Timorese people. However, more training is still needed, especially in relation to vocational training in the tourism, fisheries, and small manufacturing sectors. More progress is required in terms of providing more food to reduce malnutrition and supporting the healthy development and education of Timorese children. In response to that, the government has established feeding programs at schools and health centres around Timor-Leste to support the physical development of children through improved access to healthy foods.

The main sectors that provide and support employment in Timor-Leste are agriculture, livestock, fisheries, and forestry. Approximately 80% of people are engaged in these sectors, with coffee being the most important export. Most people are practising subsistence agriculture and animal husbandry to support their daily lives (PEMSEA, 2019). There are almost no large-scale farms in Timor-Leste, except for some coffee plantations. Due to the subsistence nature agriculture production, most people, especially women and children experience malnutrition. For every 1,000 babies born in 2018, about 46 babies will die within the first five years of life. Although, the rate of maternal mortality has decreased from 194 per 10,000 live births in 2000 to 142 in 2017 (Betuel, 2020). Malnutrition affects physical development, particularly during the first 1000 days of life. Timor-Leste experiences relatively high rates of child stunting, later affecting the ability of children to engage in the classroom, limiting their access to higher education and employment as an adult. During 2018 - 2021 the government announced COVID-19 related restrictions to all schools around the country, which disadvantaged students that lack access to alternative opportunities to learn and play (Child Fund Timor-Leste, 2021).

According to the Regional Assessment Report on Gender (2015) Timor-Leste has low rates of adult literacy, and the findings are gender with 63% of men and 53% of women experiencing literacy. The report also confirmed that the literacy rates among youth are improving, because almost all Timorese youth are actively participating in education. The government of Timor-Leste has committed to enhancing the quality of education across all levels, as articulated in the SDP 2011-2030, and set out in the SDG 2030 agenda. The SDP 2011-2030 emphasises the importance of gender equality within education, and the government has committed the inclusion of marginalised children from lower economic backgrounds, with disabilities, and those children that may be disadvantaged due to their mother tongue.

The government's focus on integrating gender issues and adult education is an effort to improve knowledge and business skills training for men and women, which is a priority of the National Action Plan (NAP), which is aligned with the National Employment Strategy (2017-2030). One of the main pillars of NAP is enhancing labour market supply, which is related to the technical and vocational training of men and women, and the work of the Ministry of Education and the State Secretary for Youth and Labor. Since 2019, these efforts have resulted in a rise in employment levels among men and women, although the rate is still relatively low in comparison to other countries in the region (see Figure 21). In Timor-Leste, the key barriers to education are related to social norms, unequal power dynamics and patriarchal system. It is important that the

government promote and encourage inclusive education and training programs so that women and girls can experience the same opportunities as men and boys.



Note: Paid employment includes work as an employee, employer, self-employed, producing goods mainly for sale, or a paid family worker.

Source: Gender Statistics, the Pacific and Timor-Leste, 2016

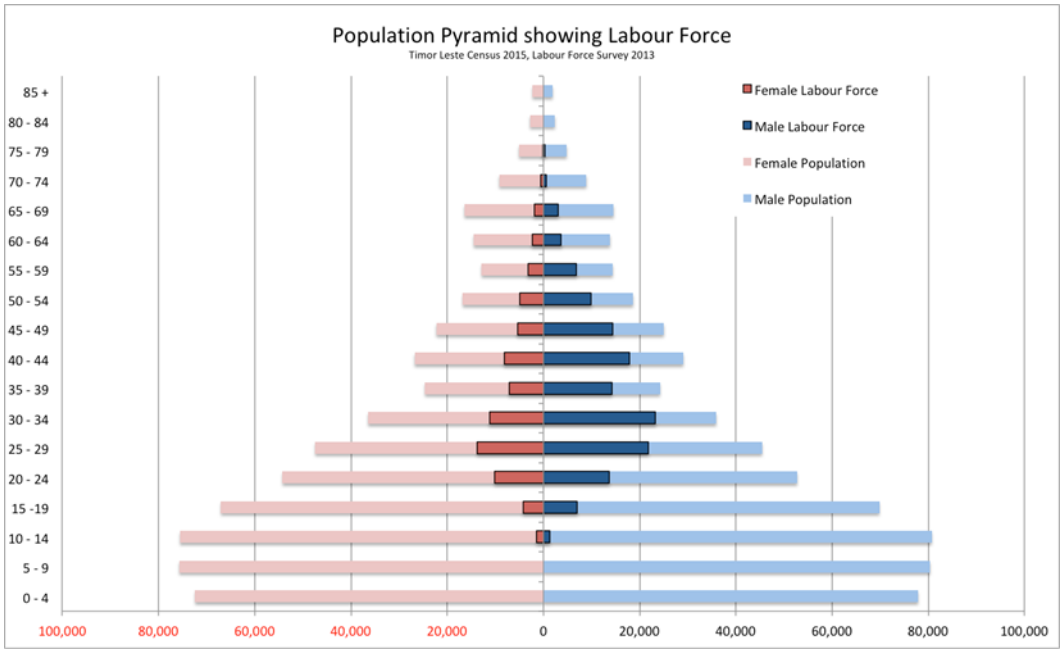
Figure 21 – Percentage of population aged 15 and above in paid employment

The social norms and patriarchal system of Timor-Leste disproportionately affects boys and girls, preventing many girls from completing their education and further engagement in technical and vocational training. In Timor-Leste, many women engage in unpaid labour such as preparing food for family members, taking care of children, cooking and collecting water. Some of these activities present health risks. Also in Timor-Leste, under the patriarchal system girls enter marriage at a young age, forcing them to halt their education to focus on childcare and domestic duties. After the birth of a child, it is difficult to return to school because social norms predicate that the wife must care for family members and children (Secretary of State for Youth and Labour, 2017). This patriarchal system is deeply embedded within Timorese culture and is something that will not change overnight.

The Gender and Sustainable Development in Timor-Leste: Key to 'Leaving No One Behind' (UN Women, 2018) report calls for substantial development in the skills of both adults and youth. This is a major priority for the government of Timor-Leste. If the skills and knowledge of the youth and adults are enhanced, ultimately their access to employment and income will be improved. The government has been investing and standardising technical and vocational education and training (TVET) system in Timor-Leste with the aim to improve access.

The rural agricultural sector involves >80% of men and women involved in subsistence activities. While still a labour market, it provides limited opportunities to increase and diversify employment and income. Some municipalities (Suai, Manufahi, Lautem and Manatuto) can draw revenue from fishing operations and eco-tourism, but this is relatively limited. While subsistence agriculture, fisheries, and livestock remain important components of economic production in Timor-Leste at a local level, low official employment rates are observed at a national level.

The participation of women and men in the labour force is varied. The Census Population Report (2015) concludes that about 63% of men aged 15 and above as being employed and only 3% unemployed. Approximately 34% of men are outside the labour force. In comparison, only 45% of women were recorded as being employed and 2% unemployed, with more than 50% of women not participating in the paid labour force. These statistics reflect a relatively high gap between men and women employment. In 2018, the working age population increased by more than 36,000 (Figure 22) (State Secretary of Youth and Labour, 2018). On average, 4,000 new jobs have been created each year by the government. The results show that at least 26,000 young men and women will get new economic opportunities (Secretary of State for Youth and Labour, 2017).



Source: Labour Market Outlook Bulletin, No 7, 2018

Figure 22 – Population pyramid and labour force, Timor-Leste, 2018

Labour participation rate is varied both age group and gender across municipalities in Timor-Leste as presented in Figure 22 and Table 12. Women's participation in employment is highest in Ainaro (60%), followed by Oecusse (59%), while men's employment is highest (75%) in Oecusse. The participation of women in the labour force is lowest in Dili city (Gardner J., 2018), likely because a large population of women in Dili are participating in full time studies.

Table 11 shows the labour participation rate from each municipality and Table 12 presents selected indicators of labour force by sex.

Table 11 – Men and women employment by Municipality, 2018

Municipality	Female	Male	Total	Percentage (%)
Aileu	13	20	33	8
Ainaro	3	17	20	5
Baucau	9	24	33	8
Bobonaro	1	3	4	1
Covalima	18	25	43	11
Dili	14	27	41	10
Ermera	4	34	38	10
Lautem	12	12	24	6
Liquisa	5	14	19	5
Manatuto	14	36	50	13
Manufahe	11	14	25	6
Oecusse	2	9	11	3
Viqueque	13	40	53	13
Total	119	275	394	-
%	30%	70%	-	-

Source: Secretaria de Estado de Juventude do Trabalho (RDTL), 2018

Table 12 – Selected indicators of the labour force by sex, Timor-Leste, 2021

	Men	Women	Total
Working-age population, aged 15+ years (000)	809.3	403.6	405.8
Labour force (000)	148.9	98.1	247.0
By education (% distribution)			
Less than primary or none	28.9	33.4	30.7
Completed primary	17.1	19.7	18.1
Completed secondary	36.9	30.3	34.3
Tertiary (first stage or completed)	17.0	16.5	16.8
Level not stated	0.0	0.1	0.0
Labour force participation rate (%)	36.9	24.2	30.5
Employment (000)	234.3	142.0	92.3
By economic activity (% distribution)			
Agriculture, forestry and fishery	24.2	31.0	26.9
Industry	16.5	8.7	13.5
Services	59.0	59.3	59.1
Economic activity not classified	0.3	1.0	0.5
By status in employment (% distribution)			
Employees	59.2	31.5	48.3
Employers	1.4	0.7	1.1
Own-account workers	26.6	48.0	35.1
Contributing family workers	12.7	19.2	15.3
Workers not classifiable by status	0.2	0.6	0.3
Share of informal employment (%)	75.3	80.4	77.3
Labour underutilisation (000)	48.9	46.0	94.9
Time-related underemployment	1.1	0.2	1.3
Unemployment	6.8	5.8	12.7
Potential labour force	40.9	40.0	80.9
Labour underutilisation rate (%)	28.9	25.8	33.3
Time-related underemployment rate	0.6	0.8	0.2
Unemployment rate	5.1	4.6	5.9
Potential labour force rate	24.7	21.6	28.9
Subsistence production as main work (000)	166.4	273.4	439.8

Source: Timor-Leste Labour Force Survey, 2021.

According to the Population Census (2022) and Secretary of State for Youth and Labour (2018) report, the rate of childless women seeking work is higher than those who are with child. Many women are working at home to prepare food, collect firewood and water for cooking and washing. This unpaid work is the key driving factor behind women not being included in the labour force. Most women on the southern coast, also engage in post-harvest fisheries and agriculture activities – such as the removal of fish from gill nets, drying fish, and selling fish at local markets and the household level.

The level of unpaid work is higher in rural areas than in urban centres, and most of the population (~70%) is living in rural areas of the country. The lack of access to training and education outside of urban centres compounds the disproportionate levels of unpaid work in Timor-Leste (Asian Development Bank, 2014). In terms of household security, unpaid work is incredibly significant which is a principal obstacle for women and girls in exercising their right to participate in the decision-making process of the development process at village or hamlet level (Gardner, 2018). In this regard, women are more vulnerable than men.

Additionally, women's self-employment is 30% lower than men. In 2018, a total of 394 people received support to become self-employed, 30% of which were women (Secretary of State for Youth and Labour, 2018). Table 12 and Table 13 present gender-disaggregated self-employment statistics in different sectors in Timor-Leste.

Table 13 – Self-employment registered at employment Centre, 2018

Sector	Female	Male	Total	Percentage (%)
Agriculture	41	85	126	32
Fisheries	13	61	74	19
Carpenter	16	57	73	19
Food production	29	32	61	19
Tailor	19	62	25	6
Block manufacture	1	2	21	5
Motor cycle workshop	0	14	14	4
Total	119	275	395	-

Source: Secretaria de Estado de Juventude do Trabalho (RDTL), 2018

In rural communities, while the occupations filled by men and women are relatively homogenous, the percentage of women and men engaging in each sector is quite diverse (see Table 13). The food production sector employs a relatively equal proportion of men and women in the sample study outlined in Table 13. Agriculture is the largest sector, yet the men workforce is nearly double that of women.

As reported by the Secretary of State for Youth and Labour (2018), the average wages for Timor-Leste employees have risen from $233 to $256 per month since 2017. The top five professional occupations are civil engineering, labourers, sales assistants, trade workers, motor and vehicle mechanics. The report also concluded that the skills experiencing the highest demand from Technical and Vocational Education and Training (TVET) recruitment providers are AC repair, electrical, automotive and welding.

Based on the national poverty lines, about 42% of Timorese people live below the poverty line (Betuel, 2020). A slight reduction in the poverty rate has been achieved over the last couple of years. Also, the proportion of the employed population in Timor-Leste has increased (Table 14).

Table 14 – Proportion of employed population age 15+ between men and women

SDG 1	Statistic	Year	Value
1.	Proportion of employed population below $1.90 PPP a day (age 15+) women	2019	16.1%
2.	Proportion of employed population below $1.90 PPP a day (age 15+) men	2019	18.4%
3.	Proportion of employed population below $1.90 PPP a day (age 15+) total	2021	22.6%

Source: Asian Development Bank: Basic Statistics, 2020

The poverty reduction effort falls under SDG Goal 1 and Goal 8 on decent work and economic growth. Improving the living conditions and protecting vulnerable people are core priorities for the government of Timor-Leste as stipulated in SDP 2011-2030. The SDP further affirms that gender-responsive poverty reduction will be guaranteed, and this sentiment is also articulated in the National Constitution and these are the rights and duties in all areas of household, political, social-economic and cultural life (Sec. 17).

Poverty reduction strategies need to be gender sensitive, and work toward gaining a deeper understanding of the different lived experiences of men and women in rural areas. For example, the differences between men and women-headed households forms part of the dynamics within households. Where possible, stakeholders should assess individual-level income and their expenditure (UN Women, 2018).

The successful implementation and management of the TDA SAP/NAP will be heavily affected by poverty rates, low education and employment levels.

3.1.6 Coastal communities – governance, livelihoods and vulnerability

Coastal communities are heavily dependent on resources and services provided by coastal ecosystems. These ecosystem services range from basic needs like water, food, and shelter, to intrinsic services like recreation and tourism. Clearly, coastal ecosystems cater to a multitude of human needs. The maintenance of ecosystems services and environmental health are in turn dependent on human interventions and management. To achieve sustainability, ecosystems require interactive and engaged governance and management whereby the local resource owners and users are involved.

Many programs from different NGOs and government agencies are promoting livelihood activities that are environmentally sound, economically realistic and sustainable. They are also working closely to address the challenges faced by coastal communities and the ecosystems that they rely on, particularly the challenges associated with climate change impacts as many coastal communities and resources are vulnerable to events such as SLR, coastal erosion, and

inundation. The limited capacity of coastal communities to adapt to climate change variability ultimately lowers their resilience to shocks. Understanding the linkages between sustainable livelihoods and its challenges are typically important for improving governance and livelihood opportunities associated with marine and coastal resources.

To secure coastal resources and improve human prosperity, innovative governance solutions must move beyond ineffective sectoral paradigms and one-dimensional approaches toward natural system dynamics. Institutional arrangements and plans for livelihood diversification align with socio-economic, local and national context (Allison, H, & Ellis, 2001).

The source of benefits that coastal communities derive from marine and coastal resources, such as income and nutritional security, is deeply connected to the capacity of coastal communities to respond and cope with shocks is deeply connected to institutional and demographic drivers (Cinner and Bodin, 2010). They also suggest that fisheries governance and its development is an entry point for improving marine environmental outcomes and human prosperity. Understanding the *livelihoods landscape* and interactions between livelihoods and coastal communities is a critical early step to guide the design of any future interventions related to marine and coastal resources governance, and management measures (Cinner and Bodin, 2010).

The integration of livelihood development activities and improvements in fisheries governance is not something which is currently in place. Most coastal communities and their local leaders have given less attention to fisheries governance, and how it is connected to livelihood development. The concept of the *livelihood landscape* should be incorporated within village development plans and allocated some budget. As many coastal communities are dependent on marine and coastal resources, investing in governance and livelihood activities is a foundational step toward improving human wellbeing, building resilient livelihoods, and securing food and nutrition. Mills et al. (2017) suggest that where there is fisheries dependence in Timor-Leste, particular attention to fisheries governance and livelihood should be given and supported by government, NGOs, and development partners.

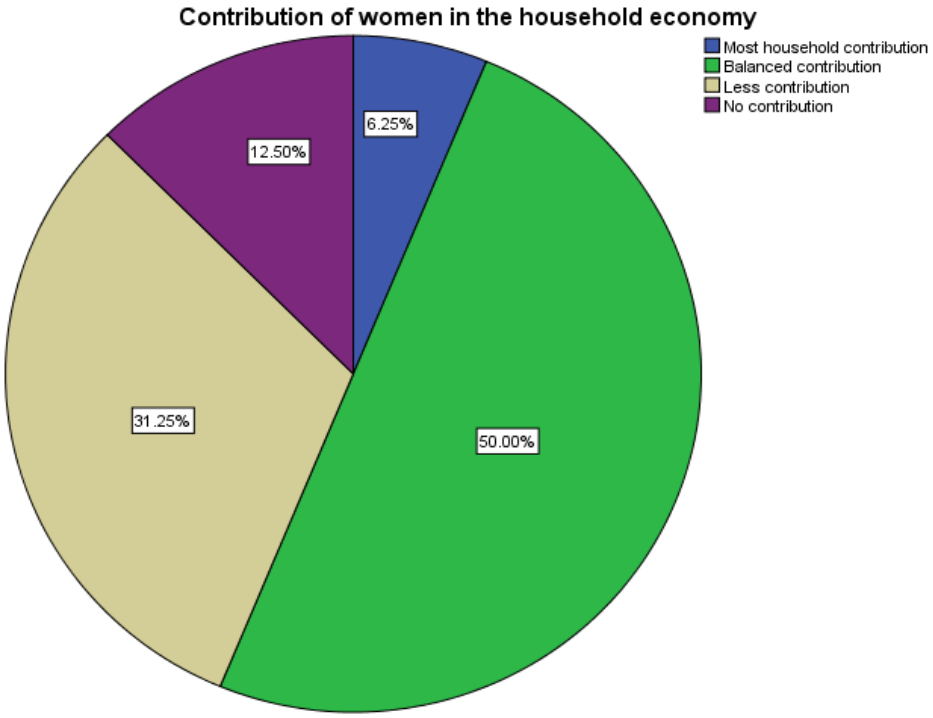
3.1.7 Gender and the coastal economy

There is a lack of information regarding coastal economies on the southern coast. In general, women and girls on the southern coast have participated differently to men, as observed in the primary data collection stage. Men normally go fishing, while women and girls assist them in preparing food and drinking water. Women and girls are heavily involved in the removal of fish from gillnets, and processing them for sale and/or consumption. Women and girls are also engaged in gleaning activities during low tide. They actively collect small fish, octopus, shrimps and other oysters for food and cash.

Women in Valu beach (Tutuala) are actively engaged in fisheries post-harvest activities - cleaning fish, drying, and barbequing for cash. These activities are relatively similar in Lore beach and Beaço in Viqueque.

Women and girls in Betano (Manufahi) and Suai are engaged in fisheries quite differently than those in Viqueque and Lospalos. They are not only engaged in gleaning and drying fish

products, but tend to be more focused on how to value-add with fisheries products. For example, they produce fish baked with palm leaves called *"Ikan Saboko"* that sell together with white vine (palm vine) and *"Ketupat"* (white rice covered by woven young coconut leaves in a diamond shape) for cash. These products are part of a roadside food park to attend or serve local visitors travelling from Viqueque to Suai (vise-versa). Apart from the above-mentioned activities; women and girls in Betano and Suai are also actively engaged in gleaning activities for collecting small octopus, fish, crabs and seaweeds for domestic consumption and also for cash. The contribution of women to the household economy is varied across coastal areas on the southern coast. While it might be considered relatively small in terms of paid labour, it plays an important role in household food security and cash income (see Figure 23).



Source: Information from site visit during primary data collection, 2022

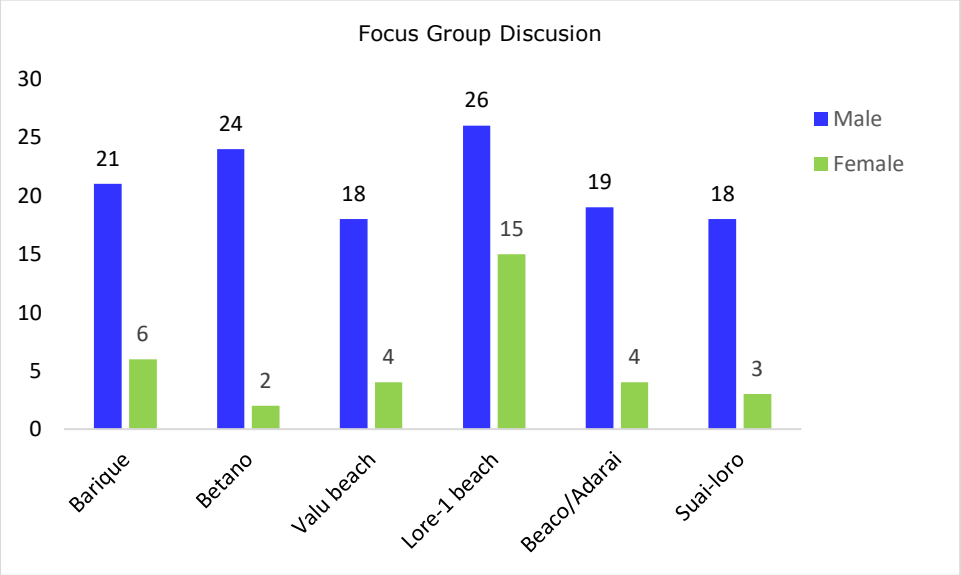
Figure 23 – Overall women contribution at household economy in five sites on the southern coast

These findings show that most coastal economies are derived from marine and coastal resources, contributing to food security and income diversification. Women and girls' participation in fishery activities are paramount as part of livelihoods supporting activities and more strategically women will actively participate in the conservation ability of biodiversity-dependent livelihoods. Specific attention must be given to improve their work both in the fisheries sector and other livelihoods opportunities.

As observed during primary data collection, there is a lack of awareness for both men and women related to marine and coastal resources. So, it is important to tailor the communication materials (marine and coastal management measures), because women have different communication channels than men. It is necessary to understand the audience to whom the information is directed, while considering gender roles; for example, men go out offshore for fishing, while women and girls are actively gleaning during low tide. Men and women need to

work side-by-side not only in consultation and decision-making process but also in fisheries conservation implementation plans. Gender considerations in fisheries management measures and aquaculture development would be a strategy to enhance biodiversity-based livelihoods. Gender mainstreaming in fisheries will strengthen women's participation in co-management mechanism through integration of good practices and lessons learnt.

The evidence shows that (Figure 24) women are not really required to participate in meetings both formal and informal due to the patriarchal system. The patriarchal system halts them to participate in any activities at community level including group discussion during the consultation period.



Source: Primary data collection, 2022

Figure 24 – Focus group discussion participated by male and female during the primary data collection in different sites

There is a need to consider gender roles in marine and coastal resources management. This is important in recognition of the importance of the marine and coastal resources for ensuring continued support for coastal livelihoods for coastal communities.
The main reasons for engaging women in marine and coastal resources management measures are set out below:

1. To ensure that men and women are working together in managing marine and coastal resources including conservation measures and decision-making process,
2. To ensure that the role of men and women in marine and coastal resources utilisation need to adequately address to avoid or reduce the impacts of biodiversity-based livelihoods,
3. To ensure that the future fisheries development requires collaborative efforts from men and women including different stakeholders.

At the global level, women and girls have often encountered a disproportionate impact in relation to fisheries resources compared to men and boys (López-Angarita et al., 2019). Women and girls across the world are more likely than men to be affected by lack of food security (fish) and likely to suffer from nutritional deficiencies (López-Angarita et al., 2019). Women have additional burdens associated with caregiving and their role in managing households' necessities such as travelling for a long way to collect firewood and clean water for household needs. This

gender inequality has a huge impact for women to not be involve in decision making, access to productive resources, opportunities and formal education.

The socio-economic status of women is lower than men in Timor-Leste context. Women face many challenges not only in economic aspect but also in access to education. Women education in Timor-Leste is relatively low than men. Even in agricultural sector women are already marginalised, for example, women have lack of access to hired labour and farming tools and they have limited engagement in cash crop production. In terms of fishers' households, similar differences can be expected in terms of fish products, where men control and manage all incomes from fisheries.

The SDGs goals 5 and 10 call for gender equality and empower all women and girls. The implementation of goals 5 and 10 is still far away from the expectation. This is because women have a workload at home (cook and provide food for household members) and also due to cultural norms. Indeed, women are very difficult to engaging in work outside home to generate income. This is expected that women's priorities and perspectives are well integrated into fisheries management programs and follow up action plans to increase their income and livelihood resilience.

The income from key livelihoods made by women is lacking. There is insufficient data on gleaning activities and the source of fish and non-fish being harvested and sold. And what is the size and how many of them have been consumed by coastal communities as part of protein intake. In addition, gleaning activities towards the environmental impact and sustainability of the gleaning activities remain unknown and undocumented. Another important coastal ecosystem which plays an important role for gleaning is in mangrove areas. This area is a key habitat for target species e.g., crabs, bivalves, snails, and small fish. This mangrove area remains an important coastal management issue across the country. Since the mangrove areas to support coastal livelihoods are not yet understood. Historically, Timor-Leste has lost high rates of mangrove loss (Boggs et al., 2009). Mangrove deforestation is believed to have huge impacts for coastal communities, in terms of coastal protection and food security. This case has been broadly documented, that mangroves ecosystem largely contributes to these aspects (Alongi, 2008).

In general, gender and fishing are lack of recognition and understanding surrounding women and girls in gleaning activities. These activities until now have been ignored in national policy, programs and formal discussion.

The government of Timor-Leste has a strong commitment to tackling gender issues and challenges. And now the government has made significant progress in addressing inequalities through laws, regulations and policy development, including institutional mechanisms and public awareness. A national action plan on gender-based violence commits to halting gender-based violence through multi-sectoral approach and collective actions. There are also many international laws, e.g., international commitments of the convention on the civil and Political Rights, International Covenant on Social and Economic Rights and the Convention on the Rights of Children. The government of Timor-Leste has adopted the Women's Economic Empowerment Strategy and National Social Protection Policy as fundamental policies that complement women's agency.

The government has encouraged women's participation and empowerment in all sectors. And strengthening the capacity of the national women's machinery at national to village level is vital. This is also to attain the 2030 Agenda of the SDGs. Implementing the 2030 Agenda (goal 5) is basically to address the long-term existing structural barriers to gender equality through multiple interventions.

The government of Timor-Leste has really recognised that gender inequality has deep socio-cultural roots and manifests in non-linear ways (Trivedy & Satyam, 2022). The government plans are to coordinate multi-sectoral inputs in comprehensive way to lessen gender inequality. The government has provided funds with a 20-year timeline to accelerate the reduction of gender inequality. For that reason, the government has focused on three key areas which are related to implementation of legislation, social protection and gender-responsive financing (Trivedy & Satyam, 2022):

1. "Laws are already there. Weaker implementation is a barrier. If the State is able to ensure the implementation of these laws, this will ultimately improve the protection of women and girls, leading to the upholding of women's rights.
2. A long-term social protection scheme will provide effective mechanisms to reduce the vulnerabilities of women and girls, leading to their empowerment and participation in all sectors,
3. Gender-responsive budgeting is a critical part of the Public Financial Management agenda and will improve the social and economic situation of women and girls by ensuring a fair allocation of resources"

The implementation of existing laws and regulations will facilitate and this is the proper time to promote gender equality agendas and incorporate gender perspectives throughout the wide range of challenges that people confront in Timor-Leste and the Pacific Region. The main purpose is to leave no woman and girl behind.

3.2 Key Socio-Economic Sectors (including profile, location, status and trends)

3.2.1 Fisheries

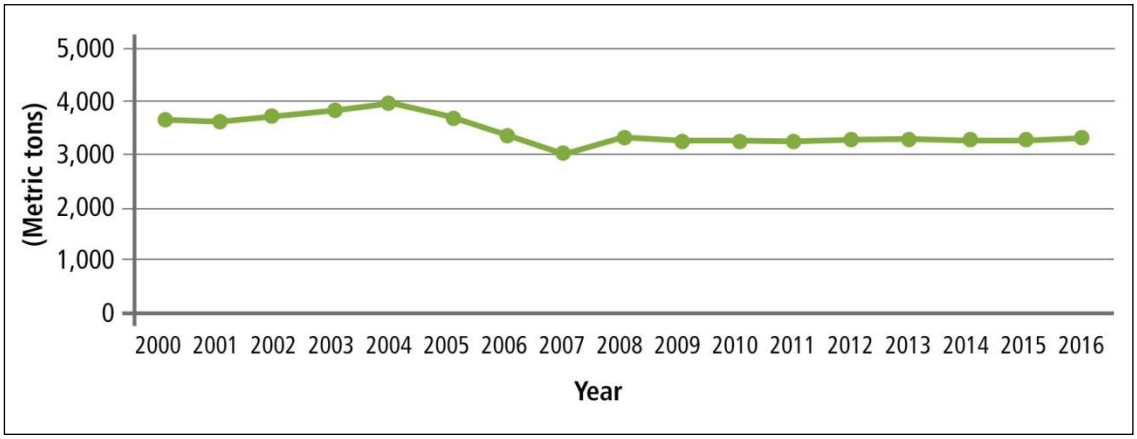
3.2.1.1 Marine capture fisheries

The fisheries sector in Timor-Leste is made up of subsistence and artisanal fisheries. Most of the equipment utilised for fishing is relatively limited, with local fishing fleets mostly consisting of non-motorised boats and fishers primarily using low technological types of gears. Hook, line and gill nets are used to capture reef and surface-dwelling fish species such as flying fish, and sardines. Fishing activities mainly occur in shallow waters around 2 km away from the coast, due to the nature of the non-motorised fleet. Domestic capture fisheries production is relatively low, with the volume of catch per year illustrated in Table 15 and Figure 25. Typically, fishers catch anywhere from 5 kg to 15 kg per trip and they sell it at local markets or through middlemen.

Table 15 – Capture fisheries production from 2000 to 2016 (tons)

YEAR	2000	2001	2002	2003	2004	2005	2006	2007	2008
TONNES	3,621	3,561	3,720	3,850	4,000	3,650	3,300	2,911	3,243

YEAR	2009	2010	2011	2012	2013	2014	2015	2016	
TONNES	3,200	3,200	3,200	3,200	3,200	3,200	3,200	3,200	



Source: World Bank, 2018
Figure 25 – Capture fisheries production between 2000 and 2016

Fisheries production was relatively consistent from 2008 to 2016. The Government of Timor-Leste committed to helping annual fisheries production per person reach 10kg, but it is believed that gross annual catch has not changed since 2016. With no demonstrable progress, this is likely due to no significant enhancement regarding fishing gear materials or vessels. The nature of fishing in Timor-Leste continues to be of subsistence and artisanal volume, with fishers catching small amounts for cash and family consumption.

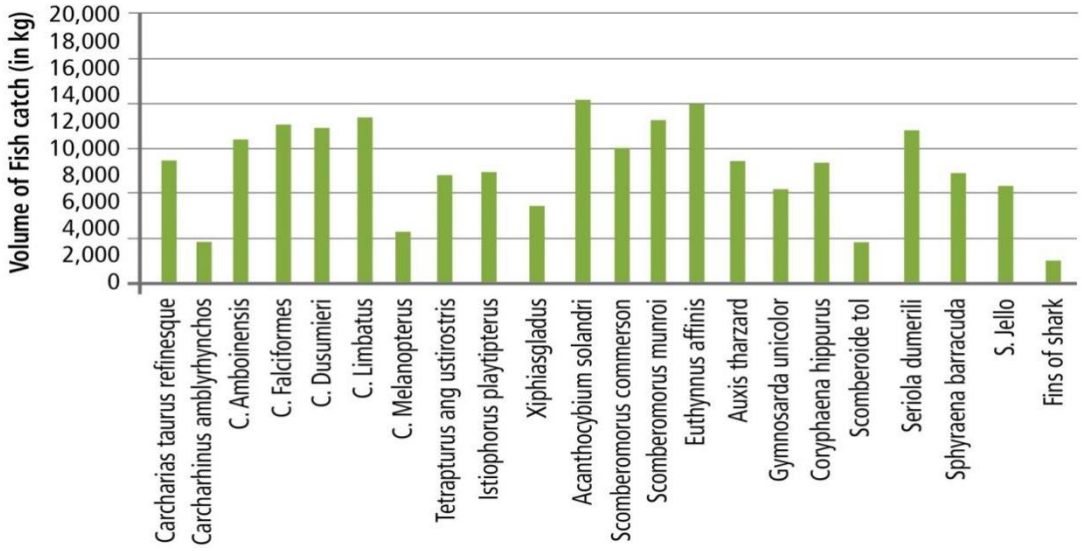
Another significant source of fisheries production in Timor-Leste is derived from gleaning practices. These activities are mainly carried out by women and children in the intertidal zone, during periods of low tide. The main target species collected are mollusks and bivalves, octopus, small fish, seaweed and crab. Most of the gleaning catch is directed toward family consumption, contributing to nutritional security, but some higher value species such as crab and octopus are sold for cash.

Due to small fisheries production, the Government of Timor-Leste has invited some investors to participate in fish capture. Last decade, the Government of Timor-Leste permitted foreign vessels (~17) access to offshore waters within the nation's EEZ. They were engaged in deep-sea fishing activities on the southern coast. However, these activities were halted due to inconsistencies involving the capture of prohibited shark species. Currently, there are no foreign vessels operating in Timor-Leste waters.

The limited development of Timor-Leste's capture fisheries has been attributed to inadequate equipment and low skills (Weiver, 2008). The SDP 2011-2030 laid out a plan to improve the fisheries sector in both the short and medium term (2011-2015 and 2016-2020), focused on increasing the catch from artisanal fishing activities to eventually exploiting offshore fishing

grounds in the Exclusive Economic Zone (EEZ). The SDP's vision involves the successful management of coastal and inland fisheries and the creation of a vibrant commercial fishery. However, this plan is yet to be realised as the capacity of fishers and domestic catch levels remain relatively unchanged.

The major species caught by foreign vessels (three boats) on the southern coast during two months (2017) is illustrated in Figure 26. All products are considered high-value species.



Source: MAF, 2017

Figure 26 – Volume of fish catch by species, 2017

The major species of fish caught and the catch composition (including abundance and volume) around eastern Timor-Leste water are presented in Table 16 and Table 17 below. These fish species were caught around Lautem, Com and around Jaco Island up to Lore 1. The catch composition is to that found in Atauro, Maliana, Suai, Betano and Viqueque. Most of these species caught are considered low-value species (MAF, 2017).

Table 16 – Composition of 10 fish species with abundance and proportion of abundance across Timor-Leste

No	Species	Category of fishes	Abundance individual (7,354)	Proportion of abundance (%)
1.	*Pomacentrus lepidogenys*	Major	650	8
2.	*Chromis.viridis*	Major	600	8
3.	*Pseudanthias hutchtii*	Major	400	6
4.	*Pterocaesio tileniger*	Major	372	5
5.	*Odonus niger*	Major	342	5
6.	*Chromis margaritifer*	Major	300	4
7.	*Lepidozygus tapeinosoma*	Major	290	4
8.	*Pseudanthias squamipinni*	Major	250	3
9.	*Lutjanus gibbus*	Major	180	3
10.	*Chromis ternatensis*	Major	160	2

Source: MAF, 2017

Table 17 – Major species caught and its volume in Timor-Leste

No	English Name	Volume
1.	Sardine	92496.03
2.	Garfishes	83997.85
3.	Frigate Mackerels	39911.00
4.	Flying Fish	29847.63
5.	Mackerel Scads	5999.93
6.	Mackerel Tuna	4961.29
7.	Bullet Tuna	2981.11
8.	Long Tom	2627.42
9.	Skipjack Tuna	1966.73
10.	Spine foots (Rabbit Fishes)	1436.83
11.	Dark- Banded Fusilier	880.52
12.	Indo- Pacific Sailfish	842.77
13.	Mackerel Scads	5999.93
14.	Mackerel Tuna	4961.29
15.	Bullet Tuna	2981.11
16.	Long Tom	2627.42
17.	Skipjack Tuna	1966.73
18.	Spine foots (Rabbit Fishes)	1436.83
19.	Dark- Banded Fusilier	880.52

Source: WorldFish, 2016

Fish species and catch composition of bottom waters were studied in Suai (ATSEA-1, 2011). The research study applied trawling with a towing time of 30 minutes within a depth of 23 up to 25 m. The results showed a total catch of 42.84 kg/30 minutes or 85.68 kg/day. Species caught consisted of demersal fish, sea urchin, shrimps and crustaceans. The dominant fish families caught were "sweet lips with the main species being *Pomadasys argyreus* and *P. kaakan*, followed by threadfin breams of the family Nemipteridae, and fish of the family Triacanthidae". Other dominant families are set out below:

1. Nemipteridae family, the dominant species are *Nemiperus tolu* and *N. japonicas*,
2. 'The fourth dominant fish group is ponyfish of the Leiognathidae family, followed by the bigeye of the Priacanthidae family and polka dot fish of Apogonidae family. The ponyfish are dominated by the species *Leiognathus daura*, the big eye group by *Priacanthustayenus*, and the polka dot fish group by *Apogon septemstriarus* and *A. poecilopterus*'
3. 'The next dominant fish group are the Sciaenidae family (the bearded croakers), the Mullidae family, the Platycephalidae family, and lizard fishes of the family Harpadontidae. The Sciaenidae were dominated by the species *Penahia macrocephalus*, *Upeneus vittatus*, *U. sulphureus*, and *Coeciellacrocodila*. The lizard fish is dominated by the species *Saurida micropectoralis* and *S. undusquamis*'

The report also confirmed that juvenile red snappers (*Lutjanus malabaricus*) were captured along with some small pelagic fish e.g., *Stolephorus indicus*. Non-fish species found included sea urchin, shrimps (dominated by *Metapenaeus ensis* and *Trachypeneus fulvus*), and other crustaceans. One of the most prominent crustacean species was *Charybdis* spp.

Capture fisheries in Timor-Leste are dynamic and heterogenous. The total fishers are estimated to be around 5,000, although this figure only considers boat-based data (Mills et al., 2017). Even though fishers play a critical role in providing food and nutrition security to subsistence

households, most of them are estimated to be experiencing malnutrition, with nearly half living in poverty. While the paid labour contribution from women and girls in the fisheries sector might not be as significant to household income, they support livelihoods in many other ways – such as childcare, and unpaid activities like gleaning.

Fisheries products are usually sold on the beach and roadside markets at an average price of $5 to $10 per kg (personal interview, 2021). The species consumed and the corresponding price is presented in Table 18, demonstrating an average of $4.42 per kg.

Table 18 – Top species of fish consumed in Timor-Leste

No	Species	Average price/kg (USD)
1.	Saba mackerel	3.50
2.	Sardine	2.00
3.	Garfishes	2.00
4.	Emperor	5.00
5.	Snapper	5.00
6.	Tuna	5.00
7.	Grouper	10.0
8.	Travelly	10.0
9.	Milkfish	4.50
10.	Sea perch	5.00
11.	Casio	4.50
12.	Tilapia	1.50

Source: MAF, 2017

3.2.1.2 Small–scale and artisanal fisheries

Many coastal households in Timor-Leste are engaged in small-scale fisheries, using relatively small amounts of capital and energy. Fishing trips are normally short in duration, and the products are primarily for family consumption. Very few products can be sold for cash or for income generation which can be related to the small volume of catch, lack of transport and refrigeration facilities, and personal consumption. Even though the volume of catch is relatively small, it is still a significant source of livelihood and food security for some.

There are some common features characterising artisanal and small-scale fisheries in Timor-Leste. These generally involve:

1. Limited budget to invest in fishery or fishing activities;
2. Fishers have limited access to capital, credit sources, and social welfare;
3. Use of small boats (canoes) with different fishing gear materials targeting many different species and size;
4. Fish trade is extremely dependent on intermediaries (middlemen) due to low capital committed, so fishers are unable to directly influence the local market;
5. Household level engagement in fishing activities from harvest to post-harvest, and marketing;
6. Fisheries production is relatively low but vital for household consumption and cash as part of income diversification;

7. Skills and knowledge in marine and coastal resources and management measures are lacking; and
8. Labour is low or cheaper.

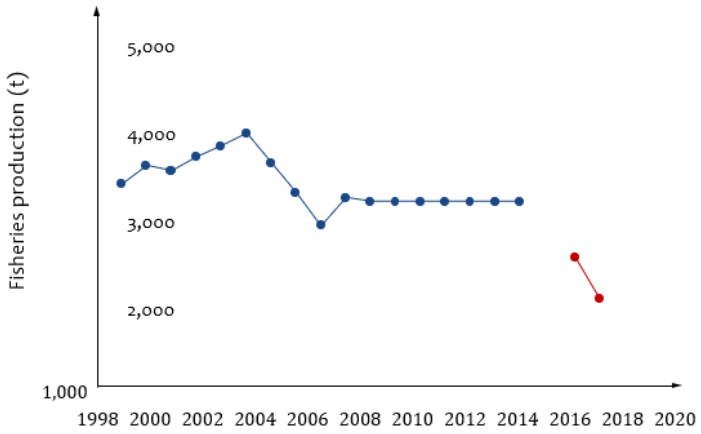
There are more than 5000 fishers in Timor-Leste (López-Angarita et al., 2019). Most fishers operate on the northern coast as the ocean characteristics are less dynamic than on the southern coast. The small-scale and artisanal fishery contributes to the livelihoods of women and youth. Women and girls are involved in gleaning fisheries and remove fish from gillnets once fishers come ashore. Fishing practices relate to distinct seasonal cycles in Timor-Leste, often more profitable during certain periods of the year. For example, during the dry season (August to November) gleaning activities are common, but due to rough conditions in the wet season fishing and gleaning activities come to a near halt.

In Timor-Leste there are two categories of fishers – part time and full time. When a fisher identifies as part-time it likely means that they engage in other activities such as animal husbandry or agricultural production (maize, rice, cassava, potato and beans). Conversely, full-time fishers generally have a broad range of gear types, allowing them to go fishing throughout the year. They have the capacity to adapt to inclement weather conditions - targeting non-fish species such as clams, shrimps, small octopus and seaweeds, whereas normally they might target pelagic species and bottom-dwelling fish.

Small-scale fishing forms just one component of a livelihood strategy for some, with people often combining various ways of earning a living. The diversification of livelihoods is particularly important in terms of the unpredictability associated with climate change. Multiple sources of livelihood build resilience toward the catastrophic effects of anthropogenic-induced climate change. Harvesting various fisheries resources and agricultural products are part of livelihood strategies. In the face of climate change and climatic variability diverse sources of livelihoods will help reduce the vulnerability of coastal communities to catastrophic effects and help to maintain food security and household income.

Small-scale fisheries in Timor-Leste experience limited access to modern technology, health care, education, economic and human capital. These constraints are further compounded by the lack of sectoral and geographic mobility, contributing to limited livelihood diversification. Other considerations relevant to the small-scale fisheries sector include water pollution (mainly solid waste), and the destruction of fish and non-fish habitats (due to removal of mangrove trees and coastal development) that occurs in coastal areas - particularly in Dili, Manatuto, Liquiça, Maliana and Suai. Marine and coastal pollution affects not only marine and coastal biodiversity but also human health (DaFonseca & Spiller, 2021). Land-based pollution is a significant threat during the most vulnerable life stages of fish and other marine life. The removal of mangrove trees threatens communities because they protect coastal areas from extreme weather events such as flash flooding and strong storms.

The small-scale fisheries in Timor-Leste generally use gill nets and hook and line to capture reef and surface-dwelling fish species such as flying fish and small sardines. WorldFish and FAO are two key organisations that provide national fisheries and catch estimates. The potential annual productivity, including unexploited offshore sectors, is estimated to be around 116,000 tons. Excluding IUU fishing, annual catch estimates from 1998 to 2016 are illustrated in below.

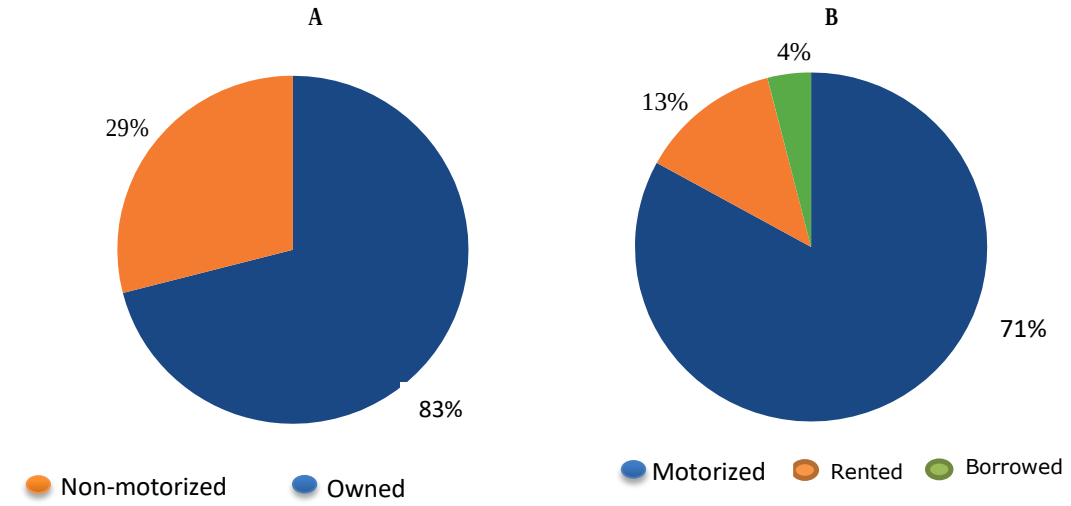


Source: World Bank WDI, 2016

Figure 27 – Estimated fish production by PeskAAS

Note: Figure 19 shows capture fisheries production between 1998 and 2016 (FAO, 2016). Red circle shows the estimate generated by data from PeskAAS

PeskAAS was established by MAF (Fisheries Department) and WorldFish to facilitate a national long-term monitoring program. The program has estimated Timor-Leste's small-scale fishing effort within two different periods - 1,963 tons and 1,865 in 2017 and 2018 respectively. These fisheries production statistics do not include gleaning activities, however WorldFish is currently working to incorporate this fishery into the PeskAAS system. Fish were caught using small canoes (from 2m to 6m in length) and larger motorised boats (from 4 m to 7 m in length). In 2018, PeskAAS reported 1,590 wooden canoes and 647 motorboats as registered (see Figure 28). The number of active vessels varies annually, and between municipalities. Atauro has the highest concentration of fishing vessels but is still considered low ownership (29%) compared to regional level (Asia), where motorised vessels represent around 70% of the fishing fleet (Schmidt, 2018). Outrigger canoes are usually powered by 10/15 HP long tail or outboard engines. These vessels allow fishers to catch small and pelagic fish using long lines and gill nets, but restrict fishers in distant, volume, and fish size.



Note: A = Artisanal fishing fleet and B = fishers whose boat is owned, rented or borrowed

Source: DIGPRP, 2018

Figure 28 – Proportion of motorized and non-motorized vessels in Timor-Leste

Fish Aggregation Devices (FADs) are another fishing technology being adopted by local fishers. The use of FADs has been observed in Baucau, Lautem, Liquiça, Bobonaro, and Atauro. Generally, a FAD is organised or owned by groups of 10 – 12 fishers. The catch from FADs can vary from small to medium size, but many fishers report successful increases in catch. The fish are sold at local markets or through middlemen. Most fishers have affirmed (during the consultation) that they do not target a particular species, but instead prefer to use a variety of fishing gears to catch as many species as possible. The composition of the catch is strongly influenced by seasonality, for example, during the dry season greater diversity of fish species are caught than during wet season. In general, species caught also vary from one fishing area to another.

Data compiled by López-Angarita et al. (2019) demonstrate the top five fish that local fishers consider most important and high value, based on species and family groupings. The data indicates the diverse values placed upon fish species by fishers around the country (see Table 19).

Table 19 – Top fish species caught regularly by local fishers as most important for sale in Timor-Leste

TOP FISH SOLD based on species/type				Average score (from fisher ranking) ◊					
Tetum name	English common name	Species name	Family	Region I	Region II	Region III	Atauro	RAEOA	Timor-Leste
Sardina	Sardine	*Sardinella* spp. and others	Clupeidae	52	60	60	0	60	52
Bainar Mutin/Kombong*	Short Bodied Mackerel*	*Rastrelliger* sp.*	Scombridae*	36	73	27	60	93	50
Tongkol/Kasareta	Bullet tuna	*Auxis* sp.	Scombridae	56	13	13	0	20	27

Samber	Garfish	*Hemiramphus* sp.	Zerchopteridae	32	40	20	0	7	26
Koku	Trevally	*Carangoides* sp.	Carangidae	32	7	20	47	33	24
Garopa/Kerapu	Grouper/Rock Cod	*Epinephelus* sp.	Serranidae	32	0	33	53	0	23
Sera/Tengiri	Spanish mackerel	*Scomberomorus* sp.	Scombridae	20	33	20	7	0	21
Ikan Manu	Flying fish	*Cypselurus* sp.	Exocoetidae	12	0	60	0	13	20
Ikan Mean/Kamera	Snapper	*Lutjanus* sp.	Lutjanidae	20	13	13	47	27	19
Ikan Daun	Long tom	*Tylosurus* sp.	Belonidae	16	0	0	13	0	6

TOP FISH FAMILIES SOLD based on family groupings	Average score (from fisher ranking) ◊					
Region I: Baucau, Manatuto, Lautem, Viqueque Region II: Manufahi, Ainaro, Covalima Region III: Dili (mainland), Liquica, Bobonaro Atauro: Atauro Island RAEOA: Special Administrative Region of Oecusse Ambeno ***** *Bainar Mutin/Kombong (Scombridae) may also include some scads (e.g. Decapterus spp. (Carangidae) because of local differences in naming.* ◊ *Higher scores indicate higher ranking.* *Note: Timor-Leste score is the overall average weighted by the number of municipalities in the region.* **Source: López-Angarita et al., 2019**	**Family**	**Region I**	**Region II**	**Region III**	**Atauro**	**RAEOA**	**Timor-Leste**
	Scombridae*	112	120	60	67	113	97
	Clupeidae	52	60	60	0	60	52
	Lutjanidae	60	13	40	47	33	40
	Zerchopteridae	32	40	20	0	7	26
	Carangidae	32	7	20	47	33	24
	Serranidae	32	0	33	53	0	23
	Exocoetidae	12	0	60	0	13	20
	Laxar (unknown)	0	27	0	0	0	7
	Belonidae	16	0	0	13	0	6
	Caesionidae	16	0	0	0	0	5
	Trichiuridae	0	20	0	0	0	5

Additionally, López-Angarita et al. (2019) identified which species are considered essential for family consumption throughout Timor-Leste. The data showed that household consumption of fish varied by region. The study identified 32 fish species, with distinct regional groupings. For example, snapper (*Lutjanus* sp.), short-bodied mackerel (*Rastrelliger* sp.) and trevally (*Carangoides* sp.) were mostly caught in Manufahi, Covalima and Ainaro on the southern coast. See geographical regions of fishing in Figure 29 and Table 20 for more detail.

Note: Region 1: Baucau, Manatuto, Lautem, Viqueque. Region 2: Manufahi, Ainaro, Covalima. Region 3: Dili (mainland), Liquica, Bobonaro. Atauro: Atauro Island. RAEOA: Special Administrative Region of Oecusse-Ambeno.

Figure 29 – Fish caught based on geographical areas across Timor-Leste

Table 20 – Top fish species caught by local fishers as most important for family consumption

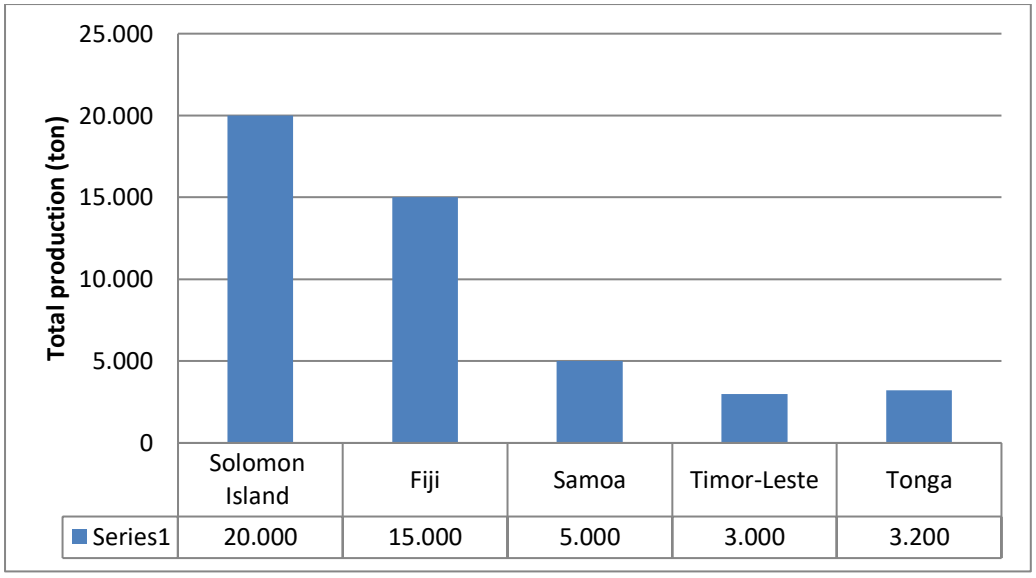
TOP FISH EATEN based on species/type				Average score (from fisher ranking) ◊					
Tetum name	English common name	Species name	Family	Region I	Region II	Region III	Atauro	Oecusse	Timor-Leste
Bainar Mutin/Kombong*	Short-bodied mackerel*	*Rastrelliger* sp.*	Scombridae*	28	73	27	27	0	37
Sardina	Sardine	*Sardinella* spp. and others	Clupeidae	36	0	80	0	33	35
Ikan Mean/Kamera	Snapper	*Lutjanus* sp.	Lutjanidae	20	87	13	0	33	34
Garopa/Kerapu	Grouper/rock cod	*Epinephelus* sp.	Serranidae	32	40	33	20	13	32
Ikan Manu	Flying fish	*Cypselurus* spp.	Exocoetidae	16	0	80	0	0	25
Koku	Trevally	*Carangoides* sp.	Carangidae	12	60	0	0	20	21
Bainar Fatuk	Fusilier	*Caesio* and *Pterocaesio* spp.	Caesionidae	32	0	0	93	27	21
Ikan Daun	Long tom	*Tylosurus* sp.	Belonidae	48	13	0	0	0	19
Tongkol/Kasareta	Bullet tuna	*Auxis* sp.	Scombridae	36	0	13	0	27	18
Kamera Merdani	Mangrove jack	*Lutjanus argentimaculatus*	Lutjanidae	36	0	0	0	0	12

TOP FISH FAMILIES EATEN based on family groupings	Average score (from fisher ranking) ◊						
Region I: Baucau, Manatuto, Lautem, Viqueque Region II: Manufahi, Ainaro, Covalima Region III: Dili (mainland), Liquica, Bobonaro Atauro: Atauro Island RAEOA: Special Administrative Region of Oecusse Ambeno **Bainar Mutin/Kombong (Scombridae) may also include some scads (e.g., Decapterus spp. (Carangidae) because of local differences in naming. ◊Higher scores indicate higher ranking.*	**Family**	**Region I**	**Region II**	**Region III**	**Atauro**	**RAEOA**	**Timor-Leste**
	Scombridae*	68	93	40	27	27	60
	Lutjanidae	76	87	20	0	33	55
	Clupeidae	36	0	80	0	33	35
	Serranidae	32	40	33	20	13	32
	Carangidae	12	60	20	0	20	26
	Exocoetidae	16	0	80	0	0	25
	Caesionidae	32	0	0	93	27	21
	Belonidae	48	13	0	0	0	19
	Acanthuridae	16	0	0	67	0	11
	Zerchopteridae	24	0	0	0	0	8

Source: López-Angarita et al., 2019

In 2017, PeskAAS estimated the gross domestic fisheries production to be1,963 tons. This estimation was calculated using the combined monthly catch per unit effort (CPUE) recorded across 19 fish landing centres. CPUE is calculated based on mean effort per trip. The average trip length of motorised boats is equal to 4:04 hours per trip, and small outrigger canoes is equal to 22 hours per trip. The average trip per month for small canoes is equal to 8:2 trips and motorboats equal 5:3 trips respectively (López-Angarita et al., 2019).

Small-scale fisheries production in Timor-Leste is relatively low compared to other countries in the Pacific (see Figure 30). However, in some places (Atauro Island, Lautem, Viqueque, and Oecusse) fish consumption per person per year is relatively higher. This is likely because many fishers in these municipalities are full time fishers compared to others. The principal barrier to higher fisheries production is that the sector is poorly developed. Both local and central governments do not allocate sufficient state budget to help develop this sector. The national fish production is likely underestimated, due to lack of monitoring and surveillance, and limited human resources.



Source: Gillett, 2016 Timor-Leste data from PeskAAS, 2019

Figure 30 – Volume of small-scale fishery production for Pacific (Small-Island countries) between 2014 and 2017 for Timor-Leste

3.2.2 Aquaculture (freshwater, brackishwater and mariculture aquaculture)

Aquaculture is also an underdeveloped sector. Many aquaculture ponds and mini hatcheries were developed during Indonesian times, but after independence almost all were destroyed. In the last decade the Government of Timor-Leste has improved ponds, particularly freshwater ponds in many municipalities across the country. Hatcheries are also being developed in localities such as Maubara, Maliana, Lospalos, Ermera, and Manufahi. This work is being done in collaboration with development partners, and both local and international NGOs. The hatcheries mainly produce fingerlings to facilitate rural fish farming. A key goal is to improve nutritional status and food security, especially for children and pregnant women.

The development of the Timor-Leste's aquaculture sector has been outlined in the SDP 2011-2030. It acknowledges that aquaculture development is vital not only for food security and combating malnutrition, but also as a source of cash income and livelihood diversification for rural and coastal communities. Many NGOs (WorldFish, MercyCorps, FAO, UNDP, Catholic Relief Services and HIVOs) are working closely with government at the municipality level to distribute fingerlings to farmers e.g., in Baucau, Lautem, Manufahi, Ainaro, Covalima and Viqueque. They also provide training to households regarding integrated farming to diversify food systems and other livelihoods options in the face of climate change.

The most farmed freshwater species are tilapia (*Oreochromis niloticus*), golden fish or carp (*Cyprinus carpio*), and catfish (*Clarias bathracus* and *Clarias gariepinus*). Whereas brackish-water species are limited to white shrimp/prawn (*Penaeus indicus or Litopenaeus vannamei*), and milkfish (*Chanos-chanos*, Forskal). Fingerlings for both milk fish and shrimp are imported from Indonesia. The fishers and local NGOs in Timor-Leste are currently unable to provide fingerlings to cater to demand, primarily because collecting fingerlings from wild stock requires a set of skills, knowledge, and equipment that is yet to be developed in Timor-Leste. Mariculture is

another challenge. There is one impounding net system (floating net cage) in Dolok Oan near the city of Dili, where grouper species (*Epinephelus summana*) are mainly being farmed. The production level is relatively low due to the restricted availability of fishmeal.

The farming of seaweed is quite a significant activity. Most seaweed farming is concentrated on Atauro Island, while smaller operations occur in Ulmera-Liquiça, Manatuto and Baucau. The number of farmers is increasing, although the production is mainly limited to local demand with just a small amount of product being sold abroad (Table 21). Due to the small-scale nature of seaweed farming operations, there is not a sufficient volume of product to attract oversea buyers and large companies. There are many opportunities to increase seaweed production, including the development of post-harvest and packaging systems. Improving all stages of the market chain, from technical capacity, production, processing, and storage will encourage the export of products to neighbouring countries.

Seaweed farming has provided an alternative source of income for coastal communities, not only in Atauro Island, but also in Dili and Liquiça. The sector has also been introduced to different municipalities on the southern coast e.g., Suai, Betano, Lore and Manatuto (Natarbora).

Table 21 – Seaweeds exportation (in kg) from 2009 to 2020

No.	Species of Seaweeds	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	TOTAL
1	*Eucheuma cottoni*	46,000	152,209	43,862	76,587	124,296	500	-	-	-	19,500	69,100	100,000	**632,054**
2	*Eucheuma spinosum*	-	-	-	-	-	57,200	52,000	156,000	148,748	25,000	46,000	-	**484,948**
3	Mixed *E. cottoni & E. spinosum*	-	-	-	-	-	-	-	-	-	-	63,000	-	**63,000**
	TOTAL (kg)	**46,000**	**152,209**	**43,862**	**76,587**	**124,296**	**57,700**	**52,000**	**156,000**	**148,748**	**44,500**	**178,100**	**100,000**	**1,180,002**

Source: Directorate of Fisheries, Aquaculture and Marine Resource Management, 2022

The further development of the aquaculture sector will play an important role in supporting food security and livelihoods. Enhancing the capacity of existing hatcheries, to provide more fingerlings locally and move away from a reliance on imported broodstocks, can be attained through:

1. Increasing viable broodstocks (all species both fish and non-fish)
2. Producing fish feed using locally available ingredients
3. Providing training for fisheries staff at the municipality level in relation to hatchery management (breeding, feeding and broodstocks management)
4. Promotion of fish species based on agro-ecologies in suitable areas
5. Design suitable training for fish farmers (feeding, breeding and fish feed production)

Currently, most inland communities are farming tilapia GIFT both mixed and monosex. The main objective is to fill their own consumption needs, with the rest being sold at local markets (approx.$4/kg) as part of income generation and diversification efforts. There are around 4000 households engaged in subsistence aquaculture activities across the country (WorldFish, 2016). These aquaculture activities have been supported by MAF, and both national and international NGOs. Initial results have shown positive impacts regarding sources of household income and

the improved nutritional status of household members. As noted by López-Angarita et al. (2019), when households participate in aquaculture activities, fish consumption tends to increase significantly. Households in Gleno, Manufahi, Maliana, Baucau, Lospalos Aileu, Ainaro and Viqueque are the main areas that consume freshwater fish species. In addition, López-Angarita et al. (2019) also noted that around 75% of households were aware of the health benefits of consuming fish, especially children. Fish contains critical omega 6's that support early brain development in children, helping to prevent long-term health effects of malnutrition.

Mills et al. (2017) found that in some municipalities (Baucau, Ermera and Maliana), ponds are yielding around 3 tons of fish per ha and most of the production (63%) is sold at local market, while the rest is utilised for family consumption and barter. The main barrier identified in tilapia farming is sourcing fish feed (pellet). The fish farmers need to reduce input and maximise the outputs. Further research is needed to examine the cost-benefit analysis and improve the sector's viability.

MAF/Fisheries are working closely with WorldFish to develop guidelines for better management practices for aquaculture development, particularly freshwater aquaculture, to enhance the fresh fish production across the country.

The Government of Timor-Leste has committed to improving annual fish supply from aquaculture to 12,000 tons by 2030. This amount will contribute around 40% of the national domestic fish consumption (MAF, 2019). To attain this target, attention needs to be given to providing quality aquaculture inputs e.g., broodstocks, feed and fingerlings, and building the skills of fish farmers. Aquaculture inputs are relatively small, causing low production at an average of 4.3 tons per ha. Table 22 shows total fish production from each municipality. In addition, ponds need to be fertilised to improve in situ fish production, and the use of formulated feeds using locally available ingredients needs to increase. These improvements are likely to advance fish productivity to over 5 tons per ha/year. This commitment can be realised if private sectors, NGOs, and development partners can subsidise and support some feasible technologies, capacity building, and extension services.

Table 22 – Total aquaculture production (kg) for each Municipality from 2019 to 2020

No.	Municipality	2019	2020	2021	2022	2023 (estimated)
1	**Aileu**	3,211	1,734	1,769	1,804	1,840
2	**Ainaro**	3,904	7,719	7,873	8,031	8,191
3	**Baucau**	16,525	16,411	16,740	17,074	17,416
4	**Bobonaro**	11,293	16,591	16,923	17,261	17,607
5	**Covalima**	313	86	88	89	91
6	**Díli**	7,370	5,523	5,634	5,746	5,861
7	**Ermera**	49,626	30,790	31,406	32,034	32,675
8	**Lautem**	2,233	4,609	4,701	4,795	4,891
9	**Liquiça**	7,799	2,580	2,632	2,684	2,738
10	**Manatuto**	4,244	9,995	10,194	10,398	10,606

11	**Manufahi**	25,842	52,882	53,939	55,018	56,118
12	**Oecusse**	34	35	35	36	37
13	**Viqueque**	4,461	16,194	16,518	16,848	17,185
	Total (kg)	**136,854**	**165,148**	**168,451**	**171,820**	**175,257**

Source: Directorate of Fisheries, Aquaculture and Marine Resources Management, 2022

There are some local aquaculture hatcheries that have been developed to sustain the production of fingerlings. These include facilities in Gleno (Ermera) for tilapia mono-sex, Genetically Improved Farmed (GIFT), mud crab (*Scylla serrata*) in Vemase (Baucau), tilapia and carp (golden fish) in Manufahi, and catfish and tilapia in Viqueque. The principal aim is to enhance fingerlings production to be distributed to communities across the country, ensuring long-term sustainable production and improved protein intake for children and pregnant women.

The development of the aquaculture sector also finds challenges in water supply and quality, flash flooding, and other biophysical factors which influence the environment in Timor-Leste. The traditional and semi-intensive culture of freshwater aquaculture is largely constrained by the limitation of production inputs and insufficient expertise in aquaculture. The process of constructing aquaculture ponds involves a relatively long transformation process and high levels of investment, resulting in few farmers being able to do so. At the community level, fish farmers are further constrained by a lack of training relating to fish breeding, feeding and broodstocks - including the treatment of eggs and fingerlings. Technical support is needed to help farmers implement technical aspects, and subsequently boost freshwater fish production for consumption and livelihood diversification.

It is hoped that the participation of fish farmers in on-farm trials will enhance their skills through applied, hands-on learning. From these programs, the fish farmers and their families will derive benefits from the practical skills and knowledge acquired, to help them secure sustainable livelihoods in the face of climate change and related shocks. This is also facilitated in providing right inputs such as seed and feed which is critically important for households' survival (food security and nutritional improvement). Nationally, fish consumption from aquaculture-sourced products is very low, with less than one kg per person per year (see

Table 23). Combination data on fish consumption from the sea and aquaculture is not available yet. The ideal volume of fish consumption for optimal human health is 25 kg/person per year (FAO, 2020). Based on fisheries and aquaculture planning in Timor-Leste, the government has set a target which involves all citizens consuming at least 10 kg/person per year.

Table 23 – The contribution of aquaculture to Fish consumption from each municipality (kg/person/year)

No.	Municipality	Aquaculture fish productions consumed at Municipality level per year (kg/person/year)				
		2019	2020	2021	2022	2023 (estimated)
1	Aileu	0.06	0.03	0.03	0.03	0.03
2	Ainaro	0.05	0.11	0.10	0.10	0.10

3	Baucau	0.12	0.11	0.11	0.11	0.11
4	Bobonaro	0.10	0.15	0.14	0.14	0.14
5	Covalima	0.00	0.00	0.00	0.00	0.00
6	Díli	0.02	0.02	0.02	0.02	0.02
7	Ermera	0.35	0.21	0.21	0.21	0.21
8	Lautem	0.03	0.06	0.06	0.06	0.06
9	Liquica	0.10	0.03	0.03	0.03	0.03
10	Manatuto	0.08	0.18	0.18	0.18	0.18
11	Manufahi	0.43	0.85	0.84	0.83	0.83
12	Oecusse	0.00	0.00	0.00	0.00	0.00
13	Viqueque	0.05	0.18	0.18	0.18	0.18
Nasionál		**0.10**	**0.12**	**0.12**	**0.12**	**0.12**

Source: Directorate of Fisheries, Aquaculture and Marine Resources Management, 2022

3.2.3 Marine tourism

Marine tourism is one of the main sources of potential economic growth in Timor-Leste, as it can provide job opportunities, income generation diversification. The natural beauty of the island on both the northern and southern coasts attracts locals and foreigners to visit for leisure and adventure. One of the biggest sources of marine tourism is located toward the easternmost point of the country. This area is also the first National Park in Timor-Leste, called Nino Konis Santana National Park. The Park occupies an area of 1,236 km^2 (477 square miles). There are many visitors, owing to the impressive diversity and abundance of coral reefs, marine life, and many species of marine birds. Within the National Park, there is also a heritage site of historical significance that attracts visitors. The site, "Ili-kerekere", has been promoted within the last decade to attract more visitors. Table 24 describes the number of international visitors since 2016, from the ten most common nationalities of tourists.

Table 24 – Foreign tourists and origin countries

No.	Nationality	Year						Total
		2011	2012	2013	2014	2015	2016	
1.	American/USA	2,269	2,240	2,162	2,039	2,161	2,429	10,871
2.	Australia	13,499	14,476	13,351	13,846	14,229	13,030	69,401
3.	British/England	1,194	1,320	1,361	1,380	1,186	743	6,441
4.	China	3,549	3,010	3,704	3,821	5,321	7,569	19,405

5.	Filipina	3,063	4,655	4,234	4,345	4,014	3,489	20,311
6.	Indonesia	47,115	82,673	55,706	57,274	56,188	65,798	298,956
7.	Japan	1,281	1,489	1,541	1,510	1,401	1,391	7,222
8.	Malaysia	2,168	2,493	1,527	1,736	1,826	1,769	9,750
9.	Portugal	6,148	6,016	6,186	6,674	8,603	7,821	33,627
10.	Singapore	1,529	1,438	1,462	1,523	1,404	1,380	7,356
Total		**81,815**	**119,810**	**91,234**	**94,148**	**96,333**	**105,419**	**588,759**

Source: RDTL, 2016

Accommodation facilities for tourists are much more concentrated on the northern coast than on the southern coast. The southern coast is less populated, and facilities such as clean water and access to electricity are not as developed. Hence, the development of tourism there has received less attention from the government. Yet the natural beauty is very similar to that of the northern coast, indicating potential for future tourism development. While there are no accommodation facilities in Lore and Beaco, there are some projects under development in Betano and Suai.

Soon it is expected that eco-tourism development on the southern coast will become a priority, following on from the SDP 2011-2030 which described the tourism industry as one which can enhance the Timorese economy, providing significant sources of employment and facilitating potential benefits to communities. The SDP 2011-2030 synopsised that the development of the tourism industry requires combining economic viability, socially responsible and social sustainability.

The principal challenges for tourism development on the southern coast are set out below:

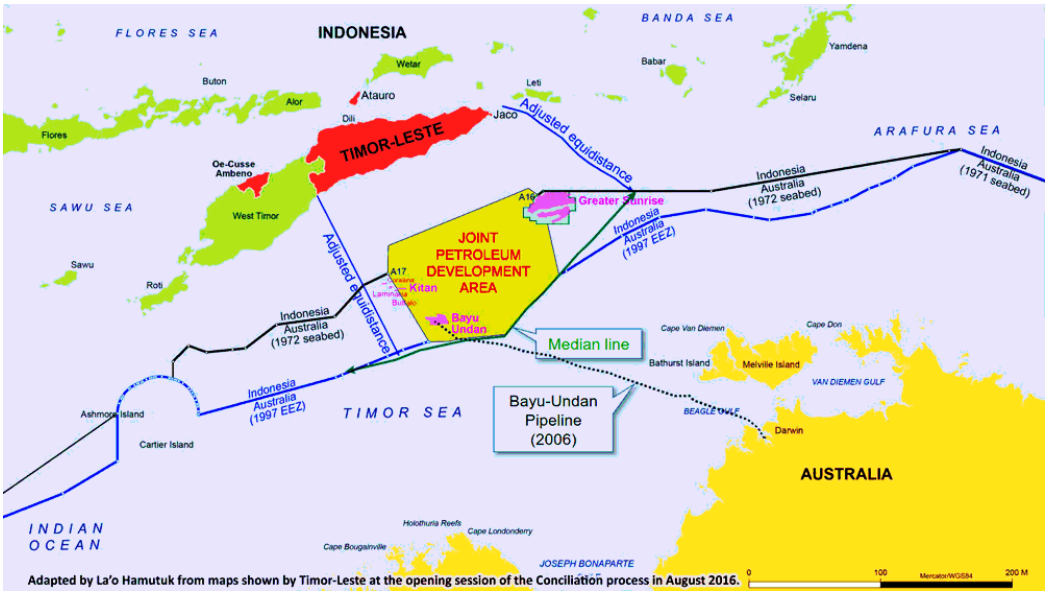
1. Tourism sector is not a priority area in the village development plan in all sites,
2. Coastal communities have limited skills and knowledge in relation to eco-tourism development
3. Limited control over marine and coastal resources and their benefits
4. Lack of investment from NGOs in the tourism sector

The above challenges to tourism planning and development can be overcome with a collaborative, interdisciplinary effort. Potential stakeholders will need to adopt best practices in community development that reflect economic sustainability, supporting the delivery of benefits to communities. These actions should be linked through a coordinated network aimed at building tourism and community development (Costa et al., 2008)

The coastal areas on the southern coast are very distinct. It is not only about natural beauty, but also a high abundance of crocodiles, biodiversity and culture heritage. These resources should be managed in an appropriate and sustainable way. Tourism development should be considered part of an Integrated Coastal Management approach, that will comprise marine and coastal resources management, MPA/LMMA, pollution control and climate change adaptation measures. Additionally, the delivery of basic needs to support eco-tourism are essential, particularly clean water, power, accommodation, security and hospitality.

3.2.4 Offshore oil and gas exploration and production

Timor-Leste' Offshore oil and gas exploration began two decades ago, in 2002. The main area of exploitation covers Bayu Undan, Elang Kakatua and Kitan in the Joint Petroleum Development Area (JPDA) (see Figure 31).



Source: http://laohamutuk.blogspot.com/2017/09/

Figure 31 – Oil and gas exploration in Timor-Leste

The offshore oil and gas resources have been exploited over various timescales. For example, oil and gas production on Elang Kakatua started between 1998 and 2006, production at Bayu Undan started in 2004 and is predicted to end in 2022. The Kitan operation started in 2011 and was suspended in 2015, although operation may recommence. In 2005/2006 the first bidding round was exercised for exploration blocks in JDPA and offshore exclusive areas.

There is a rough estimation for potential value to be developed and explored over the next 50 years. The total petroleum ranges from 12–17-billion-barrel oil equivalent. In the Timor Gap, it is estimated that the recoverable resources will be approximately 6.3 billion. In comparison the 'Bayu Undan reserve is around 1 billion and the monetary value of these resources at an average of USD59 per barrel in the next 50 years is USD372 billion' (PEMSEA on Blue Economy report, 2019).

The "Tasi Mane" project is a new investment opportunity for Timor-Leste. "Tasi Mane" Suai Supply Base oil and gas services potentially hold $372 billion worth of resources, yet to be monetized within the next 50 years. The project requires development and maintenance, including exploration, worth $222 billion over the next 50 years. The government can benefit around $31 billion if the project is fully explored. The benefits from taxes and oil profits, particularly upstream take including Timor Gap dividends, are expected to be approximately $16 billion.

To attain full exploration the Government of Timor-Leste first needs to invest around $2.2 billion to update the Suai airport, and Suai Supply Base including highway. These investments will

ensure that around 27% of the $100 billion is captured within Timor-Leste's national economy, with additional multiplier effects. It is expected to create thousands of job opportunities and increase trade, ultimately sustaining GDP growth in the immediate and near future.

The oil and gas industry will be developed alongside the southern coast, providing the biggest contribution to the economy of Timor-Leste. The Suai Supply Base, oil refineries, petrochemicals and LNG plants will greatly diversify the economy, providing job opportunities and reducing the reliance on purely extractive activities.

3.2.5 Offshore mining

Timor-Leste is rich in natural resources - silver, chromite bentonite, sandstone, onshore and offshore oil and gas, and silica. To date there are no mining activities across the country. There are some diving and exploitation activities related to marble being conducted by some local NGOs. This activity doesn't cause environmental pollution. Petroleum extraction just began in Suai Loro on the southern coast. The extraction will be managed in accordance with pollution management to avoid and reduce environmental pollution.

3.2.6 Shipping and ports

One fishing port is in Com, Lautem Municipality (Figure 32), although it is not being utilised due to limited commercial fishing activities in the area. There are no ports along the southern coast. In the last couple of years, some foreign vessels were operating on the southern coast but operations were halted because they were found to have caught some marine species that are under protection.

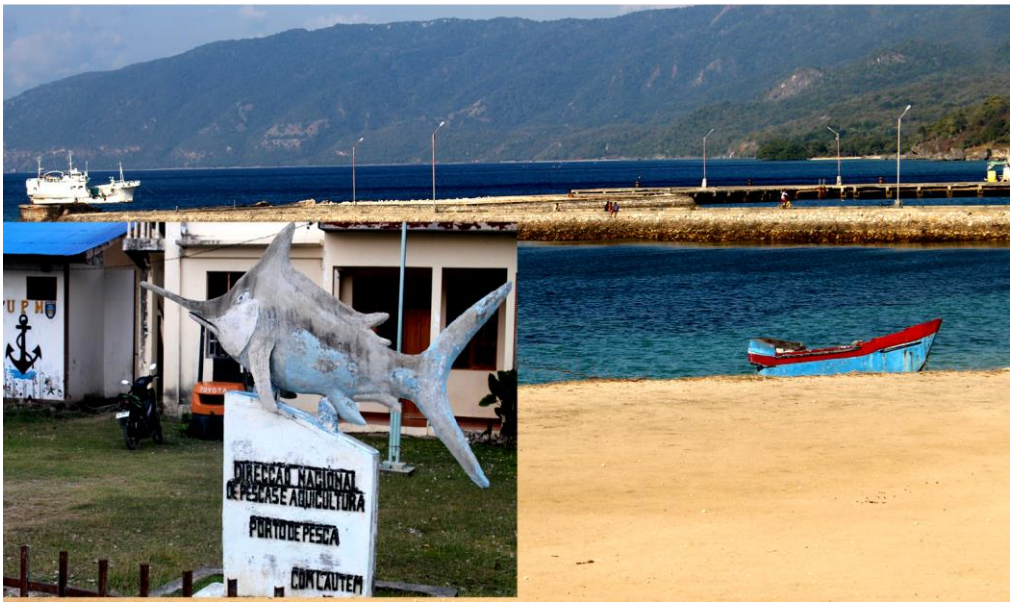


Image by: Dessy, 2019
Figure 32 – Fish Port in Com (Lautem)

The major port and shipping location is Tibar located on the western part of Dili city (Figure 33), with two others located on Atauro Island and Oecusse. The Tibar port in Dili facilitates the movement of all goods, cargo, and construction materials. The port is under the responsibility of port authorities, who oversee the imports from different countries such as Indonesia, China, Australia, India, and Brazil. This port also serves national and regional lines - Oecusse, Atauro, Indonesia, and Singapore. The new port will facilitate all cargos from different countries because Dili Port is not able to accommodate all deliveries and carriages from different countries at once.

Image by: Julieta Oliveira, 2023
Figure 33 – Major port and shipping in Tibar - western part of Dili city

3.2.7 Coastal agriculture

Coastal areas contain both critical terrestrial and aquatic habitats - coral reefs, coastal mangroves, wetlands and seagrass beds which are significant feeding areas for many aquatic species. These resources are vital to subsistence, and support income diversification for coastal communities.

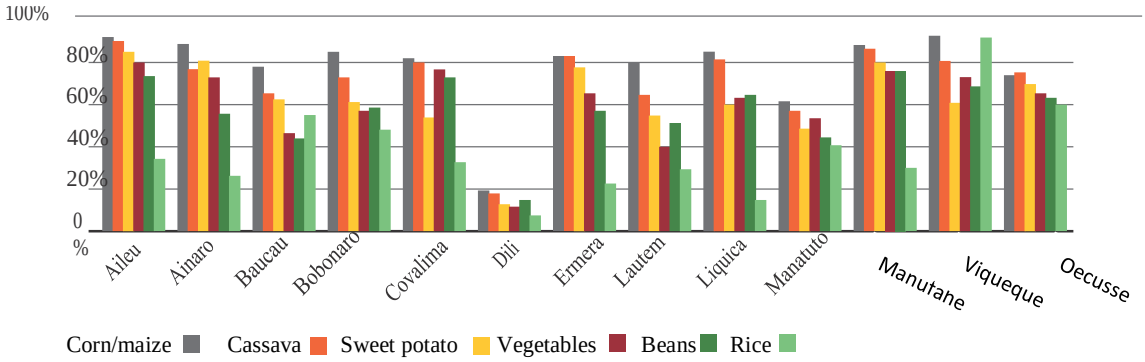
Many agricultural systems in Timor-Leste have been developed in coastal areas, owing to the opportunities offered by geographies, raw agricultural materials, and demand for food and income diversification. The humid climate on the southern coast has resulted in the growth of different crops compared to the northern coast. The southern coast is predominantly agricultural-based, and the high agricultural potential of this region has facilitated an effective and beneficial agricultural sector. Coastal farmers on the southern coast tend to integrate diverse livelihoods - crops farming, livestock, fishery and forestry.

Many coastal areas on the southern coast possess good soil and climatic conditions suitable for productive forms of agriculture, which have been practised by coastal communities for thousands of years. These agricultural activities play an important role in supporting the coastal economy.

Coastal agriculture on the northern coast does not experience such favourable conditions due to the long, annual dry season. As a result, it tends to be less significant in terms of contribution to the economy of coastal communities and national agricultural production.

Because coastal agricultural production on the southern coast shows more promise, specific attention should be given to enhance productivity through multi-cropping to meet future challenges such as climate change, food security, and a growing human population. To support multi-cropping systems, irrigation schemes and environmental preservation efforts must be made, so that existing agricultural systems based on local resources can be enhanced. It is important to consider and combine traditional techniques and practices with practical biotechnological approaches that have demonstrated success. For example, combining brackish water aquaculture programs with forestry will help to alleviate pressure on coastal fisheries and wetlands.

Coastal agriculture in Timor-Leste is mostly dominated by mixed-farming crops such as corns, beans, sweet potato, pumpkins, cassava, banana, papaya and taro (Figure 34). Additionally, rice fields are another agricultural activity that dominate some areas (Natarbora in Manatuto, Oecusse, Baucau, Viqueque and Maliana).



Source: Fanzo & Bonis-Profuno, 2019

Figure 34 – Existing main crops across the country

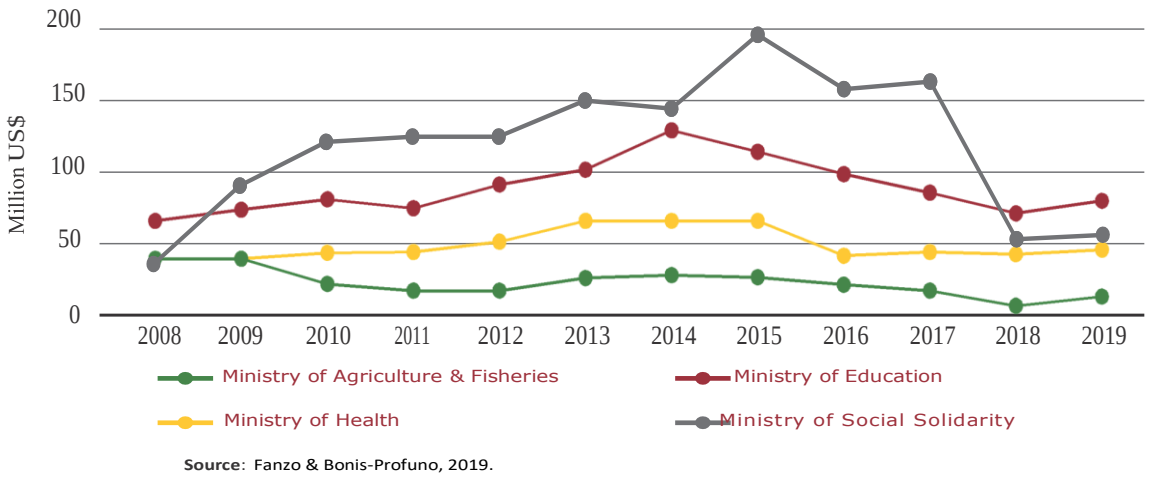
Aside from the main crops mentioned above, there are also agricultural products which are mainly for export. Between 2010 and 2017 these export crops have primarily included coffee, teak wood, candlenut, and sandalwood (see Table 25).

Table 25 – Agricultural products been exported from 2010 to 2017 (US$ million)

Agricultural commodities Export (USD)	2010	2011	2012	2013	2014	2015	2016	2017
Coffee	15,987	11,919	18,813	15,181	13,773	10,731	23,963	13,558
Teak wood / Ai Teka	312	85	11	17	-	-	-	-
Candlenut / Kami'i	60	40	125	143	84	258	97	-
Sandal Wood / Ai Kameli	-	398	834	-	-	-	-	-
TOTAL exports (Re-exports not included)	**16,395**	**13,202**	**30,793**	**16,049**	**13,868**	**11,074**	**24,030**	**14,867**
% Coffee over TOTAL exports	**97.5%**	**90.3%**	**61.1%**	**94.6%**	**99.3%**	**96.9%**	**99.7%**	**91.2%**

Source: **Fanzo & Bonis-Profumo, 2019**

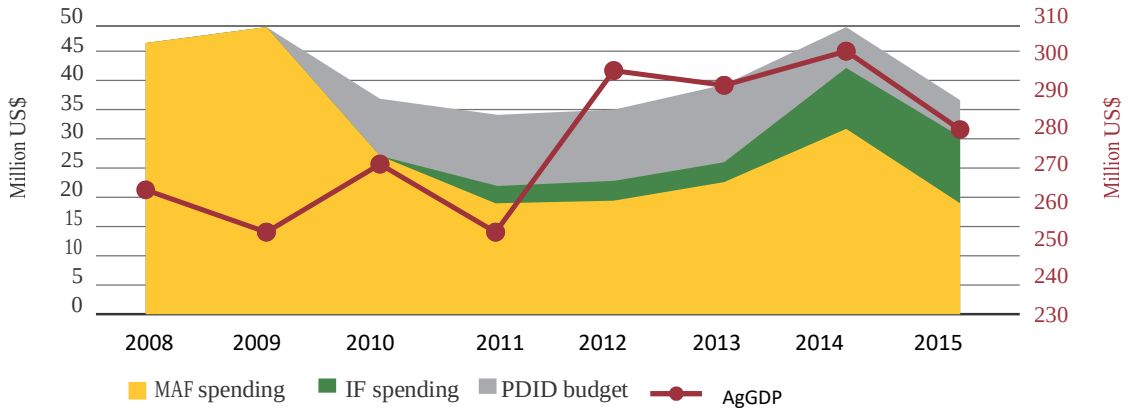
It is extremely difficult for the Ministry of Agriculture and Fisheries (MAF) to deliver and meet the national demand for food and protein intake, because the annual state budget allocation toward the sector is quite low. Investment from external actors is also relatively low, so the production levels also tend to remain quite small. Budget allocated for MAF from 2009 to 2019 is lowest than other key line ministries (see Figure 35).



Source: Fanzo & Bonis-Profuno, 2019.

Figure 35 – State budget allocated to key ministries between 2009 and 2019

The Strategic Development Plan 2011-2030 states that the agricultural sector is key to promoting economic growth and reducing poverty, particularly in rural areas. This is likely because many rural communities rely on agriculture-based livelihoods. However, less than 2.5% of total state budget and expenditure is allocated to the agriculture sector, undermining the government's aim to diversify the economy. The contribution of non-oil sectors to GDP remains low. There does not seem to be much balance between government expenditure in the agricultural sector and the contribution of agriculture to GDP (see Figure 36). This is likely because the contribution of agriculture toward GDP tends to fluctuate with the yield's performance, which is not secure as yield is extremely sensitive to weather conditions and climate change variability.



Source: Fanzo and Bonis-Profumo, 2019

Figure 36 – Government expenditure in agriculture sector versus agriculture GDP value

Coconut, coffee, orange trees, and ornamental crops are grown in almost all areas. Coffee and ornamental crops seem to grow well at high latitudes. Conversely, coconut trees perform well at

lower latitudes within a high to medium temperature range. Palms, agroforestry, bamboo, mahoni, sandalwood and mangroves are also found across the country.

In the remote areas agriculture activities have impacted other sectors due to slash and burn practices that contribute to erosion and flash flooding. This has negatively affected land fertility, ultimately creating a situation where low productivity causes food insecurity. Low-lying agricultural land such as in Suai Loro (Covalima) is frequently subjected to severe drainage and soil salinity problems due to stagnation of rainwater and flash flooding from Tafara River. The soil salinity problems negatively impact future use for rice paddy irrigation systems, and other agricultural products such as vegetables and ornamental crops. Low-lying agriculture lands in Suai Loro are also susceptible to shoreline retreat and flooding events because of coastal erosion. These areas then experience conditions which are suited for the occurrence and propagation of certain invasive maize diseases and pests (e.g., armyworm) that can reduce maize production. In 2018, armyworms significantly affected maize production in Bobonaro and Covalima.

3.2.8 Socio-economic knowledge - information gaps/priorities

Economists have widely recognised 'knowledge' as the most important factor in an economy's development. Hans-Dieter (2003) suggests that the production and utilisation of knowledge can support the economy, and Korres, Patsikas, & Polichronopoulus (2002) echo this sentiment, stating that knowledge is the most important factor of production, and its growth is pivotal in guiding a country into a state of self-sustained economic growth. Low levels of knowledge are therefore a significant obstacle that Timor-Leste needs to overcome to reduce poverty, reach political stability, and foster a stronger democracy.

In recognising socio-economic knowledge as the emerging 'knowledge-based economy', tangible and sustained action is required to foster future outputs. Long term economic growth is dependent on allocative efficient measures, and boosting the knowledge base of the economies through increased investment in the human knowledge, and altering the institutional and regulatory framework (Frank and Schaffler, 2019)

Coastal communities in Timor-Leste have limited socio-economic knowledge in relation to marine and coastal resources. Further study is required to identify key knowledge gaps, which will be essential for improved monitoring and management strategies. Gaps concerning marine and coastal resource degradation in conservation areas should be identified. MPAs have been used by many NGOs to streamline funds and address the ongoing marine and coastal resources crisis of degradation, while simultaneously securing coastal communities' livelihoods (Frank and Schaffler, 2019).

There are significant trade-offs between the protection of the environment and marine biodiversity, and people's wellbeing. Sometimes, choosing to protect the environment without regard for human dimensions might lead to increased social inequality and food insecurity, threatening the wellbeing of coastal peoples. These information gaps and challenges need to be addressed, so that balanced and equitable decisions can be made regarding the protection and management of coastal resources.

Social inequality is a significant challenge in Timor-Leste and hinders the sustainable use of resources and human well-being. A limited understanding of the socioeconomic and ecological contexts prevents effective fisheries and ecosystems from being truly realised. Historically, the concept of marine and coastal conservation has mostly been enforced with a top-down approach, by restricting and banning the use of resources at the local level even though coastal communities might depend upon them.

A range of attempts have been made by different agencies to identify knowledge gaps in education, training, and public awareness. Ecological and socioeconomic knowledge gaps were the most significant challenges identified during the field survey. These forms of knowledge are important because the economic benefits are essential for local fishers and protection/conservation of marine and coastal resources. More research is required to fill these knowledge gaps, linking biodiversity conservation and ecosystem services to social, cultural, and economic aspects of social-ecological systems.

Education and public awareness of the implications of marine and coastal resource exploitation and their potentially negative consequences needs to be raised. Understanding these complex relationships between resource use and livelihoods is essential in the future management and sustainable use of marine and coastal resources (Neudert et al., 2017).

Traditional ecological knowledge and wisdom is an essential instrument component of marine and coastal resource management. *Tara Bandu* is just one aspect of the traditional ecological knowledge complex that has been incorporated into some management programs in Timor-Leste. There is much cultural and ethnic diversity in Timor-Leste, so the use of traditional knowledge in coastal resource management will vary from place to place. Transdisciplinary and interdisciplinary approaches to knowledge production and integration are important in this regard (Bonebrake et al., 2018). Diverse methodologies, theoretical underpinnings, and ways of thinking will help to foster social and human-centred approaches in environmental research.

To analyse socioeconomic and demographic characteristics, key indicators should be selected (GoTL, 2016). This analysis will facilitate the assessment of significant areas of vulnerability within Timor-Leste's population. The assessment should seek to gain a deeper understanding of how wellbeing is distributed throughout Timor-Leste, trends relating to fertility and mortality, livelihoods, land tenure regimes, and education. It is important to collate gender-disaggregated data to better understand how the lived experience of men and women differs in Timor-Leste, across spatial and temporal scales.

CHAPTER 4 GOVERNANCE PROFILE

4.1 Economic Arrangements

4.1.1 Political and economic drivers

In Timor-Leste, transitioning toward a Blue Economy offers many windows of investment opportunity. While historically Timor-Leste has been a terrestrial-based economy, within the Blue Economy framework there are 6 potential initiatives that offer strong avenues for sustainable economic development.

The fisheries and marine tourism sectors provide the highest source of potential for sustainable growth and economic diversification under the Blue Economy development framework, due largely to the natural characteristics of the Timorese environment. Fisheries serve as just one example, where the sector is currently very small and unproductive, but has the potential to be significantly developed. In terms of marine tourism, the cultural richness and natural heritage of Timor-Leste provide a strong foundation from which to build a lively integrated ecotourism industry – from the mountain to the sea. Under the Blue Economy framework, the key sectors that should be considered include fisheries and aquaculture, coastal and marine tourism, ports and shipping, offshore oil and gas, pollution and waste management, and habitat restoration (see Table 26). As job creation is a critical pillar of the government's strategy and an important tool in building stability, it makes sense for these sectors to be prioritised (Economy Reform Report, 2022).

Table 26 – Transitioning to blue economy development in Timor-Leste

Ocean economy	Blue Economy Initiatives	Investment Opportunities
Fisheries and aquaculture • GVA of fisheries in 2015 was **US$7 million** (in constant prices). • Around 90% of fisheries is artisanal. • ***Pressures:*** extreme bathymetry; limited skills, techniques and gears; destruction of reef habitat, and declining fish stocks (due to El Niño); illegal fishing (foreign)	**Sustainable fisheries and aquaculture** • Community-based fisheries • Integrated farming system • Livelihood diversification: seaweed farming; grouper • Mangrove planting and mud crab culture • 10 municipalities provide support to youth for aquaculture of Tilapia sp.	**Aquaculture** - Aquaculture is a promising industry in Timor-Leste. Potential areas for various types of aquaculture have been identified (e.g., grouper and seaweed culture; aquasilviculture).
Coastal and marine tourism • GVA of coastal and marine tourism sector in 2015 was US$19.6 million. • ***Pressures***: High cost of traveling; limited accommodation and freshwater availability; potential of crocodile attacks; habitat degradation; increased solid waste and wastewater generation	**Sustainable tourism** • Dugong and seagrass conservation as a model of ecotourism • Community-based ecotourism, with sustainable accommodation and local sourcing of food	• The tourism sector ranks closely behind oil and coffee as the third largest sector. • Major ecotourism sites identified, including MPA and national parks • Community-based ecotourism • Diving and boat operation • Cruise tourism

Ocean economy	Blue Economy Initiatives	Investment Opportunities
Ports and shipping • GVA of transportation sector in 2015 was **US$66.7 million**. • ***Pressures:*** habitat degradation due to port construction and dredging; oil spills from operations and accidents; pollution from ships and ports	**Sustainable ports** • Construction of Tibar Port: through public-private partnership; use of new technologies to improve port performance and services, and energy-use efficiency	• Expansion of passenger terminal in Dili Port; and terminal for cruise ships • Transforming Dili Port and new Tibar Port into 'green port'
Offshore oil and gas • GVA of oil and gas in 2015 was US$1.5 billion, accounting for 66% of GDP. • ***Pressures:*** oil spills; depletion of oil and gas reserves	**Offshore oil and gas** • Monitoring of water quality and sediments at the offshore oil and gas platforms and surrounding areas	• Establishment of downstream industries, e.g., Suai Supply Base, refineries, petrochemicals, and LNG plant to ensure additional income and multiplier effects through job creation, trade, small- and medium-enterprise (SME) development
Water • Marine environment	**Pollution reduction/waste management** • Solid waste management: recycling system in schools; collection system and landfill in Dili • Wastewater management: wastewater treatment facility (waste stabilization ponds) in Dilli • Used oil management: tanks for used oil and daily collection system	• **Solid waste management** Expansion of solid waste management system; Improvement of sanitary landfill; recycling facility; disposal and treatment of oily waste, e-waste and hospital waste • **Sanitation and wastewater management** Expansion of wastewater management system
Coastal and marine ecosystems • Estimated value: US$5.25 billion	**Habitat restoration and management** • MPAs; marine national parks, locally managed MPAs • Mangrove restoration • Seagrass and dugong conservation • Coral reef protection	• MPA and ecotourism • Mangroves and sustainable aquaculture (aquasilviculture: mudcrabs and shrimp culture in mangrove areas)

Source: PEMSEA and Ministry of Agriculture and Fisheries (Timor-Leste), 2019

The Government of Timor-Leste's current effort toward the advancement of economic arrangements is highly centred on Public-Private Partnerships (PPP), which have been recognised as a modality for project implementation over the last 8 years. This approach was established with PPP Policy, legislation, and a dedicated PPP Unit (established under the Directorate General for External Resource Mobilization and Management, Ministry of Finance). The PPP policy is based on Decree-Laws No. 42/2012 as amended by Decree-Law No. 02/2014, and Decree-Law No. 08/2014 sets out a framework for enabling the public and private sectors to be parties in a PPP arrangement. The policy also defines the authorities of relevant agencies and regulates the procedures associated with the PPP projects cycle.

Decree Law No. 8/2014 also stipulates National Directorate of PPP or DNPPP (National Directorate under the General Directorate of Management and Mobilization of External Resources - Ministry of Finance) to take on the task of facilitating, managing and implementing the PPP project cycle in coordination with line ministries and under oversight of the Council for Administration of Infrastructure Fund (CAFI). Another important role of the DNPPP is to foster an

environment which attracts Foreign Direct Investment (FDI) through PPP modality, while at the same time looking for how to encourage local private sector involvement in PPP projects by pursuing policies and regulations that will allow for development of small to medium scale PPPs.

There are 4 PPP projects that have thus far been implemented by the Government of Timor-Leste such as the Tibar Bay Port PPP (ongoing implementation) that was inaugurated by the President of Timor-Leste on 30 November 2022. Another significant project involves Medical Diagnostics, which is still in the negotiation phase. Other projects still in the feasibility stage include Affordable Housing-Cristo Rei, and President Nicolau Lobato International Airport. As an example of PPP modality, a 30-year concession was chosen for Tibar Bay Port, including the design, partial financing, construction, operation and maintenance of the port infrastructure. The project was awarded to a consortium comprised by Bolloré Africa Logistics and SDV Timor-Leste through an international competitive bidding process, which formed the Timor Port. The capital expenditure is around $280m (phase 1 stage). The Concessionaire will fund most of the amount by means of equity and debt and the Government of Timor-Leste has allocated an amount of USD 129.45 million as Viability Gap Funding (VGF) to the Concessionaire (Ministry of Finance, 2021).

Table 27 presents a snapshot of top funded donor projects and programs in 2022. In this regard, the Government of Australia is responsible for five out of the ten projects with the highest levels of scheduled funding. The combined total of the top ten projects represents 35.4% of all expected disbursements in 2022.

Table 27 – The top 10 donor projects with highest scheduled non-lending disbursements in 2022

Project Title	Development Partner	SDP Sub Pilar	2020 (Total, $million)
Governance for development	Australia	Public Sector Management & Good Governance	4.9
Timor-Leste Police Development Program (TLPDP)	Australia	Security	3.6
Timor-Leste: Sustainable Agriculture Productivity Improvement Project (SAPIP)-P155541-TF0A2869 & TF0A0236	World Bank	Agriculture	3.6
5530-Escola Portuguesa Rui Cinatti – Centro de Ensino e Lingua Portuguesa	Portugal	Education & Training	8.4
Australia – Timor-Leste Partnership for Human Development-Health Sector	Australia	Health	8.3
Australian NGO Cooperation Program (ANCP)	Australia	• Agriculture • Health • Social Inclusion	7.6

		• Justice • Water & Sanitation • Public Sector Management & Good Governance • Education & Training	
Ai ba Futuru – Partnership for Sustainable Agroforestry Project (PSAF)	GIZ with Germany Funds	Agriculture	7.1
Safeguarding Rural Communities and Their Physical Assets from Climate Induced Disasters in Timor-Leste	UNDP with Green Climate Funds	Rural Development	5.5
10383-Escolas de Refêrencia de Timor-Leste-Centro de Formação	Portugal	Education & Training	5.2
Partnership to Strengthen Village Development and Municipal Administration (PARTISIPA, formerly PNDS-SP)	Australia	Rural Development	5.2

Source: Ministry of Finance, 2021

4.1.2 National budgetary allocations

The Government of Timor-Leste adopted the UN 2030 Agenda and Sustainable Development Goals through Government Resolution No. 34 of 2015 on 23 September 2015, two days before they were formally adopted by the United Nations at the General Assembly. This Resolution also mandated the establishment of a working group on SDG implementation to be chaired by the Prime Minister's Office. Adoption of the 2030 Agenda and the SDGs was subsequently ratified by a resolution of the National Parliament on 18 November 2015. Resolution No. 19/2015 also recommended that the Timor-Leste Government align its planning and budget systems with the SDGs.

The Government subsequently issued a directive (Directive No. 038/2015/XII/PM of 22 December 2015) establishing the SDG Working Group, and a Decree (Government Decree No. 1, dated on 1 February 2016) mandating that the SDGs should be reflected in annual plans and budgets. The current example of 2022 General State Budget (GSB), where the Council of Ministers have approved the budget ceiling draft at $1.57 billion and its disaggregation to the Line Ministries, Municipal Authorities and other relevant institutions. These budget ceiling and its disaggregation are only preliminary and may undergo amendments through the Budget Review Committee assessment, the Parliamentary debate and the Presidential evaluation. The 8 cycles of budget are described in the Budget Book Cycle (Figure 37).

Source: Ministry of Finance, 2021

Figure 37 – Budget book cycle

Table 28 shows government priorities and state budget allocation for year 2022.

Table 28 – The six government priorities and others of the state budget allocations in 2022

No.	Priority Items	Budget allocation ($)	% Of GSB 2022
1	Development of Human Capital (Education, Training and Health)	228,641,480	11.7%
2	Housing and Social Inclusion	483,986,278	24.8%
3	Productive Sectors (Agriculture, Tourism, Environment and Connectivity)	370,256,811	19.0%
4	Private Sector Development	96,838,312	5.0%
5	Rural Development	123,156,425	6.3%
	Good Governance	122,600,417	6.3%
	Others*)	523,563,568	26,9%

***) Including the transferring funds of $5.6 million to RAEOA based on budget law**

Source: Ministry of Finance, 2021

Notes: The non-oil economy accounts for Timor-Leste only contribute 21% of the GDP. Even though not reflected in GDP, the agriculture sector plays a very important role in Timor-Leste's economy. It employs more than 50% of the total population, and is particularly significant from a food security perspective, and as a way of reducing imports [*https://www.timorleste.tl/east-timor/about/economy/*].

4.1.3 Investments (national, international)

The national and international investments system that has been implemented since 2003 for the oil and gas sector is related to the Extractive Industries Transparency Initiative (EITI). It is a framework that encourages countries' transparency in the disclosure of revenues generated from the extraction of natural resources. Timor-Leste adheres to EITI to provide clear and accountable reports of the revenues and payments to the Government from oil, gas and mining companies (both from tax and non-tax payments derived from the production and sale of the extracted resources). A financial reconciliation, by external parties, is undertaken to verify the figures and the resulting reconciliation is published in an annual EITI report. The country's citizens and civil society organisations are also expected to play a role in monitoring the EITI process. The TL-EITI Secretariat Office was created in July 2008, under the Ministry of Petroleum and Minerals Resources and the Multi-Stakeholder Working Group (MSWG). The MSWG includes representatives from government, extractive industry company associations and civil society organisations (CSOs).

The reason behind the implementation of EITI is that the oil and gas revenues are a significant source of income to Timor-Leste. The Petroleum Wealth Fund and its investment returns have been used to finance the national budget for construction of major infrastructures. Despite Timor-Leste's ongoing economic improvements, it remains a heavily oil-dependent country. For the last several years, Timor-Leste has been experiencing a period of strong economic growth, based mostly on public expenditure and private sector activity driven by oil & gas revenue (EITI, 2019).

The Government of Timor-Leste still depends on foreign loans to meet its borrowing needs for concessional loans. As established in the Strategic Development Plan 2011-2030 and regulated by public debt regime law No.13/2011, the primary objective of taking concessional loans is related to the construction of strategic infrastructure for the development of the country. The terms of loan that are being applied are described in Table 29.

Table 29 – Terms of loans

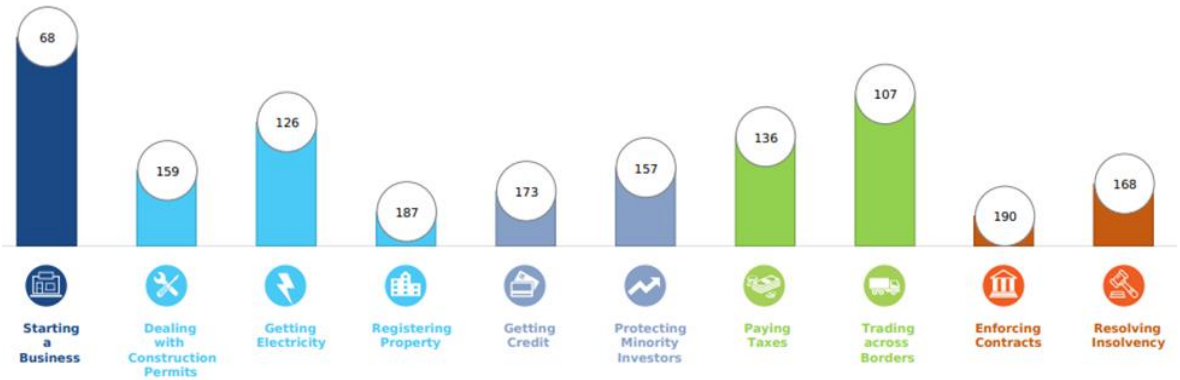
Lender	Currency	Approved Loan ($ million	Grace Period (year)	Initial Amortization (year)	Year complete	Interest Rate (Fiscal year 2020)
ADB	USD, SDR	271.65	5.3	20	2044	1.89%
WB	USD, SDR	174.20	8	20	2060	2.72%
JICA	JPY	68.72	10	20	2042	0.71%
Total		**514.58**				

Source: Ministry of Finance, 2021

Another instrument utilised to monitor country-wide economic progress is the 'Ease of Doing Business' indicator. The Ease of Doing Business report is produced by The World Bank to measure the index of business regulatory performance of a country. The scale ranges from 0 to 100, where 0 represents the worst regulatory performance and 100 is the best regulatory performance. For global comparison, in 2020, Timor-Leste's score was 39.4 (or rank 181 out of 190 countries in the

world). This score was lower compared to similar countries in Asia-Pacific, such as Fiji, Solomon Island, Lao PDR, Brunei Darussalam, and Vanuatu [*https://doingbusiness.org*].

Doing business captures several important dimensions of the regulatory environment as it applies to local firms. It provides quantitative indicators on regulation for starting a business, dealing with construction permits, getting electricity, registering property, getting credit, protecting minority investors, paying taxes, trading across borders, enforcing contracts and resolving insolvency; and measures features of employment. Although it does not present rankings of economies based on the employing workers indicators or include the topic in the aggregate ease of doing business score or ranking on the ease of doing business (see Figure 38), it does present the data for these indicators.



Starting a Business (rank)	68
Score of starting a business (0-100)	89.4
Procedures (number)	6
Time (days)	13
Cost (number)	0.7
Paid-in min. capital (% of income per capita)	0.3
Dealing with Construction Permits (rank)	159
Score of dealing with construction permits (0-100)	55.3
Procedures (number)	16
Time (days)	207
Cost (% of warehouse value)	0.5
Building quality control index (0-15)	3.0
Getting Electricity (rank)	126
Score of getting electricity (0-100)	63.0
Procedures (number)	3
Time (days)	93
Cost (% of income per capita)	1,255.7
Reliability of supply and transparency of tariff index (0-8)	0
Registering Property (rank)	187
Score of registering property (0-100)	0.0
Procedures (number)	No Practice
Time (days)	No Practice
Cost (% of property value)	No Practice
Quality of the land administration index (0-30)	No Practice

Getting Credit (rank)	173
Score of getting credit (0-100)	20.0
Strength of legal rights index (0-12)	0
Depth of credit information index (0-8)	4
Credit registry coverage (% of adults)	8.7
Credit bureau coverage (% of adults)	0.0
Protecting Minority Investors (rank)	157
Score of protecting minority investors (0-100)	28.0
Extent of disclosure index (0-10)	5.0
Extent of director liability index (0-10)	4.0
Ease of shareholder suits index (0-10)	5.0
Extent of shareholder rights index (0-6)	0.0
Extent of ownership and control index (0-7)	0.0
Extent of corporate transparency index (0-7)	0.0
Paying Taxes (rank)	136
Score of paying taxes (0-100)	61.9
Payments (number per year)	18
Time (hours per year)	234
Total tax and contribution rate (% of profit)	17.3
Postfiling index (0-100)	1.4

Trading across Borders (rank)	107
Score of trading across borders (0-100)	69.9
Time to export	
Documentary compliance (hours)	33
Border compliance (hours)	96
Cost to export	
Documentary compliance (USD)	100
Border compliance (USD)	350
Time to export	
Documentary compliance (hours)	44
Border compliance (hours)	100
Cost to export	
Documentary compliance (USD)	115
Border compliance (USD)	410
Enforcing Contracts (rank)	190
Score of enforcing contracts (0-100)	6.1
Time (days)	1,285
Cost (% of claim value)	163.2
Quality of judicial processes index (0-18)	2.5
Resolving Insolvency (rank)	168
Score of resolving insolvency (0-100)	0.0
Recovery rate (cents on the dollar)	No Practice
Time (years)	No Practice
Cost (% of estate)	No Practice
Outcome (0 as piecemeal sale and 1 as going concern)	0
Strength of insolvency framework index (0-16)	No Practice

Source: **https://archive.doingbusiness.org/content/dam/doingBusiness/country/t/timor-leste/TMP.pdf**
Figure 38 – Model of business and its indicators

4.2 Institutional Setting

4.2.1 Institutions, regulatory agencies, administrative arrangements (national, sub-national, local)

There are three principles of effective governance for sustainable development – effectiveness, accountability, and inclusiveness. An IISD (2018) report provides an integrated approach, delineating commonly used strategies at all levels of institutions, regulatory agencies, and administrative arrangements at national and local levels that can be used to foster these principles at all stages of governance (Table 30).

Table 30 – Principles of effective governance for sustainable development with a commonly used strategies setting

Principles	Commonly used strategies
1. Effectiveness	
Competence: To perform their functions effectively, institutions are to have sufficient expertise, resources and tools to deal adequately with the mandates under their authority	a) Promotion of a professional public sector workforce b) Strategic human resources management c) Leadership development and training of civil servants d) Performance management e) Result-based management f) Financial management and control g) Efficient and fair revenue administration h) Investment in e-government
Sound policymaking: To achieve their intended results, public policies are to be coherent with one another and funded on true or well-established grounds, in full accordance with fact, reason and good sense	a) Strategic planning and foresight b) Regulatory impact analysis c) Promotion of coherent policymaking d) Strengthening national statistical systems e) Monitoring and evaluation systems f) Science-policy interface g) Risk management frameworks h) Data sharing
Collaboration: To address problems of common interest, institutions at all levels of government and in all sectors should work together and jointly with non-State actors towards the same end, purpose and effect	a) Centre of government coordination under the Head of State or Government b) Collaboration, coordination, integration and dialogue across levels of government and functional areas c) Raising awareness of the Sustainable Development Goals d) Network-based governance e) Multi-stakeholder partnerships
2. Accountability	
Integrity: To serve in the public interest, civil servants are to discharge their official duties honestly, fairly and in a manner consistent with soundness of moral principle	a) Promotion of anti-corruption policies, practices and bodies b) Codes of conduct for public officials c) Competitive public procurement d) Elimination of bribery and trading in influence e) Conflict of interest policies f) Whistle-blower protection g) Provision of adequate remuneration and equitable pay scales for public servants

Transparency: To ensure accountability and enable public scrutiny, institutions are to be open and candid in the execution of their functions and promote access to information, subject only to the specific and limited exceptions as are provided by law	a) Proactive disclosure of information b) Budget transparency c) Open government data d) Registries of beneficial ownership e) Lobby registries
Independent oversight: To retain trust in government, oversight agencies are to act according to strictly professional considerations and apart from and unaffected by others	a) Promotion of the independence of regulatory agencies b) Arrangements for review of administrative decisions by courts or other bodies c) Independent audit d) Respect for legality
3. Inclusiveness	
Leaving no one behind: To ensure that all human beings can fulfil their potential in dignity and equality, public policies are to consider the needs and aspirations of all segments of society, including the poorest and most vulnerable and those subject to discrimination	a) Promotion of equitable fiscal and monetary policy b) Promotion of social equity c) Data disaggregation d) Systematic follow-up and review
Non-discrimination: To respect, protect and promote human rights and fundamental freedoms for all, access to public service is to be provided on general terms of equality, without distinction of any kind as to race, colour, sex, language, religion, political or other opinion, national or social origin, property, birth, disability or other status	a) Promotion of public sector workforce diversity b) Prohibition of discrimination in public service delivery c) Multilingual service delivery d) Accessibility standards e) Cultural audit of institutions f) Universal birth registration g) Gender-responsive budgeting
Participation: To have an effective State, all significant political groups should be actively involved in matters that directly affect them and have a chance to influence policy	a) Free and fair elections b) Regulatory process of public consultation c) Multi-stakeholder forums d) Participatory budgeting e) Community-driven development
Subsidiarity: To promote government that is responsive to the needs and aspirations of all people, central authorities should perform only those tasks which cannot be performed effectively at a more intermediate or local level	a) Fiscal federalism b) Strengthening urban governance c) Strengthening municipal finance and local finance systems d) Enhancement of local capacity for prevention, adaptation and mitigation of external shocks
Intergenerational equity: To promote prosperity and quality of life for all, institutions should construct administrative acts that balance the short-term needs of today's generation with the longer-term needs of future generations	a) Multilevel governance b) Sustainable development impact assessment c) Long-term public debt management d) Long-term territorial planning and spatial development e) Ecosystem management

Source: IISD, 2018

In the context of Timor-Leste as a new and emerging country in the Asia-Pacific region since 2002, it has been attempting to implement the effective governance principles for sustainable development. However, from the above commonly used strategies, Timor-Leste still needs to

significantly improve in the areas of investment in e-government; strengthening national statistical systems; monitoring and evaluation systems; science-policy interface; risk management frameworks; and data sharing. Additionally, also relevant to Timor-Leste is the inclusive principle of intergenerational equity, which outlines commonly used strategies such as long-term public debt management; long-term territorial planning and spatial development; and ecosystem management.

These areas should be considered as policy gaps, and efforts to improve these institutional aspects of effective governance should be made to support an effective integrated coastal and marine governance for sustainable development.

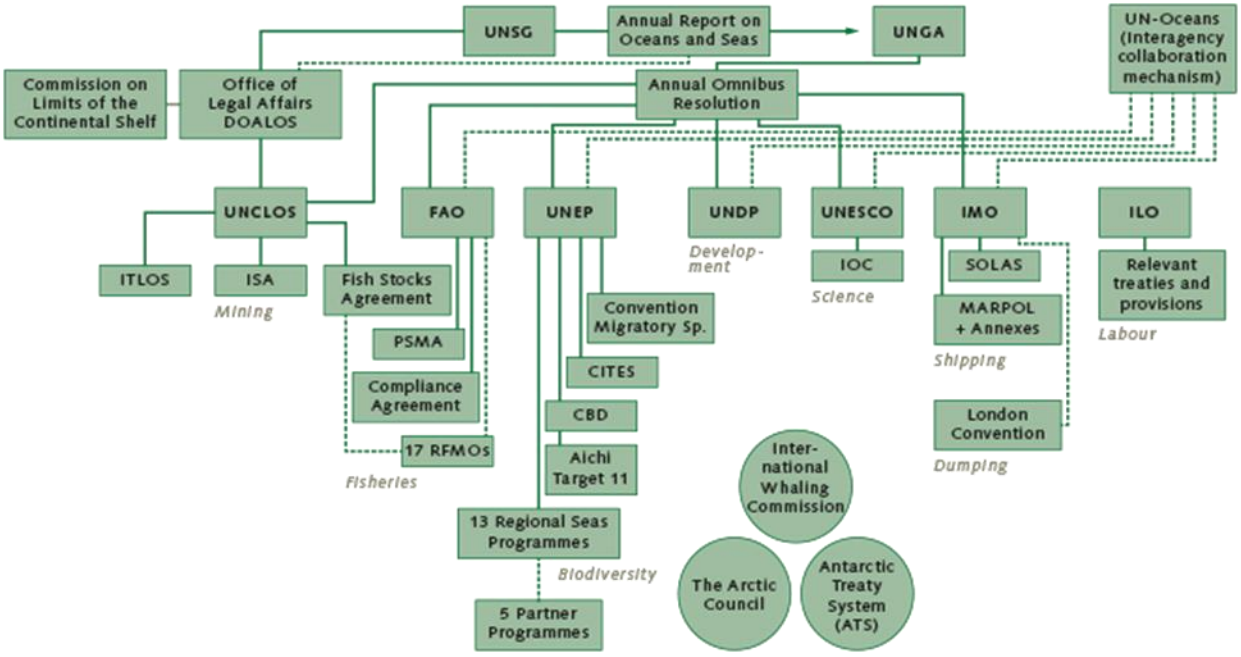
4.3 Legal, Policy Setting

4.3.1 International legal/policy frameworks & forums

The majority of international policy frameworks and forums that are being used globally in relation to ocean governance are more related to the UN agencies annual omnibus resolution, such as UNCLOS, FAO, UNEP, UNDP, UNESCO, IMO, and ILO (Figure 39). The ATSEF/ATSEA program was initiated in consideration of UNCLOS Article 122 and 123 on enclosed and semi-enclosed seas. The Article 122 of UNCLOS states that "for the purposes of this Convention, "enclosed or semi-enclosed sea" means a gulf, basin or sea surrounded by two or more States and connected to another sea or the ocean by a narrow outlet or consisting entirely or primarily of the territorial seas and exclusive economic zones of two or more coastal States". Meanwhile, Article 123 of UNCLOS regarding Co-operation of States bordering enclosed or semi-enclosed seas, remarks that "States bordering an enclosed or semi-enclosed sea should cooperate with each other in the exercise of their rights and in the performance of their duties under this Convention. Toward this end, the states should make an effort directly or indirectly through an appropriate regional organisation to: a) coordinate the management, conservation, exploration and exploitation of the living resources of the sea; b) coordinate the implementation of their rights and duties with respect to the protection and preservation of the marine environment; c) coordinate their scientific research policies and undertake where appropriate joint programmes of scientific research in the area; d) invite, as appropriate, other interested States or international organisations to cooperate with them in furtherance of the provisions of this article."

The FAO (2022) is more closely associated with sustainable fisheries and aquaculture, particularly in relation to its declaration to recognise wild-caught and aquaculture fisheries for their contribution to fighting poverty, hunger and malnutrition.

Frameworks from UN agencies (Figure 39) are mainly focused on aspects of ocean governance relating to the use of ocean space, in both a geographic and sectoral sense. To resolve the kinds of governance issues arising from these geographical and sectoral boundaries, cooperation and coordination between multiple actors and institutions will need to take place. Oceans are not only governed by governments, but also by local communities, industries, and other stakeholders. In practice, ocean governance must not just focus on international law, but also national, public and private, and customary laws (Singh & Ort, 2020).



Source: Maribus, 2015

Figure 39 – Ocean governance in a wide arena

4.3.2 Regional legal/policy frameworks & forums

The current ocean governance initiatives relevant to the ATS region are as follows: ATSEA, BOBLME, COBSEA, CTI-CFF, NOWPAP, PEMSEA, SSME, WCPFC/WPEA, RPOA-IUUF, and YSLME (White A. T., 2016). However, the Government of Timor-Leste has only been working with four of these, as outlined in Table 31.

Table 31 – Summary of four ocean governance initiatives in the East Asian Region

Ocean Governance Initiatives	Geographical scope	Institutional arrangements	Gaps and challenges	Participating countries	Donors
ATSEA	Arafura and Timor Seas, Indian Ocean, Pacific Ocean, Gulf of Carpentaria, and Torres Strait	Arafura-Timor Experts Forum, a non-legal binding but ministerial declaration to support the implementation of ATSEA SAP	• Means of communication across country agencies needs to be improved • Coordination mechanism needs to be strengthened	Australia, Indonesia, Papua New Guinea, and Timor-Leste	National, sub-national and GEF/UNDP with some support from NGOs, the Regional Secretariat supported by Indonesia
CTI-CFF	Pacific Ocean, Indian Ocean, Indonesian Seas	Regional Secretariat (RS) with legal agreement among member countries to support the RS and to	• Information system for tracking process designed but inadequate input from member countries • The NCC s and TWGs of CTI-CFF	Malaysia, Papua New Guinea, Philippines, Timor-Leste, and Solomon Island	National governments with assistance from ADB, GEF, USAID, Australia, WWF, CI, TNC, CTC and

		coordinate and facilitate RPOA implementation	need support to implement the RPOA and NPOA • Regional-wide financial architecture not developed yet to pool and coordinate funding		hosted by Indonesia
PEMSEA	Yellow Sea, East China Seas, South China Sea, Indonesian Seas, Pacific Ocean, and Indian Ocean	Permanent secretariat, legally incorporated on inter-governmental organisation with headquarters in Manila (the Philippines), operates as a regional partnership among national and local governments, business sectors and NGOs who contribute technical and financial support to implement the SDS-SEA as voluntary basis	• A major gap between legislation, policy and its implementation in the most member countries • National policy changes lags behind recommendations in the regional SDS-SEA • Coordination among overlapping LME programs still missing to efficiently manage information systems and M&E	Cambodia, PR China, DPR Korea, Indonesia, Japan, Lao PDR, Malaysia, Philippines, Republic of Korea, Singapore, Thailand, and Timor-Leste	GEF, UNDP, and World bank, voluntary contributions and non-country partners, project support to collaborators (e.g., UNDP, GIZ, KOICA, UNEP, etc.)
RPOA-IUUF	Pacific Ocean, Indian Ocean, Indonesian Seas, Gulf of Carpentaria, and Torres Strait	Regional cooperation amongst countries to promote responsible fishing practices & to combat illegal fishing is essential, particularly to sustain fisheries resources, ensure food security, alleviate	• Overfishing and illegal fishing are seriously depleting the region's fish stocks • Port states measurement is not fully applied yet among the participating countries in combating IUUF in the region	Australia, Brunei Darussalam, Cambodia, Indonesia, Malaysia, Papua New Guinea, Philippines, Singapore, Thailand, Timor-Leste, and Vietnam	National, sub-national and GEF/UNDP with some support from NGOs, the Regional Secretariat supported by Indonesia

		poverty and to optimise the benefits to the people and economies in the region			

Source: Adapted from White, 2016; [https://www.rpoaiuu.org]

For ATSEA, under the GEF/UNDP/PEMSEA Project on Implementation of the Arafura and Timor Seas Regional and National Strategic Action Programs (ATSEA-2) (2019-2024), efforts are currently in progress to establish a country-led regional governance mechanism for the ATS region, to be adopted through a new Ministerial Declaration along with an updated Strategic Action Programme (SAP). Besides the ATS, there are another two regional forums relevant to Timor-Leste – the Archipelagic and Island States Forum (AIS Forum), and the Pacific Island Development Forum (PIDF). The AIS Forum is a platform designed to include island states and archipelagic countries regardless of their region, size, and development level. This global initiative consists of 47 archipelago and island states, including Timor-Leste, taking part in a collective forum addressing challenges of ocean resources. There are four thematic focus areas – climate change mitigation and adaptation, blue economy development, marine plastic debris, and good maritime governance *(https://www.iasforum.org/ais-countries)*.

The AIS Forum was formally established through the adoption of the Manado Joint Declaration during the first Ministerial Meeting of the participating countries on 1st November 2018. The initial 21 member countries were 1) Republic of Cabo Verde, 2) Republic of Cuba, 3) Republic of Cyprus, 4) Republic of Fiji, 5) Republic of Guinea Bissau, 6) Republic of Indonesia, 7) Jamaica, 8) State of Japan, 9) Republic of Malta, 10) Democratic Republic of Madagascar, 11) Independent State of Papua New Guinea, 12) Republic of the Philippines, 13) Federation of Saint Christopher and Nevis, 14) Democratic Republic of São Tome and Principe, 15) Republic of Seychelles, 16) Republic of Singapore, 17) Democratic Socialist Republic of Sri Lanka, 18) Republic of Suriname, 19) Democratic Republic of Timor-Leste, 20) Kingdom of Tonga, and 21) United Kingdom of Great Britain and Northern Ireland.

The results of the first AIS Forum ministerial meeting were as follows:

1) Strengthen our commitment to be part of a collaborative action to address our common challenges in the areas of:
    a) climate change mitigation, adaptation, and disaster management;
    b) economic challenges and opportunities which consist of blue economy, responsible and sustainable fisheries and aquaculture, economic growth and creation of decent working opportunities;
    c) marine plastic debris;
    d) good maritime governance;
2) Identify and work towards actionable, concrete collaboration and partnerships with all relevant stakeholders, including but not limited to, youth, civil society, academics, startups, philanthropists, industry, private sector, and international and multilateral organisations to strengthen our joint efforts through smart and innovative solutions, including project

implementation supported by blended finance mechanism, to achieving sustainable development, improving livelihoods of coastal communities, and restoring ocean health;
3) Encourage the development of an integrated approach to maritime and ocean governance, recognising that the challenges facing our oceans are closely interconnected; and
4) Establish Archipelagic and Islands State Forum (hereinafter referred to as "AIS Forum") as an open-ended, complementary, integrated, and inclusive developmental forum, with regular meetings that is in synergy with other initiatives and serving as an avenue for collaboration and sharing of expertise to generate smart and innovative solutions among archipelagic and islands states and its collaborative partners.

Pacific Islands Development Forum (PIDF) members states are 1) Fiji, 2) Federated States of Micronesia, 3) Kiribati, 4) Marshall Islands, 5) Nauru, 6) Palau, 7) Solomon Islands, 8) Timor-Leste, 9) Tokelau, 10) Tonga, 11) Tuvalu, 12) Vanuatu, 13) Pacific Islands Association of Non-Government Organization (PIANGO), and 14) Pacific Islands Private Sector Organization (PIPSO). Timor-Leste joined the PIDF on July 13th, 2016. The PIDF regional initiatives that Timor-Leste participates in are the Pacific Green Business Center, Capacity Building on Green Economy and Renewable Energy, Solarization of Residences of PIDF members' Heads of States, Island Resilience Initiative, Bamboo Development Center, Institute of Human Rights Research, and Center on Renewable Energy [*https://www.pidf.int*].

Timor-Leste has already ratified 3 conventions (2020), i.e., the International Convention for the Safety of Life at Sea (SOLAS Convention); International Convention for the Prevention of Pollution from Ships (MARPOL); and International Convention on Standards of Training, Certification and Watch keeping for Seafarers (STCW78).

Multilateral environmental agreements that have been ratified by the Government of Timor-Leste from 2007 until 2017 include the UNCCD, UNFCCC, CBD, Kyoto Protocol, Vienna Convention, UNCLOS, and Paris Agreement. Meanwhile, Timor-Leste's current membership of CITES and the Nagoya Protocol was declared in the NBSAP (2011-2020), creating a clear roadmap for the CBD implementation. Table 32 presents a list of conventions and protocols signed by the government of Timor-Leste.

Table 32 – Status of the multilateral environmental agreements' ratification under the government of Timor-Leste

Party status*	Date of ratification	Status
UNCCD	20 August 2003	Accession
UNFCCC	10 October 2006	Accession
UNCBD	8 January 2007	Accession
Kyoto Protocol	14 October 2007	Accession
Vienna Convention	16 September 2009	Accession
UNCLOS	8 January 2013	Accession
Paris Agreement	16 August 2017	Ratification

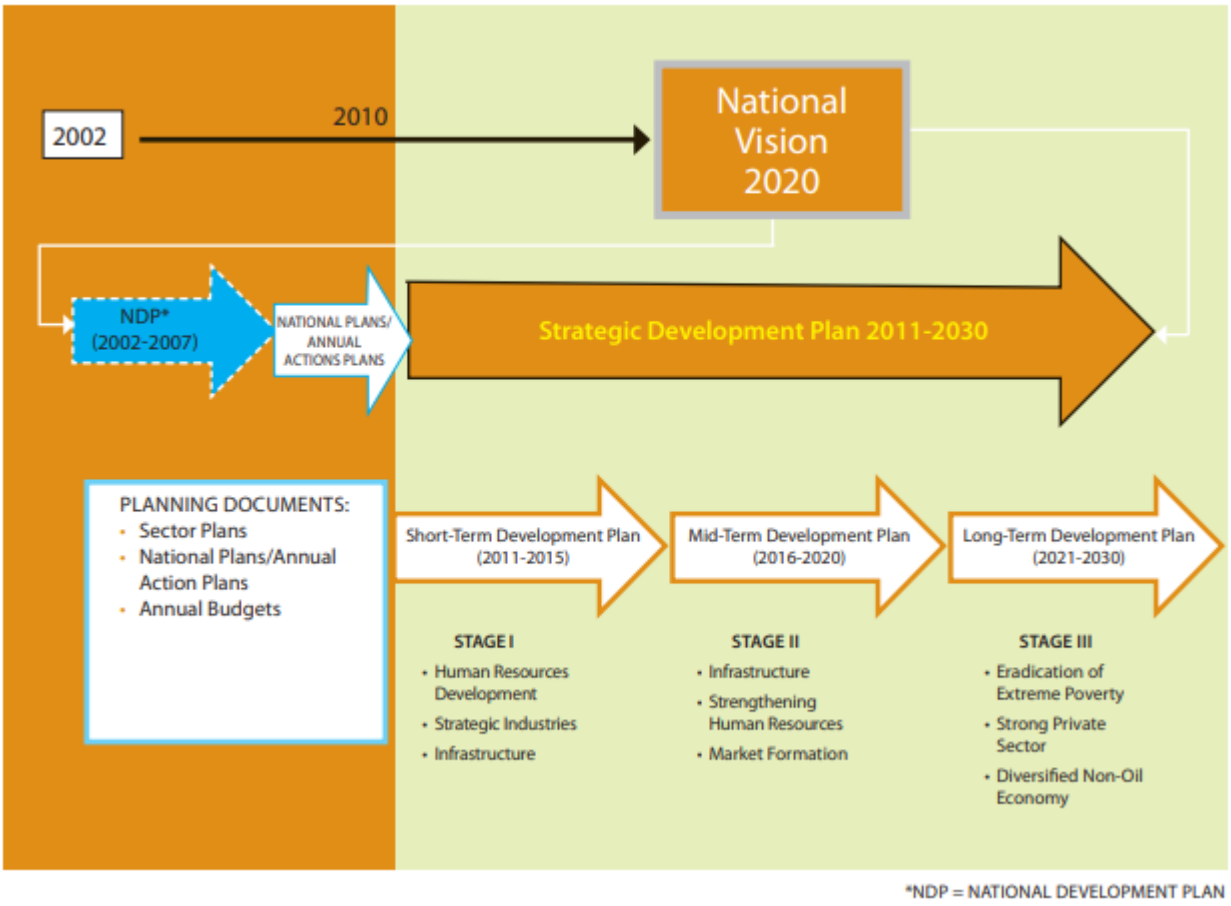
Source: www.informea.org

***** Access information on multilateral environmental agreements

Besides those above mentioned multilateral environmental agreements, Timor-Leste also has been pro-actively involved in the RPOA-IUU Fishing as part of sub-regional mechanism under the ATS Region (https://www.rpoaiuu.org).

4.3.3 National legislation, policies

The Timor-Leste Strategic Development Plan (2011-2030) provides a framework for identifying and assessing priorities and serves as a guide to implement recommended strategies and actions (Figure 40). The SDP is relevant to the ATSEA program which will support the country-wide strategies, policies, programs and plans, and also to the National Oceans Policy of Timor-Leste which has been drafted but is awaiting approval from the Council of Ministers.



Source: SDP Timor-Leste (2011-2030)
Figure 40 – SDP for Timor-Leste, 2011-2030

Table 33 outlines what the SDP might look like in the fisheries sector. The SDP articulates short to long-term visions in the fisheries sector. Timor-Leste in the long-term hopes to move toward an export-based and industrial-sized fishing industry.

Table 33 – SDP short to long-term planning in fisheries sector

Short-term (2015)	Medium-term (2016-2020)	Long-term (2021-2030)
Traditional fishing activities will have increased, and fishing will have increased in the Exclusive Economic Zone	• There will be at least three types of aquaculture activities supporting coastal communities • The fisheries sector will be export based and have expanded to include ocean fishing	More industrial fishing

The current Government of Timor-Leste is focusing more heavily on priority sectors such as Agriculture, Tourism, and Industry, rather than Fisheries. There is real potential for the sustainable development of a fisheries and aquaculture sector in Timor-Leste, as outlined in objective three of the National Oceans Policy and Blue Economy Roadmap (See also Figure 41).

Figure 41 – Five enablers for Timor-Leste's progress towards sustainable development

See Table 34 for a relevant list of examples of Law, Government Decree Law, Government Decree, and Ministerial Order in marine affairs and fisheries sectors that have been enacted in Timor-Leste.

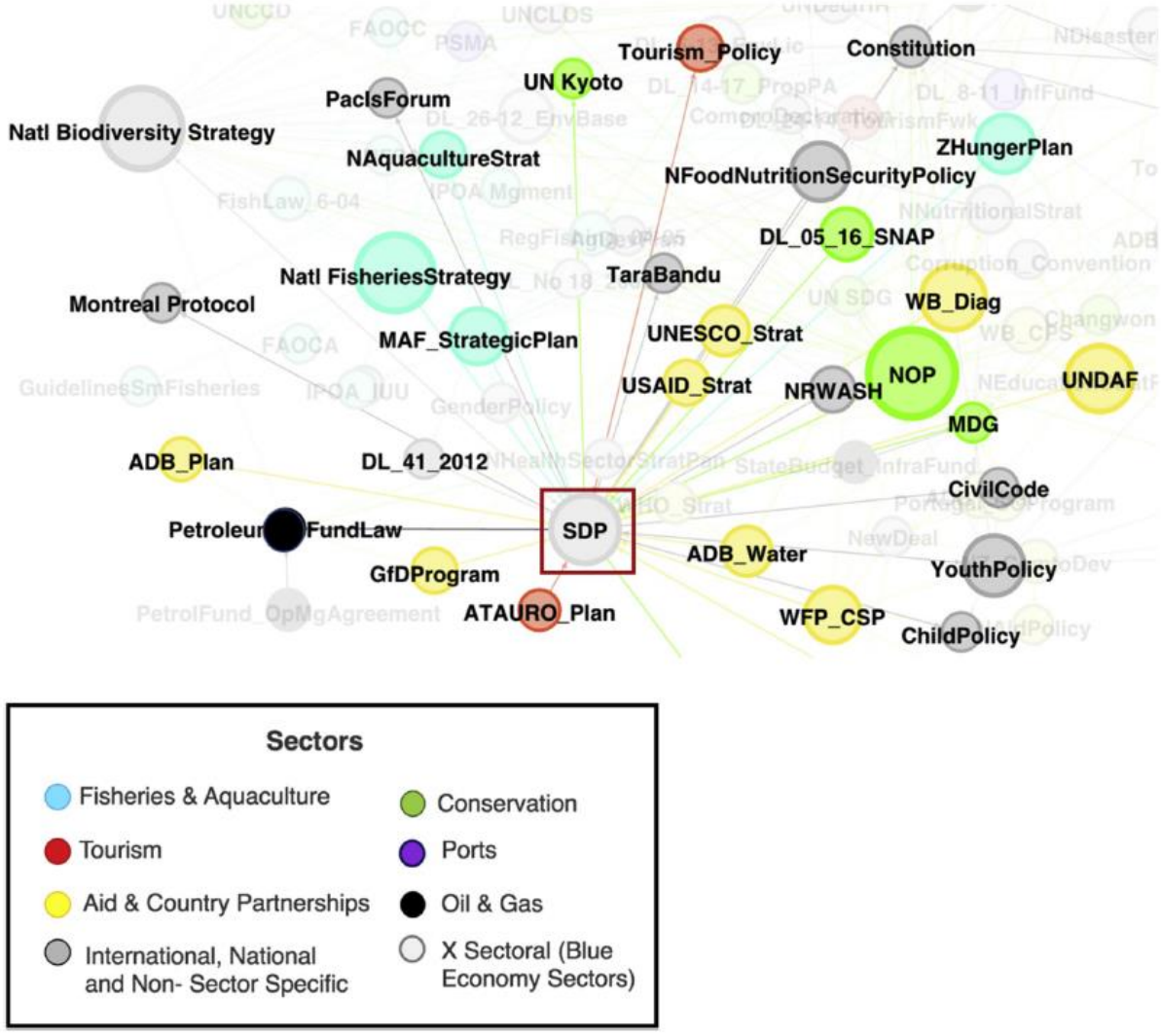
Table 34 – Related laws in the area of marine affairs and fisheries sector

Decree	Subject	Publication date
Law No. 12/2004	Fishing related offences	29 Dec 2004
Government Decree Law No. 6/2004	General Bases of the Legal Regime for Fisheries and Aquaculture Management and Regulation (Amended by Decree Law 4/2005)	21 Apr 2004
Government Decree Law No. 21/2008	Implementation of Satellite System for Monitoring Fishing Vessels "SIMOCEP"	25 June 2008
Government Decree No. 5/2004	General Regulation on Fishing (Commercial Fishing License and Non-Commercial Fishing License)	28 Jul 2004
Government Decree No. 2/2005	Establishing the Rate of Fishing License, Inspection and Related Services to Fishing Activities	6 Jul 2005
Government Decree No. 4/2006	The amendment of Government Decree No. 2/2005 of 6 July	15 Nov 2006
Ministerial Order No. 01/03GM/I/2005	Definition of Fishing Zone	
Ministerial Order No. 02/04/GM/I/2005	Main Fisheries	
Ministerial Order No. 03/05/GM/I/2005	Bycatch tolerated percentage	
Ministerial Order No. 04/115/GM/IV/2005	List of Protected Aquatic Species	
Ministerial Order No. 05/116/GM/IV/2005	Minimum Size and Weight Species to be Captured	
Ministerial Order No. 06/42/GM/II/2005	Fines for Fishing Offences	
Ministerial Order No. 1/03/GM/I/2005	Definition of fisheries area	27 Jun 2007
Ministerial Order No. 17/GM/MAP/01/2012	Trans-shipments at the sea	13 Jun 2012
Ministerial Order No. 5/GM/I/2015	Aquatic Nature Reserve in Batugade Coastal Area in Balibó Sub District, Bobonaro District	25 Feb 2015
Ministerial Order No. 6/GM/I/2015	Aquatic Nature Reserve in Maumeta-Vila Coastal Area in Atauro Sub District, Dili District	25 Feb 2015
Decree Law No. 4/2016	Council for Definitive Boundaries Delimiting of Maritime	16 Mar 2016
Decree Law No. 5/2016	National System of Protected Areas	16 Mar 2016
Government Decree No. 6/2020	Legal regime for the protection and conservation of biodiversity	6 Feb 2020

Source: Jornal da republica [https://www.mj.gov.tl/jornal]

4.3.4 Current development plans, policies

The NOP is being updated for presentation to the Council of Ministers. Updating of the ATS SAP and NAP can be designed to support the long-term targets in the SDP (2021-2030), the implementation of the NOP (when adopted by Council of Ministers), the SDG targets (especially SDG 13 and 14), and the Blue Economy Roadmap. Key long-term SDP targets (2021-2030) relevant to ATSEA-2 include fisheries and biodiversity. There is also a coordination network that will help to facilitate the implementation of development plans and policies (see Figure 42).



Source: (Voyer M, 2020)

Figure 42 – Coordination network mapping focusing on SDP

The coordination mapping links to the Strategic Development Plan (2011-2022) revealed that the Aid and Country Partnerships focusing on the conservation sector and NOP was predominantly among other links. It means that the NOP has addressed the importance of guidance on the development of Blue Economy (BE) in Timor-Leste.

The integrated approach of the NOP reflects the genuine idea behind its vision as a basis legal instrument for potential BE development. The NOP's vision is as follows: **"A healthy and secure ocean that sustains the livelihoods, prosperity, and social and cultural values of the people of Timor-Leste in a fair and equitable manner."** This vision is further outlined in its 6 objectives:

1. Working together: An integrated participatory ocean governance system, which facilitates collaboration across jurisdictions, allows for the exchange of knowledge, data, ideas, skills, and experience, and recognises and considers local customary law, national law, and international and regional commitments.
2. Securing national jurisdictions and exercising sovereign rights over our oceans: maintenance and protection of the rights of Timorese people to equitably use and manage their marine natural resources.
3. Our future: a diverse Blue Economy based on the sea.
4. Strengthening our natural defence: protecting, maintaining and restoring coastal and ocean resources and ecosystem services.
5. Investing in our people: developing the capacity of Timorese to engage in ocean-based development and protection through research, education and capacity building.
6. Climate change vulnerability: adaptation and mitigation.

4.4 Civil Society and Participation

4.4.1 Key NGOs and special interest groups

The Government of Timor-Leste has led public consultations on large government projects and important legislation through the National Program for Village Development (PNDS) program, the Special Zones of Social Market Economy of Timor-Leste (ZEESM) in Oecusse, the Land Law, and the Plan to Develop and Integrate the Districts (PDID) under the Ministry of State Administration. The Ministry of Agriculture and Fisheries has established Conselho Nasional Seguransa Aihan no Nutrisaun (CONSANTIL), which is a mechanism to ensure civil society's input into the ministry's plans. In the maritime sector, the National Maritime Authority (AMN) under the Ministry of Defence was approved by the Council of Ministers on July 15, 2020. AMN is as an institutional framework for the coordination of entities, bodies or services at the central and peripheral level with coordination, executive, advisory or police functions, who can exercise powers of State authority over maritime spaces under national sovereignty or jurisdiction. With this Decree-Law, the National Maritime Authority (AMN) was created, which is related to the Chief of Staff-General of the Armed Forces.

Besides that, the Government of Timor-Leste also promoted civil society's involvement in social audits, where the beneficiaries of public funds participate in the evaluation of projects, policy, and implementation. Civil Society Organisations (CSOs) are expected to play a key role in the social audit process, with the government working with civil society on social audits in the health, agriculture, infrastructure, and education sectors. CSOs are also independently active in monitoring and auditing government projects and expenditure. For example, the NGO *Luta Hamutuk* has a budget transparency division and a community networking initiative. In its monitoring work, *Luta Hamutuk* engages the local community to monitor government investments in the community.

NGOs which have been operating in the field of conservation include Blue Ventures, Konservasaun Flora Fauna (KFF), and the primary fisheries and aquaculture research institution is WorldFish (see Table 35).

Table 35 – List of key CSOs and NGO in Timor-Leste

CHURCH-BASED ORGANIZATIONS

- **Caritas Diocese Baucau:**
  E-mail address: caritas_baucau@yahoo.com
  Mobile: (+670) 7727 4244
- **Caritas Diocese Dili:**
  http://diocesededili.org/instituicoes-diocesanas/caritas-diocesana/
  E-mail address: sekcaritas@yahoo.com
  Tel: (+670) 332 3442 or 331 3443
- **Diocesan Justice and Peace Commission:**
  http://djpcdilitimorleste.blogspot.com/
  E-mail address: jpcdili.2009@gmail.com
  Tel: (+670) 331 2166
- **Observatorio da Igreja Para Os Assuntos Socials (OIPAS):**
  Mobile: (+670) 7723 3084

LOCAL NONGOVERNMENT ORGANIZATIONS

- **Alola Foundation**, focusing on improving the lives of women and children:
  http://www.alolafoundation.org/
  E-mail address: info@alolafoundation.org
  Tel: (+670) 332 3855
- **Asosiasaun HAK**, focusing on law, human rights, and justice:
  https://asosiasaunhak.blogspot.com/
  E-mail address: info.asosiasaunhak@gmail.com
  Mobile: (+670) 7804 0405
- **Ba Futuru (For the Future)**, focusing on child protection and conflict protection:
  http://www.bafuturu.org/
  E-mail address: bafuturu@bafuturu.org
  Tel: (+670) 332 2437
- **Belun**, focusing on conflict prevention and resolution, research and policy development, and community capacity development:
  http://www.belun.tl/en/
  E-mail address: office.belun@gmail.com
  Tel: (+670) 331 0353
- **Cruz Vermelha de Timor-Leste**, Red Cross affiliate:
  http://www.redcross.tl/
  E-mail address: info@redcross.tl
  Mobile: (+670) 7317 2613
- **Ema maTA Dalan ba Progressu (ETADEP)**, focusing on agricultural development:
  E-mail address: etadep2000@yahoo.com
- **Forum Komunikasi Untuk Perempuan Timor Lorosae (FOKUPERS)**, focusing on eliminating domestic violence:
  https://fokupers.org/
  E-mail address: fokupers2003@yahoo.com
  Tel: (+670) 332 1534
- **Fundasaun Bia Hula**, focusing on water and sanitation:
  E-mail address: biahula@hotmail.com
  Mobile: (+670) 7725 4564
- **Fundasaun Mahein**, focusing on the security sector:
  http://www.fundasaunmahein.org/en/
  E-mail address: direktor.mahein@gmail.com
  Mobile: (+670) 7831 6075, 7751 5437
- **Haburas Foundation**, environmental advocacy:
  https://www.facebook.com/HABURAS-FOUNDATION-191524777599020/
  Tel: (+670) 331 0103
- **Judicial System and Monitoring Program (JSMP)**, focusing on justice and legal affairs:
  http://jsmp.tl/
  E-mail address: info@jsmp.tl
  Tel: (+670) 332 3883
- **La'o Hamutuk, Institute Timor-Leste Institute for Development Monitoring and Analysis:**
  http://www.laohamutuk.org
  E-mail address: laohamutuk@gmail.com
  Tel: (+670) 332 1040
- **Luta Hamutuk**, focusing on sustainable development:
  https://www.facebook.com/Luta-Hamutuk-Institute-2005-1050895585078485/
- **Organizacao Popular Mulheres Timor (OPMT)**, women's group:
  http://opmt21.blogspot.com/
  Mobile: (+670) 7731 4141
- **Rede ba Rai**, land infrastructure advocacy:
  https://www.facebook.com/redeba.rai.7/
  E-mail address: redebarai13@gmail.com
  Mobile: (+670) 7792 2648

LOCAL NONGOVERNMENT ORGANIZATIONS

- **Resistência Nacional Dos Estudantes De Timor-Leste,** student organization:
  http://renetil.blogspot.com.au/
  E-mail address: renetil-sccp@yahoo.com
- **Timor Aid,** focusing on Tais research and agricultural development:
  http://www.timoraid.org/
  E-mail address: info@timoraid.org
  Tel: (+670) 331 2260

INTERNATIONAL NONGOVERNMENT ORGANIZATIONS

- **Adventist Development and Relief Agency—Timor-Leste (ADRA):**
  http://adra.tl/
  E-mail address: info@adra.tl
  Tel: (+670) 331 0515 | Mobile: (+670) 7734 3963
- **Care International Timor-Leste:**
  http://www.care-international.org/where-we-work/timor-leste
  E-mail address: info@care.org.au
  Tel: (+670) 332 1407, 332 1411, 331 7274 | Mobile: (+670) 7731 1807
- **Caritas Australia:**
  http://www.caritas.org.au/learn/countries/east-timor
  E-mail address: questions@caritas.org.au
  Tel: (+670) 331 3669, 331 3274
- **Catholic Relief Services (CRS):**
  http://www.crs.org/countries/east-timor
  E-mail address: info@crs.org
  Tel: (+670) 332 4641
- **Child Fund Timor-Leste:**
  https://www.childfund.org/timor-leste/
  E-mail address: questions@ChildFund.org
  Tel: (+670) 332 3828 | Mobile: (+670) 7839 8601
- **Health Alliance International:**
  http://healthallianceinternational.org/timor-leste/
  E-mail address: hai@u.washington.edu
  Tel: (+670) 332 2608 | Mobile: (+670) 7712 2612
- **Humanistisch Instituut Voor Ontwikkelingssamenwerkling (HIVOS) International Timor-Leste:**
  http://www.hivos.org
  E-mail address: info@hivos.nl
  Mobile: (+670) 7790 9077
- **International Committee of the Red Cross:**
  https://www.icrc.org/en/where-we-work/asia-pacific/timor-leste
  E-mail address: dil_dili@icrc.org
  Tel: (+670) 331 0452 | Mobile: (+670) 7732 1648
- **International Conservation Timor-Leste:**
  https://www.conservation.org/Pages/default.aspx
  E-mail address: timor-leste@conservation.org
  Tel: (+670) 331 0016
- **Instituto Marques Vale Flór:**
  http://www.imvf.org
  E-mail address: info@imvf.org
  Tel: (+670) 331 0098
- **International Republican Institute:**
  http://www.iri.org
  E-mail address: info@iri.org
  Tel: (+670) 332 5118 | Mobile: (+670) 7723 1841
- **Marie Stopes International Timor-Leste:**
  https://www.mariestopes.tl/
  E-mail address: mstl@mariestopestl.org
  Tel: (+670) 332 2841, 332 2923 | Mobile: (+670) 7808 5472
- **Mercy Corps Timor-Leste:**
  https://www.mercycorps.org/countries/timor-leste
  Tel: (+670) 223 3841
- **Oxfam International:**
  https://www.oxfam.org/;
  https://www.oxfam.org/en/countries/timor-leste-east-timor
  E-mail address: enquiries@oxfam.org.uk
  Tel: (+670) 331 2605 | Mobile: (+670) 7723 0831
- **Plan International Timor-Leste:**
  https://plan-international.org/timor-leste
  E-mail address: info.timorleste@plan-international.org
  Tel: (+670) 331 2492
- **The Asia Foundation:**
  https://asiafoundation.org/
  https://asiafoundation.org/where-we-work/timor-leste/
  E-mail address: timorleste.general@asiafoundation.org
  Tel: (+670) 331 3457
- **Union Aid Abroad (APHEDA):**
  http://apheda.org.au/
  http://apheda.org.au/tag/timor-leste/
  E-mail address: apheda.dili@gmail.com
  Mobile: (+670) 7723 2075
- **Water Aid:**
  http://www.wateraid.org
  https://www.wateraid.org/au/where-we-work/timor-leste
  E-mail address: supportercare@wateraid.org
  Tel: (+670) 332 2944
- **World Vision East Timor:**
  http://www.wvi.org/timor-leste
  E-mail address: asiapacific@wvi.org
  Tel: (+670) 331 2830

Umbrella and Coordinating Bodies

The **Forum ONG Timor-Leste (FONGTIL)** is the umbrella group for nongovernment organizations (NGOs) in Timor-Leste. In 2018, it had 348 members: 324 local NGO members and 44 international. Its mission is to promote and advocate in all sectors for the well-being and interests of all Timorese citizens; work toward ensuring that the people of Timor-Leste are free from all forms of injustice, including poverty, exploitation, and discrimination; have the opportunity to participate openly and freely in the political and democratic decision-making process; and strengthen the NGO sector to be an effective voice for all Timorese citizens, especially the most vulnerable members of the community.[26]

Contact details:

Forum ONG Timor-Leste	Tel: (+670) 332 1005
Rua do Mercado	Mobile: (+670) 7742 2821 or 7723 6782 or 7756 0005
Municipal Dili	E-mail: info@fongtil.org or forumngo.tls@gmail.com
Timor-Leste	Facebook page: https://www.facebook.com/FONGTIL-160943704014801/

Rede Feto Timor-Leste is an umbrella organization for women's organizations established on 10 March 2000. The network promotes gender equality and women's empowerment by supporting its 22 members through advocacy, networking, and capacity building.[27]

Contact details:

Rede Feto Timor-Leste	Tel: (+670) 331 2841
Obrigado Barrack	Mobile: (+670) 7723 6783
Caicoli, Dili	E-mail: redefeto@yahoo.com
Timor-Leste	Facebook page: https://www.facebook.com/redefeto/

The **Conselho Nacional Juventude Timor Lorosae** is the umbrella organization for youth civil society organizations of Timor-Leste.

Contact details:

Conselho Nasional Juventude Timor-Leste	Tel: (+670) 331 0844
	Mobile: (+670) 7723 7936, 7728 1665
Rua de Duarte Arbiru	E-mail: cnjtl_02@gmail.com
Farol Motael, Dili, Timor-Leste	Facebook page: https://www.facebook.com/cnjtl.nasional

Source: ADB, 2019

4.4.2 Trade associations and business groups

The Ministry of Finance Timor-Leste has developed several financial mechanisms i.e., Timor-Leste Budget Transparency Portal, Aid Transparency Portal, e-Procurement Portal, Government Results Portal, and Invoice Tracking Portal [*https://www.mof.gov.tl*]. In 2017, the government passed through the Council of Ministers resolution No. 24/2017 to establish the ASYCUDA World System which has been utilised by the Customs Authority of the Ministry of Finance. In February 2021 the Minister of Finance, H.E. Rui Augusto Gomes and the coordinating minister for economic affairs, H.E. Joaquim Amaral officially launched the National Single Window (NSW) of ASYCUDA World System, integrating Trade Invest into the online platform.

The launch was an important milestone for the Customs Authority of the Ministry of Finance in the context of the fiscal and public financial reform program, which was initially started by the VI Constitutional Government. The VIII Constitutional Government is fully committed to enacting such a reform agenda. The NSW Trade Invest portal will connect Timor-Leste to the global trade market and boost the country's access to markets in priority areas such as agriculture, tourism, fisheries, livestock, and other industries – a way of enabling the diversification of Timor-Leste's economy.

The online portal will connect the Customs Authority of the Ministry of Finance with the line ministries/ government agencies that deals with the movement of goods and services, including the Tax Authority, Ministry of the Interior, Ministry of Agriculture and Fisheries, Ministry of Health, Ministry of Transport and Communications, Ministry of Tourism, Trade and Industry, Trade-Invest and Autoridade Portuáriu Timor-Leste (APORTIL). The interface system employed within public administration services will ease-up the congestion, reduce the transaction costs, including clearance times at land borders, port, and airports – making it easier for the traders. It will also help the Government through the Ministry of Finance to collect the revenue in a fair and transparent manner.

There are 3 trade associations that have existed in Timor-Leste:

i. Chamber of Commerce Timor-Leste (CCI-TL) was established in 2010 and is recognised as being representative of the private business sector in Timor-Leste. It is a trusted strategic partner of the Government.
ii. Associação Empresarial das Mulheres Timor-Leste (AEMTL) is a Timor-Leste Businesswomen Association. Its mission is to empower entrepreneurs and promote business-women readiness to compete and succeed in Timor-Leste's emergent private sector.
iii. Trade Invest is the official investment and export promotion agency in Timor-Leste, providing a host of services to both foreign and domestic companies. The aim of Trade Invest Timor-Leste as the Investment and Export Promotion Agency is to help potential investors located in Timor-Leste and assist foreign companies in identifying projects and business opportunities that are emerging in Timor-Leste. In daily practice, it performs the role of a one-stop service provider, whether for taxes, licensing, investment opportunities, permits, tariffs, or linking importers.

The Aid Transparency Portal (ATP) is an Official Development Assistance (ODA) database and has been initiated under the Development Partnership Management Unit (DPMU), Ministry of Finance of the Government of Timor-Leste. Funding and support have been provided by the Government of Japan, Australia and the Asian Development Bank; and implementation by Development Gateway International. The objective of the ATP project is to strengthen the capacity of DPMU to manage, track and report on aid flows through the implementation of a Web-based Aid Information Management System (AIMS). The ATP tracks donor commitments and disbursements to Timor-Leste on a quarterly basis. Additionally, the system links activities to OECD/DAC sectors, geographic areas, and implementing, executing and beneficiary agencies.

The ATP system is based on the Aid Management Platform (developed by Development Gateway International) and has been customised to meet the needs of the Ministry of Finance, Timor-Leste and its development partners. A series of trainings have been provided to ATP users (development partners were trained during late 2011 and January/ February 2012) to ensure a full understanding of the data requirements and the long-term sustainability of the system (Ministry of Finance, 2021).

4.4.3 Co-management, traditional systems and customary rights

Co-management, traditional systems and customary rights (such as *tara bandu*) of the people of Timor-Leste consider connectivity between humans and nature as well as connection to the sea and other island nations (e.g., in the Pacific). Hence, strong local and traditional management, and relationships with coastal resources do exist in parts of Timor-Leste.

Despite being historically ignored or excluded by the Portuguese and Indonesian regimes, these institutions have persisted to varying degrees (Tilley et al. 2019).

Tara bandu refers broadly to laws or prohibitions that can be applied by communities to regulate land use or fisheries harvest in a given area for a set period. It has been widely applied by communities, NGOs and government, and its invocation in community-based resource management seems almost inevitable. It has played an inherent role in the development of local ordinances to protect the forest-watershed areas. Some researchers suggest that *tara bandu* should form the basis of community-based fisheries management efforts.

Tara bandu has been recognised by the state-based Environmental Framework Law (Article 8), meaning that it can be further incorporated into local common law for the purpose of conserving the environment and promoting the sustainable use of natural resources. The Constitution of RDTL (Article 2) affirms that "The State shall recognise and value the norms and customs of Timor-Leste that are not contrary to the Constitution and to any legislation dealing specifically with customary law". Meanwhile, co-management is a means to regulate marine resource use, and appears to be effective at engaging communities in resource management which can then contribute to multiple objectives of national government, local communities and those recognised in the SSF Guidelines in terms of accessibility and wellbeing. The way in which the process and ritual of *tara bandu* has led to the development of co-management illustrates a meaningful interaction between local communities and national government.

Tara bandu is clearly a valuable institution for the development of local rules, and for facilitating engagement between resource owners and stakeholders in multi-scale governance processes but must be supplemented by contextually derived approaches and institutional architecture appropriate for managing important mobile fisheries resources (such as small pelagic species) at scales larger than community fishing areas. Table 36 shows an example of *tara-bandu*'s application in Beacou.

Table 36 – List of biodiversity under "Tara Bandu" authority

Lulik objects/spaces under protection	Forestry resources under protection	Coastal and marine resources under protection
Sources of water	Tamarind trees	Coral reefs
Namon. Place for rituals when there is no fish abundance	Sandal forest	Turtles
Oho no Rae. Place "where the spirit of the land inhabits"	Forest	Salt production area
Lulin Baun/Udan be'en. The "place of the spirit of the rain".	Cajeput tree[1]	Fish bombing and fish poisoning prohibited

Violating once the Tara bandu, the offender(s) should provide	Violating twice the Tb, the offender(s) should provide	Violating three times the Tb, the offender(s) should provide
One goat	One water buffalo	One water buffalo
Two boxes of alcoholic beverages (palm wine/beers)	Two boxes of alcoholic beverages (palm wine/beers)	Four boxes of alcoholic beverages (palm wine/beers)
100 US$	100 US$	200 US$
Two sacs of rice	Two sacs of rice	Four sacs of rice
Two packs of cigarettes	Two packs of cigarettes	Four packs of cigarettes
Betel leafs and areca nuts	Betel leafs and areca nuts	Betel leafs and areca nuts

Source: Población, et al, 2016

4.4.4 Decentralised governance, coastal governance (formal, informal)

The Government of Timor-Leste has been working toward decentralisation, because under a centralised mode of government it is difficult for local authorities to exercise power and supervise projects and programs in their respective locality. With more autonomy and agency, local governments will be able to improve service delivery and work directly with external actors to communicate the needs and aspirations of their communities. There are some requirements stipulated in Law No. 3/2016 with Article 5 concerning decentralisation, and Article 72 concerning Regional Government. In this sense, there is an opportunity to endorse decentralised coastal governance. In terms of Integrated Development Planning at the district level, Decree-Law No. 4/2012 (15 February) stated that the process of integrated planning should involve the relevant agencies such as a) District development committee, b) Sub-District development committee, c) Delegation of inter-ministerial designated to District and Sub-District, and d) Council of villages [*https://portal.municipio.gov.tl/en/*].

The Coastal Governance Index (CGI) involves a wide-ranging desk-based research component from the Economist Intelligence Unit (EIU) which was initially launched in 2015 and updated in 2019. It sampled 20 countries such as Japan, France, Chile, Spain, RO Korea, Canada, South Africa, Mexico, Brazil, China, Indonesia, Philippines, Peru, Vietnam, India, Nigeria, and Russia. The CGI entails a set of 24 indicators and 47 sub-indicators across six thematic categories that are subsequently grouped into two main categories - foundational and asset.

In the context of piloting the best practices of Integrated Coastal Management (ICM) from 3 existing coastal municipalities (Manatuto, Liquiça, and Dili) to other municipalities, the Government of Timor-Leste may consider the CGI indicators when developing their coastal governance mechanism. A concrete example of an ICM system to support local coastal governance can be observed in the ongoing project of the ATSEA-2 Project at the Village of Uma Boco, Administrative Post of Barique, Manatuto Municipality.

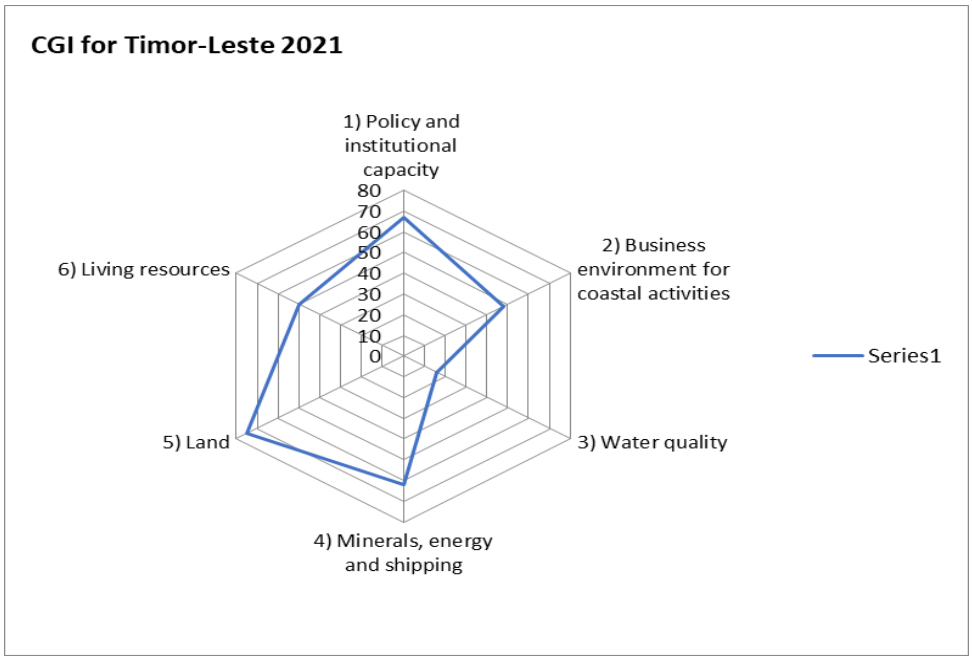
In the current country-wide situation, the application of ICM approaches and good practices (inter-agency and muti-sectoral coordination mechanisms, integrated planning, stakeholder participation and engagement in planning and implementation, etc.) and consideration of CGI scores (see Table 37) can support the implementation of Decree-Law No. 4/2012 (15 February) - particularly the process of integrated planning and implementation at the District, Sub-District and Villages levels.

Table 37 – Coastal governance index of Timor-Leste

SUMMARIES of Coastal Governance Index (CGI) indicator:	**A. Foundational categories**	Score	**B. Asset categories**	Score
Score per category	1) Policy and institutional capacity	67	3) Water quality	16
	2) Business environment for coastal activities	48	4) Minerals, energy and shipping	62
	AVERAGE	**57.5**	5) Land	75
			6) Living resources	50
			AVERAGE	**50.7**
TOTAL AVERAGE (A + B): 54.1 (The overall score)				

Source: Cabral, M.M. 2021

In 2021, Timor-Leste's Coastal Governance Index (CGI) stated value of 54.1 (Annex 1 & 2) was categorised as being within the less favourable zone (average scores), meaning that the Government of Timor-Leste has improved its HDI value during the last 20 years, which correlates with improved environmental protection. The HDI value of Timor-Leste was 0.484 in 2000 and significantly increased to 0.606 in 2019 (12.2%), positioning Timor-Leste at 141 out of 189 countries and territories, within the medium human development category (UNDP, 2020). For Timor-Leste's overall CGI score in 2021 see Figure 35. This figure demonstrates that the land category attained the highest score of 75, followed by policy and institutional capacity category at 67, and ranking third was mineral, energy and shipping at 62 (see Figure 43 and Table 38).



Source: Cabral, 2021

Figure 43 – Coastal Governance Index for Timor-Leste

Table 38 – Summary of Timor-Leste's CGI normalised scores and indicator zones

Categories	Indicators	Scores obtained
WATER QUALITY	a) Freshwater pollution control agency b) Regulatory standard for water pollution c) Monitoring and enforcement	16
BUSINESS ENVIRONMENT FOR COASTAL ACTIVITIES	a) Ease of doing business b) Corruption perception c) Effectiveness of dispute resolution mechanisms d) Quality of coastal infrastructure	48
LIVING RESOURCES	a) Fisheries governance and management effectiveness b) Protection for marine/coastal species c) Ballast water treatment d) Transparency in living resources management	50
MINERALS, ENERGY & SHIPPING	a) Permitting and licensing b) Monitoring and enforcement c) Risk mitigation for the mineral and oil and gas industries	62
POLICY & INSTITUTIONAL CAPACITY	a) Coastal management policy and strategy b) Presence of established institution c) National strategies to address climate change d) Marine Spatial Planning (MSP) e) Stakeholder engagement f) Transparency in rents distribution g) Adoption of the United Nations Convention on the Law of the Sea (UNCLOS)	67
LAND	a) Prevalence of coastal protected areas b) Environmental impact of coastal development c) Government commitment to sustainability in coastal tourism development d) National disaster risk mitigation	75

Criteria:
Scores < 34 or below average : unfavourable zone
Scores 34 – 66 or average : less favourable zone
Scores > 66 or above average : favourable zone
Source: Cabral, 2021

The Land category's high ranking is connected to good institutional performance, such as the Ministry of Agriculture and Fisheries' establishment of protected areas (McLntyre M. A., 2011) and Decree-Law No. 5/2016 relating to the creation of a national system of protected areas *[https://www.informea.org]*. This effort has boosted the scores of the sub-category for prevalence of coastal protected areas. It also included the sub-category of environmental impact of coastal development, which was influenced by the Secretariat of Environment creation of the environmental licensing system by the issuance of Decree-Law No. 5/2011 *[https://leap.unep.org]*. Additionally, the sub-category of natural disaster risk mitigation relates to the Ministry of Social Solidarity, and the successful creation of a national disaster risk policy (Ministry of Social Solidarity, 2008) and production of Timor-Leste's disaster management reference handbook (CFE-DM, 2019).

4.4.5 Community participation, civil society and public awareness

Civil society organisations are defined broadly as any organisations, whether formal or informal, that are not part of the apparatus of government, that do not distribute profits to their directors or operators, that are self-governing, and in which participation is a matter of free choice. Both member-serving and public-serving organisations are included. Embraced within this definition, therefore, are private, not for-profit health providers, schools, advocacy groups, social service agencies, anti-poverty groups, development agencies, professional associations, community-based organisations, unions, religious bodies, recreation organisations, cultural institutions, and many more.

The Civil Society Organization Sustainability Index (CSOSI) is aimed toward assessing the capacity of civil society to serve as both a short-term partner in implementing development solutions, and a long-term actor in ensuring that development outcomes are sustained. This resource allows local civil society organisations to assess the environment in which they are operating and their capacity to advocate, operate sustainably and communicate with citizens. The index addresses both advances and setbacks in seven key components: legal environment, organisational capacity, financial viability, advocacy, service provision, sectoral infrastructure, and public image. It will be a useful resource for local civil society organisations, governments, funders, and academics (USAID, 2021).

A survey carried out at the national and local level showed that the involvement of CSOs in public awareness was mostly enabling coastal community awareness of the impacts of climate change driven sea level rise, and beach clean-ups to divert land-based pollution (particularly plastic pollution) from the ocean. The overall score of CSOSI Timor-Leste is 3.5, meaning that it is at a moderate level of sustainability (see Table 44).

Source: USAID, 2021

Figure 44 – Civil Society Organization Sustainability Index

The CSO Sustainability index uses 7 points of scale from 1 to 7. The lower numbers indicate more robust levels of CSO sustainability. The levels of sustainability are categorized into 3 broad clusters:

Sustainability Enhanced	Sustainability Evolving	Sustainability Impeded
1.0 – 3.0	3.1 – 5.0	5.1 – 7.0

Note:
Sustainability Enhanced (Score: 1.0 – 3.0) = the highest level of sustainability
Sustainability Evolving (Score: 3.1 – 5.0) = moderate level of sustainability
Sustainability Impeded (Score: 5.1 – 7.0) = the lowest level of sustainability

Table 39 below illustrates seven different legal and regulatory aspects in the CSO environment and their related sectors.

Table 39 – List of legal and regulatory aspects which deal with different sectors and their implementation

1- **LEGAL ENVIRONMENT:** The legal and regulatory environment governing the CSO sector and its implementation.
Registration – Legal procedures to formalize the existence of a CSO
Operation – The enforcement of the laws and its effects on CSOs
State Harassment – Abuses committed against CSOs and their members by state institutions and groups acting on behalf of the state
Taxation – Tax policies that affect CSOs
Access to Resources – Legal opportunities for CSOs to mobilize financial resources
Local Legal Capacity – Availability and quality of legal expertise for CSOs

2- **ORGANIZATIONAL CAPACITY:** The internal capacity of the CSO sector to pursue its goals
Constituency Building – Relationships with individuals or groups affected by or interested in issues on which CSOs work
Strategic Planning – Organizational goals and priorities for a set timeframe
Internal Management – Structures and processes to guide the work of CSOs
CSO Staffing – Quality and management of human resources
Technical Advancement – Access to and use of technology

3- **FINANCIAL VIABILITY:** The CSO sector's access to various sources of financial support
Diversification – Access to multiple sources of funding
Local Support - Domestic sources of funding and resources
Foreign Support – Foreign sources of funding and resources
Fundraising – CSOs' capacity to raise funds
Earned Income – Revenue generated from the sale of products and services
Financial Management Systems – Processes, procedures and tools to manage financial resources and operations.

4- **ADVOCACY:** The CSO sector's ability to influence public opinion and public policy
Cooperation with Local and Central Government – Access to government decision-making processes
Policy Advocacy Initiatives – Initiatives to shape the public agenda, public opinion, or legislation
Lobbying Efforts – Engagement with lawmakers to directly influence the legislative process
Advocacy for CSO Law Reform – Initiatives to promote a more favorable legal and regulatory framework for the CSO sector

5- SERVICE PROVISION: The CSO sector's ability to provide goods and services

Range of Goods and Services – Variety of goods and services offered
Responsiveness to the Community – Extent to which goods and services address local needs
Clientele and beneficiaries – People, organizations and communities who utilize or benefit from CSOs' services and goods
Cost Recovery – Capacity to generate revenue through service provision
Government Recognition and Support – Government appreciation for CSO service provision

6- SECTORAL INFRASTRUCTURE: Support services available to the CSO sector

Intermediary Support Organizations (ISOs) and CSO Resource Centers – Organizations and programs that provide CSOs with training and other support services
Local Grant Making Organizations – Local institutions, organizations or programs providing financial resources to CSOs
CSO Networks and Coalitions – Cooperation within the CSO sector
Training – Training opportunities available to CSOs
Intersectoral Partnerships – Collaboration between CSOs and other sectors

7- PUBLIC IMAGE: Society's perception of the CSO sector

Media Coverage – Presence of CSOs and their activities in the media (print, television, radio and online)
Public Perception of CSOs – Reputation among the larger population
Government/Business Perception of CSOs – Reputation with the government and business sector
Public Relations – Efforts to promote organizational image and activities
Self-Regulation – Actions taken to increase accountability and transparency

CHAPTER 5. ECOSYSTEM STATUS & PRIORITY ENVIRONMENT CONCERNS (INCLUDING IDENTIFYING KEY LOCATIONS, IMPACTS, UNDERLYING CAUSES/ISSUES)

Marine and coastal environmental concerns are now at the heart of fisheries management initiatives, NGOs, and coastal communities. In Timor-Leste, 19 MPAs and 5 LMMAs have been established as part of conservation measures. The National Oceans Policy (NOP) is another initiative that is in the process of being finalised. The NOP is a new fisheries governance model that recognises fisheries as complex socio-ecological systems which require interdisciplinary and holistic approaches. This approach is building upon existing biological-driven models to guide the complexity of values and priorities that drive primary stakeholders' actions on the ground.

Timor-Leste has signed various international conventions such as UNFCCC, UNCBD, UNCLOS, the Vienna Convention and two protocols (Kyoto and Montreal) which are relevant to marine and coastal ecosystems. These conventions and protocols align with existing policies and other legal instruments to address marine and coastal resources concerns, helping to build a holistic, ecosystem-based approach toward management where a dynamic range of management objectives are considered. Long-term vision on fisheries management has been articulated in the SDP 2011-2030 as well as in the UN SDGs 2030 Agenda (particularly goals 13, 14 and 17). Fisheries plans are updated every five years, with adjustments primarily being made to approaches and priorities, based on scientific information from different NGOs, universities and development partners.

Fisheries plans form the basis of management approaches that promote collaboration to secure resilience in fishing systems. Understanding biological and physical parameters of coastal ecosystems is vital for adaptive management. In addition, dynamic socio-economic variables need to be understood and monitored. Understanding the social-ecological system helps guide approaches that successfully manage stakeholders' interactions with marine and coastal resources. Socio-economic monitoring is an instrument that provides a practical and flexible standard method for collecting and learning from social and economic monitoring data to facilitate the implementation of effective management measures for marine and coastal resources (FAO, 2017). Socio-economic monitoring and information gathering also facilitates decision-making on coastal community needs associated with food security, key livelihoods, and the equitable use of marine and coastal resources (FAO, 2017).

Based on socio-economic surveys and monitoring, it was found that almost all coastal communities in Timor-Leste rely on coastal resources for subsistence. This has put pressure on coastal resources, sometimes leading to habitat degradation, localised extinctions, mangrove depletion, etc. As mangrove forests provide many ecosystem services - protecting shorelines from erosion, providing nursery habitats for significant species, filtering water, serving as carbon sinks – it is critical that they retain their integrity and health. However, in Timor-Leste many mangrove areas have already been converted to salt distillation and fishponds (for example, in Ulmera and Hera).

Poor catchment and waste management systems increase the sediment, nutrient and pollution loadings in rivers and end up on reefs and lagoons. This is a process which can largely be

observed in Manatuto (Natarbora) and Lore beach on the southern coasts. Also, shifting agricultural practices is another concern that contributes to high sedimentation loadings into coastal areas.

Unsustainable fishing practices, IUU fishing and over-exploitation of marine species, such as red snapper, continues to be a major problem in Timor-Leste, particularly along the southern coast. Unsustainable fishing has caused localised species extinctions, even those species which are under protection. In addition, destructive fishing practices (such as the use of explosives and fine meshed nets (mesh size <1 inches), have resulted in the destruction of key fish habitats, ultimately contributing to the depletion of fish stocks. Non-fish species, such as sea cucumber and trochus, are also being illegally exploited by foreign vessels. The collection of corals for traditional purposes in Suai, Viqueque and Los Palos also poses a serious threat to the marine environment. The local government needs to implement tangible actions on the ground in close cooperation with relevant agencies and other stakeholders, to manage marine and coastal resources in a sustainable and equitable way. Table 40 describes key stakeholders' understandings of unsustainable and IUU fishing, marine and land-based pollution, and climate change vulnerability and impacts.

Table 40 – Results of stakeholders consultation held on 23 September 2022 at MAF office

Priority marine and coastal environmental concerns	Main causes	Underlying causes	Solution
1. **Unsustainable fisheries**	Unsustainable use and exploitation of marine and coastal resources by locals and by illegal fishing (IUU fishing). Pelagic and near-shore fish resources are being caught illegally.	Lack of coordination among littoral countries to manage and control all marine resources across transboundary area. Inadequate legislation at country level to penalise illegal boats operating in Timor-Leste waters. Lack of surveillance at country level due to lack of capacity of marine police and Falentil-Força Defesa de Timor-Leste (F-FDTL) to control all Timor-Leste waters. Maritime boundary unresolved.	It needs to strengthen the diplomacy channel with littoral countries to solve the maritime boundary and reduce IUU fishing on transboundary area. The government needs to prepare more equipment to support F-FDTL and Marine Police in order to control Timor-Leste marine water.
	Local fishers are using destructive fishing practices e.g., explosives, fish poison (use poisonous roots) and fine meshed nets (mesh size <2 inches).	Lack of awareness/low priority given to conservation of fish stocks and non-target species. Low priority given to coastal and	The local government needs to give more priority to fish stock and its conservation through village development plan. Education and public

	This method has resulted in fish habitat destruction and has caused fish stock depletion.	marine habitats/environments.	awareness are another essential approach to proceed.
	Gleaning activities which have impacted on marine and coastal resources such as collecting non-target species as well as collecting coral reefs for traditional ceremony.	Lack of understanding of the importance of the corals and lack of local or community level enforcement capacity.	Increase information regarding the importance of coral reefs particularly for fish habitat and elevate coastal communities' knowledge on coral reefs.
	Destructive fishing practices (inappropriate fishing methods) and associated damage to critical habitats such as reefs and seagrass beds. This has increasing pressure on the assimilative capacity of marine and coastal environments which degrades the quality of the coastal resources and the habitats.	Lack of public awareness, motivation and support needed to ensure local fishers and other entities to adopt a more pro-active in marine and coastal environmental protection. Lack of effective protected areas legislation that is not compatible with economic circumstances at community level.	Provide education and training on how to protect marine and coastal resources and its environment. Provide other livelihoods option and reinforce existing legislations. There is an urgent need for training and capacity building in fisheries research and management. It needs a proper coastal planning to reduce habitat degradation and water quality. MPA is another plan to conserve and preserve marine conservation.
2. Unsustainable fisheries on Socio-economic impacts	Destruction of critical habitats and biodiversity that affect coastal livelihoods	Options for sustainable livelihoods and income generation in coastal communities is lacking,	Development marine and coastal environmental conservation to secure livelihoods options and business management and technical support skills needed to conserve coastal resources.

	Conservation and management programs of fisheries are not integrated into local-based development or village development plan that utilises local resources in an ecologically sustainable manner to generate community benefits. These benefits may include not only cash incomes but also improvements in community infrastructure (e.g., local market) and services through capacity development and investment to facilitate more income generations.	There is no community-based marine and coastal planning and conservation, associated with the identification of local development options that are compatible with livelihoods options or income diversification.	Need to develop community-based planning for marine resources conservation incorporated with income diversification and job opportunity.
	Over-harvesting or IUU fishing of marine and coastal resources species	The local government is unable to control IUU fishing across the territory.	Central government has to allocate a state budget to buy boats and equipment in order to control IUU fishing. Capacity building is needed for marine and coastal resources management.
	Little local government and coastal community support given to marine and coastal resources concerns in particular from fisheries agencies at local level.	Limited local capacity for marine and coastal resources management.	It requires a collaborative monitoring from different sectors (e.g., local authorities, fisheries, F-FDTL, Marine Police etc.). And boost their capacities to collect and share data related to marine conservation issues.

	Women and girls are collecting fish and non-fish during low tide. Biodiversity collected is undocumented and it has great potential to destroyed marine and coastal habitat as observed.	Inadequate marine and coastal resources monitoring and skills. Lack of reliable and accurate marine and coastal resources conservation information.	Dissemination of existing laws and regulations and allocate more budget for marine conservation. And boosting the capacity of the fisheries staff at local level.
		Lack of implementation and law enforcement. Lack of funding for fisheries management and conservation. And scarcity of technical skills and experience.	Training in fisheries is pivotal to be developed gradually. And marine and coastal conservation should be given high attention and priorities to secure coastal environment.
		Lack of awareness and training in fisheries best practices and low priority given to marine and coastal environmental considerations.	Marine policy and planning should be developed in a coherent manner, engaging different sectors. This is to secure collaborative actions and share resources (human and budget), share responsibility and share benefits.
		Lack of integrated policy development between fisheries, and other sectors e.g., agriculture, private sectors, Academia environment pollution, forestry etc. And poor coordination among key stakeholders to deal with marine and coastal resources.	
3. Marine and land-based pollution including habitat degradation due to anthropogenic causes	Deforestation which leads to habitat destruction and sedimentation which disturbance coastal habitat when leaching occurs to main rivers.	Unsustainable agricultural and logging practices and unplanned development such as road construction that affects catchment areas.	Regulating illegal logging and ban shifting agriculture to reduce erosion and road construction requires proper planning.

	Deterioration in marine water quality from sedimentation due to shifting agriculture practices. This will affect fish/coral diversity and abundance of native species.	Lack of understanding of the shifting agriculture and their impacts for short and long term.	Education and public awareness on shifting agriculture and their short- and long-term impacts.
	Many solid wastes from marine and land-based pollution end up on beaches particularly on the southern coast.	Marine debris is more related to IUU fishing. Lack of diplomacy among neighbour countries to control and halt IUU fishing. And there is no treatment for these solid wastes and also there is a lack of rubbish dump on the beach. Improper disposal of community rubbish.	There is an urgent need for negotiation between Timor-Leste, Australia and Indonesia to control IUU fishing and marine pollution produced by neighbour countries. Solid waste needs to be managed with proper management measures.
	Sediment loading and run-off in the major rivers (on the southern coast) is the principal contributors to marine pollution. High nutrient levels at point sources of pollution, rivers (from sediment and land run-offs).	Lack of education and public awareness regarding run-off and sedimentation impacts on marine and coastal resources.	Develop proper training about run-off and sedimentation impacts on marine and coastal resources.
	Development of roads has altered water system flow; habitats have been degraded and changed in areas where forests have been replaced by farmland and where coastal lowlands have been extended or converted to other activities e.g., fish ponds and salt distillation (it happens on the northern coast).	Lack of roads development planning such as lack of road drainage and lack of knowledge regarding conversion of mangrove lands to aquaculture activities and salt distillation.	Road development should be integrated with other activities e.g., climate change impacts. Need a proper training related to mangrove conversion and the short and long-term impacts.
	Unsustainable use of critical habitats such as the cutting of	Economic pressure is the main option for cutting trees for cash	The local government has to provide job

	mangrove stands and other associated forest areas by local communities for firewood or timber (mangroves are important spawning and nursery areas for many coastal biodiversity).	and for cooking and heating.	opportunities and alternative livelihoods.
	Increasing pollution of coastal and near-shore environments from land-based development, including: domestic waste (liquid and solid)	There is a general lack of appreciation of the change in quality of marine and freshwater caused by human activities such as high population concentration, shifting agriculture, infrastructure development, (road and houses).	Really need proper training, education and public awareness to coastal communities and other stakeholders to reduce shifting agriculture and design proper infrastructure development. Develop proper solid waste disposal for households and small industries. There is a need for community based solid/liquid waste management practices.
	Increasing loads of sediments, wastes and other contaminants entering coastal systems from domestic waste (liquid and solid)	Improper solid waste disposal litter, household and small industry waste.	Prepare adequate pollution control measures at source (both north and south). Lack of environmental awareness of the impacts of these pollutants of marine and coastal environment and its resources. Therefore, it needs to raise pollution awareness.

	Direct disposal of wastes with a high oxygen demand into the coastal and marine environments, particularly refuse and plastics and organic wastes such as sewage (animal manure etc.)		Develop proper waste water disposal with a sewerage system.
4. Climate change impacts	Inundation/sea level rise has greatly affected coastal communities, basic infrastructure, e.g., roads, houses, hospital, schools and church.	Increased greenhouse gas emissions from burning fossil fuels and industrial emissions from developed countries together with a reduction in global greenhouse gas "sinks" such as forests and other net absorbers of carbon dioxide. This caused increased sea surface temperatures related to global warming.	Capacity building for climate change adaptation, target in vulnerable areas.
	Flash flood has destroyed field rice, impact on psychological wellbeing and other agricultural farm across the country. This has led to low agricultural production and caused hunger, food storage and malnutrition.	Changes in local weather patterns due to climate change. Lack of awareness and low skills in managing environmental impacts	Design proper education and awareness on environmental impacts arising from unsustainable practices e.g., cutting trees.
	Coastal erosion has affected coastal structure and habitat and destroys boats or canoes parking.	Increased sea temperatures related to global warming that caused sea level rise and at the end provoked coastal erosion.	Management of coastal areas and its vegetation.
	Drought has greatly affected water resources, both for human and animal husbandry (cattle and water buffalos). It has also affected pastoral	Alteration of local weather patterns due to climate change.	Management and sustainability of natural resources.

	lands and agricultural production.		
	Climate change has potentially severe impacts, but current level of impact is hard to accurately assess typically at hamlet level.	Global warming has caused ozone depletion. Emissions concentrations have increased related to CFC's, halons, and other man-made chemicals that react with and deplete the ozone layer.	Reduce gas which is not environmentally friendly e.g., R22 to reduce ozone depletion. Conduct climate change vulnerability assessments at hamlet level & identify tangible adaptation options as part of village development plan.
	It is predicted that a global weather phenomenon is continued happen, thus if impacts occur, these are likely to be widespread and unpredictable.	Unclear, a lack of long-term records limits the causal analysis of such changes.	It needs a long-term record for climate change and its vulnerability and impacts. This will enable us to do the Casual Chain Analysis. Existing laws and regulations need to be implemented together with local wisdom. This is to avoid unsustainable use of marine and coastal resources, littering and uncontrolled discharge of small industrial waste. Reduce the vulnerability of coastal communities to potential climate change impacts by improving natural coastal defences e.g., mangrove rehabilitation. Increase the resiliency of coastal communities through livelihood diversification. Improve weather forecasting and develop early warning systems.

The major concern highlighted during the stakeholder meeting was IUU fishing, carried out by industrial-sized foreign vessels. The participants argued that IUU fishing was more prevalent on the southern coast than on the northern coast. This mode of IUU fishing has increased fishing pressure in most parts of the southern coastline. Associated with this concern for IUU fishing, is the widespread use of destructive fishing practices - particularly the use of fine meshed nets. These practices damage the corals and eliminate juveniles from the fish populations. The participants also discussed certain high value benthic species such as lobsters, sea cucumber and trochus which are thought to be seriously endangered. There is localised extinction due to high exploitation illegally around Jaco Island, and Lore beach on the southern coast.

5.1 Status of Fisheries and Marine Living Resources

5.1.1 Coastal fisheries

Coastal fisheries in Timor-Leste play an important role in providing food and nutrition security, a source of livelihoods, social wellbeing, and cultural identity. The ecosystems of marine and coastal areas are relatively pristine, and local fishing pressure in coastal areas is also relatively low. The small-scale nature of fisheries in Timor-Leste contributes to this. Local knowledge along with official laws and regulation can contribute to the protection and equitable access of marine and coastal habitats. The sustainability of fish stocks is integral to supporting Timor-Leste's food security and livelihoods.

Many external actors such as WorldFish, TOMAK, MercyCorps, Marketing Development Facility (Australia), UNDP, the ATSEA-2 project, and CRS are working on freshwater and brackish water aquaculture projects across the country. PEMSEA is working on a climate change adaptation and livelihoods program on the northern coast, in close cooperation with the Ministry of Agriculture and Fisheries. Livelihoods diversification is another activity being promoted in almost all coastal areas. For example, seaweed mariculture in Ulmera, Hera and Atauro Island are being promoted largely as a source of income generation. Livelihood diversification schemes recognise that income generation from marine resources in the coastal areas should consider Timor-Leste's annual climate variation. For example, during strong winds and currents fishers are unable to fish, so activities such as gleaning, aquaculture, or mariculture might provide alternative sources of household nutrition and income. Livelihood diversification ultimately builds resilience to environmental shocks.

To adapt to variable weather conditions, fishers have invested in different fishing materials and vessel sizes, including small canoes. These different fishing gears and vessels allow fishers to adjust their practices to suit characteristics of various fishing grounds and respond to different weather conditions – ultimately increasing their ability to secure catch and resilience to environmental change. Choosing the appropriate fishing gear materials requires a high level of experience, knowledge, and financial capacity. Generally, fishers employ different fishing strategies during the dry and wet seasons. During the dry season fishers generally operate from small canoes fit for various types of fishing gears suitable for different target species (from pelagic to demersal fish). Normally, they use gill net multi-filament and hand-hooks. Whereas during the wet season, they equip themselves with hand-hooks, but no gill-net due to strong

winds and currents. Examples of fishing gear materials utilised for coastal inshore and offshore fishing, and their respective benefits, are presented in Table 41.

Table 41 – Combination of fishing gear materials used by fishers during different season in Timor-Leste

Combination of fishing gear materials	Fishing characteristics	Benefits of combination
Coastal fishing: gillnet in combination with trap and gleaning done by women and girls	Investment is low. Gillnet. Can be operated from August to December on the northern coast with little wind and no/low current. High stock of small pelagic fish, operated very near to the coast or shallow water and clear water.	This is very practical for poor fishers or poor households. It can be switched between species, tide, fishing ground and seasons
Inshore fishing: Gillnet in combination with portable trap. Gleaning using barriers trap	The investment is relatively low as well. Gillnets are operating in combination with portable trap made by bamboo located in fishing grounds with less current and wave	Use moveable trap in combination with gillnet. Women and girls are conducting gleaning, but it depends on the weather condition.
Offshore fishing: Gill-net and long-line	Requires high cost to buy fishing gear materials. Long-line fishing requires bait. The fishing can be done from August to December and January to March both sides (northern and south). It requires more labour and skills. Gillnets use in two seasons per year: from January to June and from August to December.	Reduce variable costs: fish caught by gillnet are used as bait for long-line fishing. Switch among species, seasons and fishing grounds. To adapt to availability of fish: if catch is good with gillnet, then continue fishing; if not, stop fishing and return home

External factors such as strong winds and currents can influence the fishers' decision to fish offshore or stay ashore. During the season with favourable conditions, they tend to fish offshore to maximise their catch, to compensate for the cost of fuel and outboard motor. Fishers generally choose to use powered vessels with several types of fishing gears to exploit as many species as they can. On the northern coast for instance, they can potentially harvest 5 days per week depending on the fish availability and weather conditions. On the southern coast the weather becomes harsher during the wet season, preventing all fishers from leaving the shore. However, fishers with less agency and financial capacity to diversify their livelihood, may have to take the risk of fishing in unfavourable weather - often returning to shore early with no catch due to rough conditions.

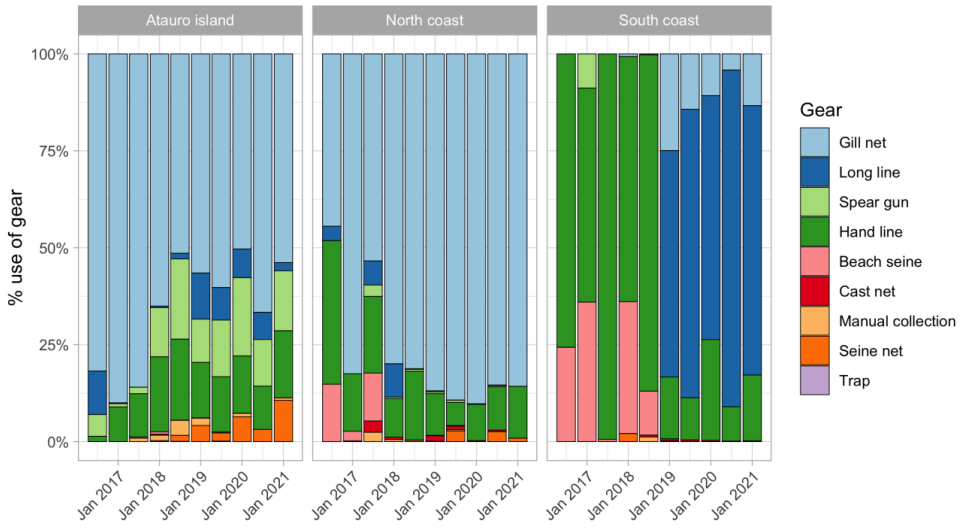
In the intertidal zone during low tide, women and girls commonly engage in the collection of small fish, crabs, oysters and octopus. Additionally, there are also traps made of woven bamboo as part of fishing equipment for fishing reef fish. This trap can be operated by men or women.

5.1.2 Pelagic fisheries

Most of the fishers in Timor-Leste are engaged in capturing pelagic fisheries, using relatively traditional fishing equipment. The boats used by fishers are less than 12 m, some with or without outboard motors. The fishers commonly concentrate their efforts along coastal areas, usually operating in shallow waters and returning to the beach after operating 5-7 hours a day. The fishing gears utilised vary from gill net, long line to spear gun. This equipment is brought with them in one boat.

Types of demersal fish normally targeted consist of snapper, grouper, scads, threadfin, emperor, rabbitfish, barramundi, yellowtail and goatfish (Vellait, 2021). The most common pelagic target species consists of sardine, flying fish and others. The gill nets are primarily used for catching pelagic fish species.

The variety of fish captured with each trip is different, making it relatively difficult to monitor the fish stock. Pelagic fish on the northern coast are under more pressure due to the high concentration of fishers, compared to the southern coast. Stock assessments on the northern coast are required to examine the fish population dynamics. Fishing gear materials also require management. In Atauro Island, the use of gill nets has decreased over time, while there has been an increase in the use of spear guns which are very selective. Fishers on Atauro Island also use seine nets and hand lines. Most fishers on the northern coast have exhibited an increase in the use of gill nets, and a decrease in the use of hand line. Whereas on the southern coast more hand lines and long lines are in use. Figure 45 shows different fishing gear materials composition through time series and in different coasts (Atauro, northern and southern coasts).

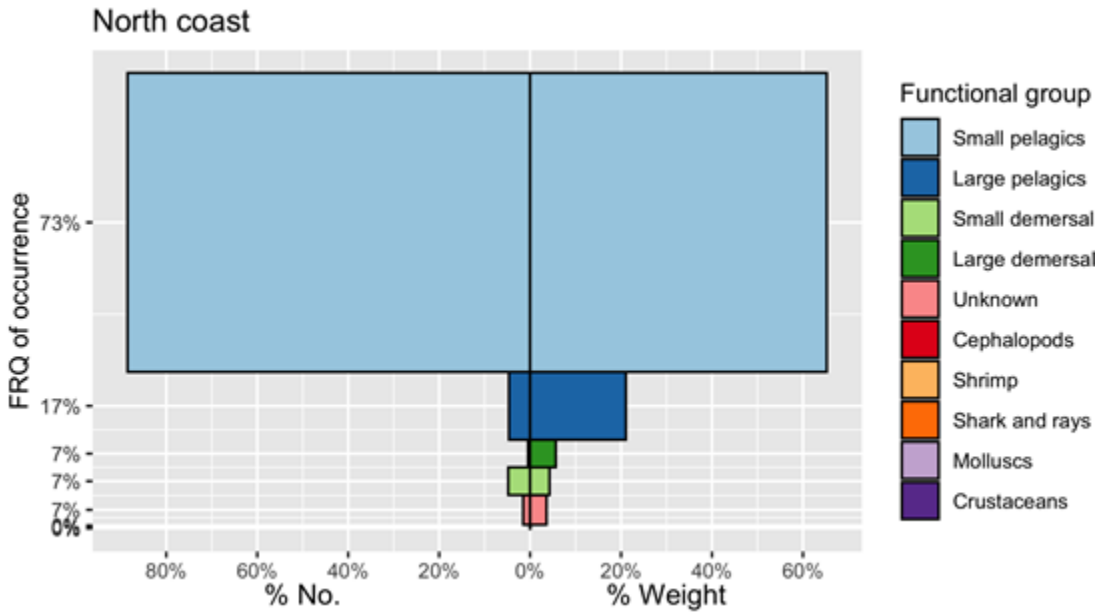


Source: Vellait, 2021

Figure 45 – Fishing gear materials use over time, gears operated in different locations (Atauro, North and south coasts)

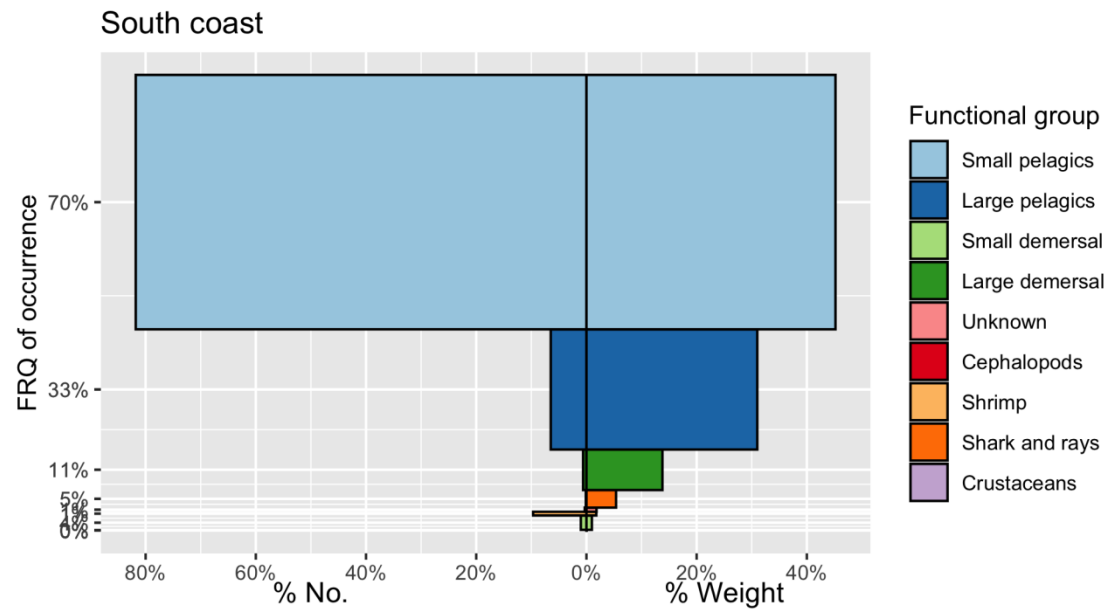
The catch composition is generally dominated by pelagic fish, while the small demersal fish is caught less commonly than pelagic fish. Vellait (2021) comparatively assessed the pelagic fish

composition along the northern and southern coastlines of Timor-Leste, using the "Index of Relative Importance" (IRI), and found the pelagic fish composition to be relatively homogenous. See Figure 46 and Figure 47.



Source: Vellait, 2021

Figure 46 – Fish catch composition from September 2016 – 2021 on the north coast



Source: Valleit, 2021

Figure 47 – Fish catch composition from 2016-2021 from the southern coast

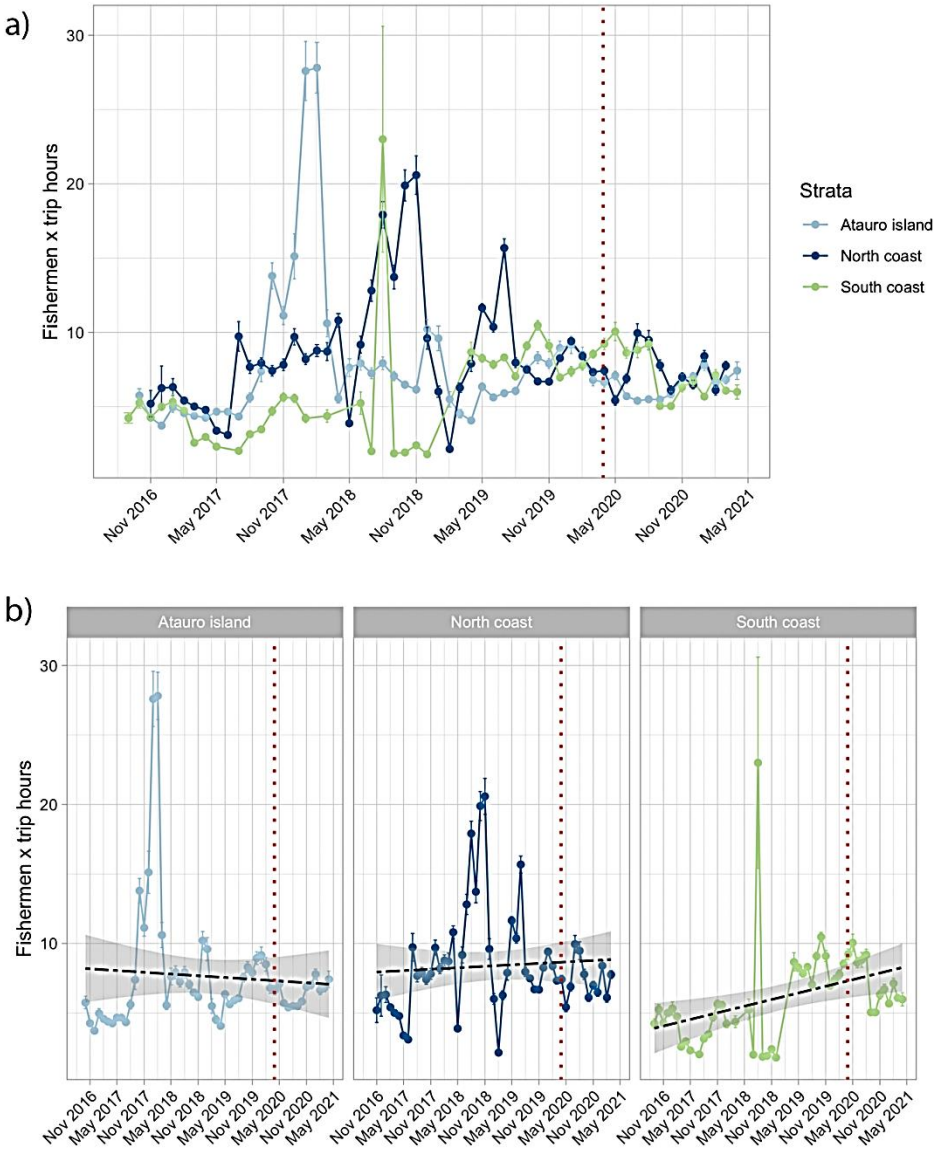
Timor-Leste's national fishing effort is based on geospatial data which covers entire country. See Figure 48. The data indicates that most of the fishing trips are concentrated around fish landing centres which are located within proximity of the beach. High effort is represented by red dots,

with orange, yellow, and white representing a decreasing effort respectfully (Valleit, 2021).

Source: Daniel S., 2021

Figure 48 – The fishing efforts in different sites across the country

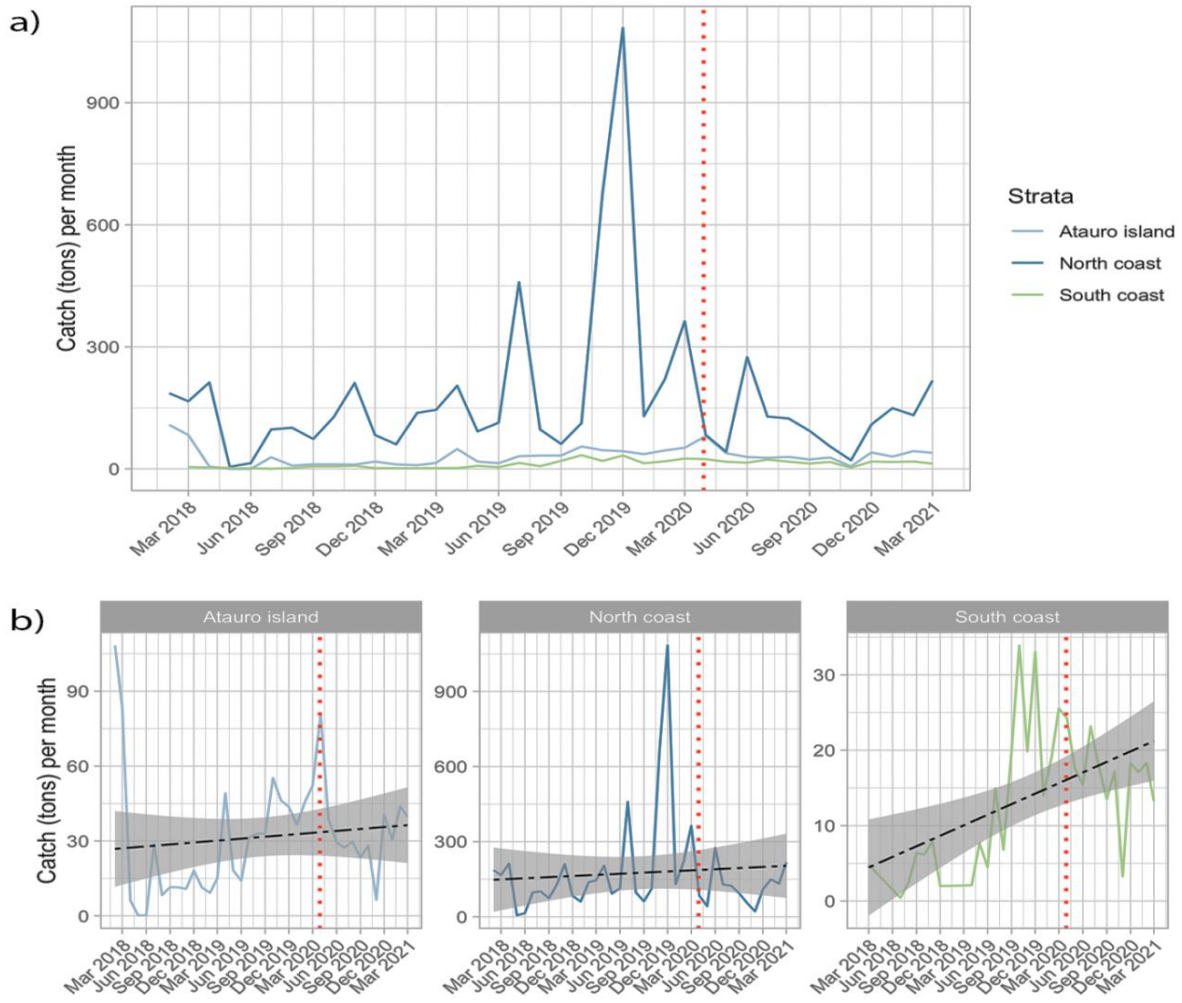
Fishing trips vary according to ocean characteristics, weather conditions, and individual choices. However, fishing trip effort (fishers x hours) in three different locations (Atauro Island, north, and south coasts) is relatively similar. For example, trip effort on Atauro Island typically ranges from two to ten fisher-hours, and this is generally true of the north coast, while the southern coast shows a slight increase (refer to Figure 49). The mean trip effort (fishers x hours) of a fishing trip on Atauro Island is represented by light blue, the north coast with dark blue, and the south coast with green. This fishing effort was observed between 2016 and 2021 (Valleit, 2021).



Source: Valleit, 2021

Figure 49 – The average trip of fishers with 95% confidence intervals.

The fishing effort generally corresponds with total monthly landings in each landing centre (tons). The total fish landings on the north coast (including Atauro Island) are usually higher than on the south coast. Fish landings on the southern coast increase in October and November, while on the northern coast and Atauro Island, landings remain relatively constant. This difference is likely indicative of seasonality. Figure 50 demonstrates an estimation of total monthly catch from different locations with Atauro Island represented by light blue, the north coast with dark blue, and the south coast with green.



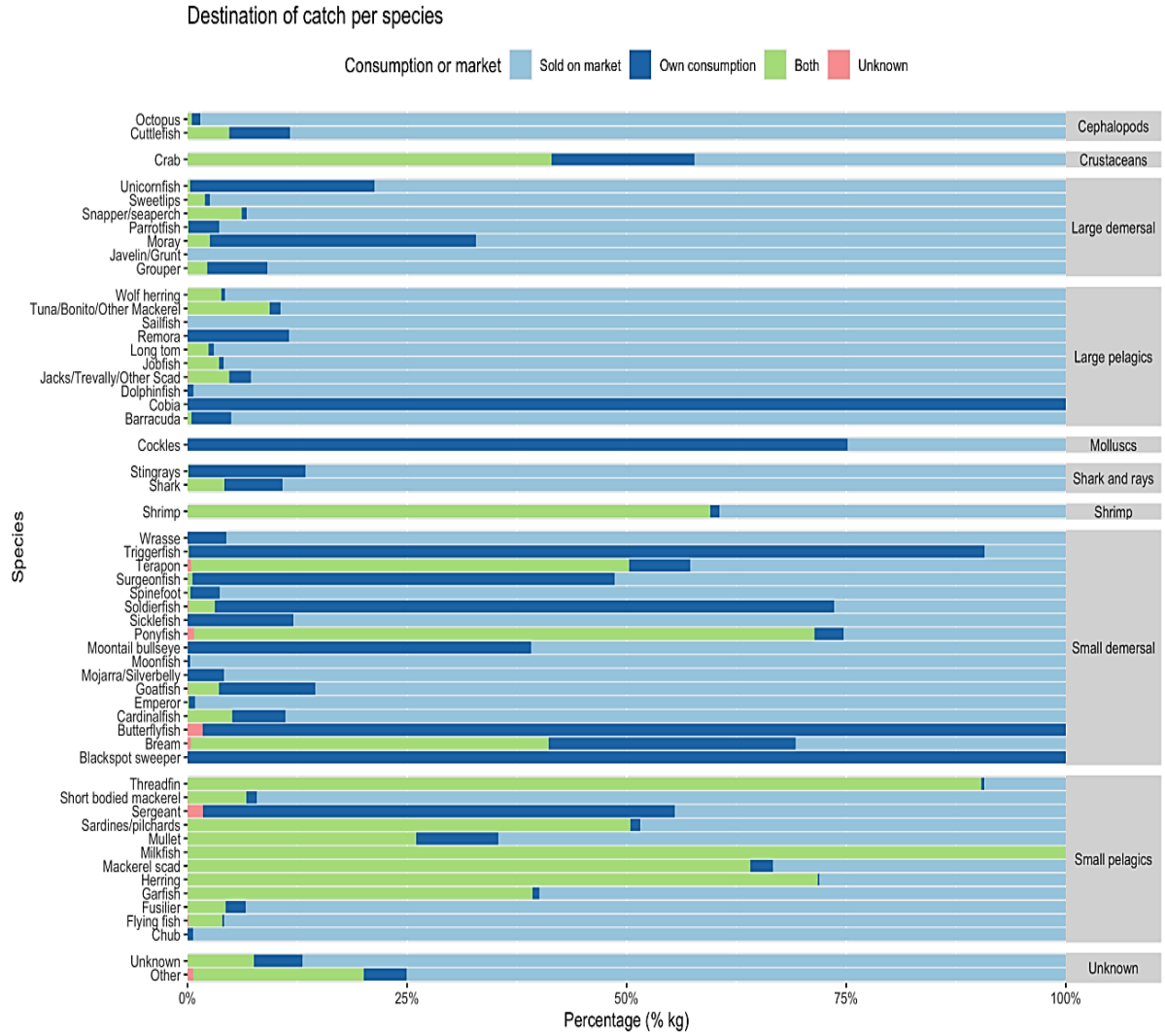
Source: Valleit, 2021

Figure 50 – Estimate monthly total catch (tons) in different locations

Many fish landings are sold at local markets, because very few fish products can be traded over long distances or exported. This constraint is related to transport barriers such as additional costs and road conditions, and product hygiene because lack of ice, refrigeration, and stable electricity mean that fish are not able to be stored for long periods of time. These circumstances disempower fishers to sell their fish across great distances, for example from Natarbora to Dili. Figure 51 illustrates the different fish products that are sold and used for domestic consumption, observed during 2016 to 2021.

The price of fish is related to market supply-and-demand. When fish products are abundant, fishers will receive a lower price than when the fish products are limited. In Timor-Leste fish products are normally sold by middlemen on the side of the road. To generate cash immediately, selling fish to a middleman is a fisher's best option – even though it is less profitable than if sold directly to the final consumer (Figure 51). Fishers in Timor-Leste tend to sell larger high-value species to cater for hotels, expatriates, and tourists in Dili, keeping smaller fish for household consumption.

Fishers on the southern coast are catching relatively large fish, but due to the poor infrastructure and distance from Dili, they are marginalised from the market, missing out on the opportunity to sell their product at a high price. The middlemen show less interest in trading with fishers on the southern coast, as they would need to compensate greatly for the costs involved in transport facilities and preservation of the fish products.



Source: Vellait, 2021

Figure 51 – Destination of the catch per species sold on the local market (light blue), held for family consumption with dark blue or used for both with green colour, red colour shows without information on the destination

The small-scale pelagic fisheries in Timor-Leste offer an important role in the livelihoods of fishers and coastal communities. The small-scale pelagic fisheries also offer cash income to fishers in Timor-Leste and Indonesia across the border. Due to the transboundary nature of pelagic fisheries and shared resources in the region, these largely uncontrolled fishing practices have likely caused a decline in fish stocks (Eco. Environment, 2019).

The uncontrolled pelagic fisheries activities on the border do not only pose a threat to the biological health of fish stocks, but also disturbances in aspects such as social-political tensions, economic and national security. To minimise or avoid these potential sources of tension, Timor-

Leste and Indonesia need to strengthen collaboration and governance, particularly in relation to transboundary resources that can be managed collaboratively.

The transboundary management of small pelagic fish on the border between Indonesia and Timor-Leste (particularly on the Ombai Strait, Wetar Island and Liran close to Atauro Island) requires cooperation and coordination. These bodies of water are migratory habitats of small pelagic fish, and tuna species (Gigentika, 2017). Cultural practices at the local level on both sides of the border need to be considered when facilitating future fishery management plans. Social and economic connectivity between the two countries was established a long time ago, with people on both of sides of the border engaged in trade and exchange, as well as kinship relations. This strong relationship should be maintained, because the two countries have a rich history, similar ecological features such as fish habitat and marine environment, and comparable social and economic circumstances.

Governments should approach the issue of transboundary fishing in solidarity, considering the perspectives of both sides. According to Song et al. (2017), transboundary fisheries between Indonesia and Timor-Leste are complex and strongly related to sociocultural dynamics. Understanding the complexities and nuances of these transboundary activities is an integral part of managing the shared resources sustainably. Ecosystems and sustainability are strongly connected as part of an adaptive system that is centred on relationships between the economy, ecosystem and community. Strong, holistic fishery management can help to secure optimum socioeconomic benefits, while also conserving the ecosystem, particularly fish stocks (Akbar, Suryanto, & Triharyuni, 2016).

Fisheries monitoring and management is essential, but it requires appropriate tools and instruments to inform decision-making. "*Timor-Leste now has one of the most sophisticated data collection systems for small-scale fisheries in the world, following the launch of a new online dashboard that tracks fishing activities – including the number and type of fish caught by individual boats in near real-time.*" The PeskAAS system will be updated and monitored by fisheries officers in fish landing centres. This tool provides real-time, automated analysis of Timor-Leste's small-scale fisheries. This tool puts important data in the hands of fisheries officers and local fishers. This tool is very powerful in the sense that it can facilitate a better understanding of the contribution of fish and fisheries to local livelihoods, income and protein intake. The contribution of fish and fisheries can be supervised by fisheries officers together with local fishers by counting the quantity of fish (kg) in each fish landing centre.

WorldFish has worked closely with MAF to install 359 solar-powered tracking devices on fishing boats in Timor-Leste. WorldFish aims to install a total of 500 devices on fishing boats, at all landing sites across the country, to record all pelagic fish landed in each fish landing centre. Timorese fishers are using small canoes and most of them use paddle canoes to operate on narrow fringing reefs. The reefs are relatively pristine and hold great potential for fish stocks. There is a significant opportunity to develop small-scale fisheries to help secure national nutrition needs and income diversification.

Press release:

Timor-Leste launches world-first monitoring system for small-scale fisheries

A 2018 Inspire Challenge project led by WorldFish and Pelagic Data Systems has launched a new online dashboard that tracks fishing activities in Timor-Leste. The dashboard puts important data in the hands of fisheries officers, researchers and local stakeholders.

Figure 47 – Installation of powered tracking device in small boat (canoes)

This press release was originally published by World Fish.

Timor-Leste now has one of the most sophisticated data collection systems for small-scale fisheries in the world, following the launch of a new online dashboard that tracks fishing activities – including the number and type of fish caught by individual boats in near real-time.

The dashboard, Automated Analytics System for Small-Scale Fisheries in Timor-Leste (PeskAAS) , puts important data in the hands of fisheries officers, researchers and local stakeholders. This will enable them to better understand the contribution of fish and fisheries to local livelihoods and food security.

The system has already highlighted previously unknown fishing areas, patterns and productivity in Timor-Leste.

***Acacio Guterres, Director General of Fisheries, at Timor-Leste's Ministry of Agriculture and Fisheries (MAF) said:** "The dashboard highlights the food and income contributed by fisheries, and opportunities to develop the sector to sustainably enhance food security. We are committed to investing in this system and working with WorldFish to build the capacity of MAF staff to use and manage it."*

In 2019, MAF hired data collectors to work across 30 key landing sites in the country's 11 coastal municipalities. Data collectors meet fishers as they come back from their fishing trips, using smartphones or tablets to record the amount and type of species landed. The information is then uploaded to the data pipeline and appears on the dashboard the same day.

5.1.3 Key fisheries management issues (e.g., overcapacity, IUU fishing, compliance, EAFM, etc.)

A key aspect of improving the management of Timor-Leste's fisheries resources involves addressing IUU fishing, particularly on the southern coast. The IUU fishing presents a significant challenge for both local and central government due to the currently limited capacity to control Timor-Leste waters. Given the weak capacity of the government to conduct monitoring and surveillance operations, southern coast waters are exploited by foreign vessels. For example, based on data from Global Fishing Watch, around 15 Indonesian fishing boats were operating illegally on the southern coast from December 2020 to January 2021 (see Figure 52). These fishing boats were classified as IUU and are just one example of illegal fishing activity happening inside Timor-Leste's EEZ.

Source: https://globalfishingwatch.org/map/?locale=en

Figure 52 – IUU fishing activities on the southern coast, observed through Global Fishing Watch

As a result of IUU fishing, it is estimated that Timor-Leste has on average lost around USD 84 million each year (see Figure 53). The government has been monitoring IUU fishing activities since 2018, and it seems that the volume of fish captured was reduced from 2018 to 2021, potentially due to COVID-19. This monitoring effort was made in close cooperation with neighbour countries like Australia, Indonesia, and others, to gain an understanding of the IUU activity along the southern coastline.

Year	Tonnes/ Day	Fishing Trip	No. of Vessel	Total Catch (Tonnes)	Equivalent to (Kg)	Fish Weight Equivalent	Average (GT)	Fish Price/Kg	Total Money Loss (US$)
2021	5	12	42	2,520	2,520,000	0.2	53	2	53,424,000.00
2020	5	12	48	2,880	2,880,000	0.2	53	2	61,056,000.00
2019	5	12	69	4,140	4,140,000	0.2	53	2	87,768,000.00
2018	5	12	107	6,420	6,420,000	0.2	53	2	136,104,000.00
TOTAL									**338,352,000.00**

*** Kalkulasaun ba rekursu ikan no osan ne'ebe lakon utiliza FORMULA indika iha kraik ne'e***

INITIAL ECONOMIC LOSS FORMULA IN TIMOR SEA
Avarage GT of Vessel x fish weight equivalent x number of fishing vessels apprehended/for IUU Fishing x 12 trips x fish price/kg
With the assumption
Avarage GT at 53
Fish weight equivalent at 0.2
Ships over 30 GT operate = 12 trips in 1 year
Fish price USD 2/kg

Source: Mahabror and Hidayat (2018) ATSEA-2 Project

Source: Directorate of Fisheries, Aquaculture and Marine Resources Management, 2022

Figure 53 – Implication of the IUU fishing and economic loss in Timor-Leste water

In Timor-Leste, some species of marine life have been identified as threatened with extinction, such as sharks and turtles. IUU fishing poses a significant threat to these species. To reduce IUU fishing ATS countries need to work together closely, harnessing proper tools and regional agreements. SDG 14.4 aims that by 2020 countries will be able to "effectively regulate harvesting and end overfishing, illegal, unreported and unregulated fishing and destructive fishing practices and implement science-based management plans, in order to restore fish stocks in the shortest time feasible, at least to levels that can produce maximum sustainable yield as determined by their biological characteristics".

Pacific Island countries that are dominated by large-scale industrial tuna fisheries tend to experience lower rates of IUU fishing, which is thought to be due to their stronger management, surveillance and enforcement capabilities. Whereas countries with higher levels of IUU fishing tend to have less control over their resources, weaker enforcement and management measures (Wilcox et al. 2021). Wilcox et al. (2021) confirmed that Timor-Leste, Cambodia, Thailand and Vietnam are subject to fishing by foreign vessels from neighbouring countries, which contributes to high levels of IUU fishing. The study also identified Indonesia as having the highest level of IUU fishing by volume (between 1.5 MT and 2.4 MT), followed by Thailand with around 0.6 MT to 2.1 MT, and then Viet Nam with approximately 0.3 MT to 1.1 MT.

Global Fishing Watch has observed Indonesian vessels regularly operating in Timor-Leste's waters. They use small vessels around 5-6m long and handlines and target coral reef fish. They tend to come from the border near Batugade, toward the west part of the island. They also use these opportunities to sell fuel and basic necessities to local communities on the border. Some Indonesian fishers also come from Wetar Islands through to Atauro Island illegally. The main purpose is to sell their fish products, along with fuel and livestock. Many local fishers from Atauro Island are also regularly fishing in the Indonesian waters near Wetar and Liran Islands. There is a need to formalise this trade activity between Indonesia and Timor-Leste, because not only is it a historically and economically significant source of exchange, but it facilitates knowledge and skill sharing between fishers. For example, Indonesian fishers can help Timorese fishers to set up Fish Aggregation Devices (FADs). As fishers in Timor-Leste have limited capacity to control and

enforce the fisheries laws and regulations, diplomatically formalised relations will enable the two neighbouring countries to work together to control marine and coastal resources.

Timor-Leste's weak monitoring and surveillance capabilities have resulted in the proliferation of many IUU fishing hotspots, particularly on the southern coast. There are significant financial barriers to securing the appropriate equipment and technology needed to monitor and survey IUU fishing. There is a need to work with Indonesia to examine the level and the impact of IUU fishing. The first step is the identification of IUU fishing hotspots, then examining the level of impact and risk caused by fishing activities in those areas. Table 42 presents a risk assessment tool which can help Timor-Leste in this process.

Table 42 – Simple risk assessment tool for identifying likely IUU hotspots

Descriptor	LOW REWARD	HIGH REWARD
Resource quality	Fishery resources are depleted.	Fishery resources in good condition/abundant.
Resource value	Target species are low value and in low abundance.	Target resource is high value.
Accessibility	High competition with other legal fishers.	Low competition with other fishers (e.g., closed or protected area; closed season) Inaccessibility of fishing grounds.
	HIGH RISK OF CAPTURE/SANCTION	**LOW RISK OF CAPTURE/SANCTION HIGH LIKELIHOOD OF IUU FISHING**
Effective policies, control of corruption	Strong governance limits opportunities and provides high risk of capture and sanction. Strong, consistent government policy to combat IUU fishing.	Weak governance reduces risk of capture or sanction. Rent seeking and corruption facilitate operations. Weak inconsistent policy regarding IUU fishing, tendency to turn a blind eye or tolerate IUU fishing to avoid political conflict or support interests of fishing lobbies.
Strong judicial process	Effective prosecutions. Heavy fines/penalties (e.g., loss of license, increased penalties for recidivism).	Ineffective judicial system. Low fines/penalties (no increased fines for recidivism; multiple offences do not result in loss of license).
Monitoring, control and surveillance	Financing of MCS and related judicial processes. Hotspots targeted with regular MCS patrols. MCS units in proximity. Effective VMS.	Limited budgets constrain MCS programmes and subsequent prosecutions. Limited MCS units. MCS units distant. Ineffective VMS or no VMS.

Borders and boundaries	Clear EEZ boundary demarcation. Fishing area close to land/shore. Distant from neighbouring EEZ.	Unclear EEZ boundaries. Disputed areas. Fishing area close to EEZ boundary. Close to high sea area.

Source: Wilcox et al., 2021

A summary of hotspots identified by Wilcox et al. (2021) in 2015 for Timor-Leste is illustrated in Table 43, outlining the type of IUU fishing activity in Timor-Leste's EEZ, including species being caught.

Table 43 – Summary of IUU fishing hotspots as per 2015

HOTSPOT: TIMOR-LESTE EEZ
Type of IUU fishing activity: Trawlers and gillnetters fishing illegally in the Timor-Leste EEZ. Transshipment without authorization or illegal shipment (may not be illegal). In 2012-2020 an illegal-fishing vessel (one vessel) entered the waters of Timor-Leste and cleaned out an entire population of trochus including fish from a no-take zone located within the Nino Konis Santana National Park. The total value of the catch was USD 20,000. Flags from Indonesia and other countries. Approximate illegal catch, estimated value annual tonnage caught is estimated at less than 10,000 tons. Reportedly approximately 1,000 tons are lost to IUU fishing. Catches mainly on the outer fringes of the southern boundaries with Australia and the western boundaries with Indonesia.
Vessel nos., size & gear: small vessels – 5 GRT to 10 GRT up to >40 GRT, >100 m length. Trawling, longlining, purse seining, gillnetting.

Source: Wilcox et al., 2021

In the region, VMS monitoring is almost exclusively applied to large vessels, contributing to a weak vessel tracking system (Wilcox et al., 2021). An effective legal framework is essential for VMS to be an effective tool, and close cooperation with littoral countries is essential to strengthen Timor-Leste's use of VMS to track vessels and IUU fishing activities.

5.1.4 Coastal aquaculture

In many countries, including Timor-Leste, coastal areas are not only used for artisanal and commercial fisheries, but also aquaculture, agriculture, human settlements, tourism, ports and recreation. The complex multi-use of these areas has given rise to conflicts regarding resource use. A few years ago, conflicts in Ulmera (Liquica) related to resource use occurred. Land used for milkfish and seaweed farming was converted to salt distillation, which negatively impacted the existing aquaculture operations and their production.

The coastal aquaculture systems in Timor-Leste focus on milkfish, seaweeds, grouper in impounding net system, crabs (*mud crab*), shrimps, and trepang (*Holothuria scabra*). Aquaculture production, both freshwater and brackish water, is relatively low mainly. It is hoped that aquaculture production will be able to fill the food and nutritional security gaps left by current wild capture fisheries production. The aquaculture sector in Timor-Leste is experiencing successful development, particularly the freshwater aquaculture operations. Many NGOs and development partners are working very closely with MAF's Fisheries Department to improve

aquaculture activities across the country. However, further attention must be paid toward the potentially negative impacts of coastal aquaculture, and measures must be taken to ensure that operations do not contribute to environmental or socio-economic unsustainability. For example, the shrimp aquaculture facility in Hera caused habitat loss and modification, undermining the ecosystem services provided to coastal communities who heavily depend on them.

Coastal aquaculture is less popular on the southern coast than on the northern coast, with just a few tilapia ponds already established in Barique (Natarbora). These ponds are in an early stage of development after the central government provided some tilapia fingerlings. Although currently underdeveloped, with investment there is potential for aquaculture on the southern coast to expand - particularly milk fish in Suai Loro, sea cucumber and seaweed in Betano, Lore and Valu beach. The primary investment would involve fostering the necessary skills and knowledge within coastal communities in the south. On both the southern and northern coastlines, a significant barrier to the development of aquaculture in Timor-Leste is the expensive price of fish feed. Because it is unable to be produced locally, the central government currently imports pellets from Indonesia. Generally, local fish farmers are unable to afford these high prices, and so the government must provide subsidies to assist them. The Government of Timor-Leste has affirmed its commitment to improving access to fish feed in the SDP 2011 -2030, as part of its wider strategy to boost aquaculture development and improve food security. Few NGOs and private actors are working in the aquaculture sector, but their involvement is encouraged so that they might be able to help with financial and technical capacity.

One of the key social-economic impacts on coastal aquaculture involves the loss of mangrove resources and ecosystem services. The true value of mangrove habitats has been underestimated because of limited data, lack of research, and difficulties in assigning monetary values to functions like coastal protection. Mangrove habitats provide social benefits in terms of coastal protection, shoreline stabilisation, and carbon sequestration.

In the near future, the development of the aquaculture sector will help Timor-Leste to realise goals regarding improved protein intake, food security, and income diversification. It is important that the sector is developed while minimising negative impacts on the marine and coastal environment. A holistic, Integrated Coastal Management (ICM) approach should be used to encourage all stakeholders to actively participate in all stages of the sector's development - from the formulation and implementation processes, to monitoring and evaluation. Important steps involve determining the location of aquaculture ponds and carrying out an environmental impact assessment. Stakeholder participation is vital if questions of social equity are to be adequately addressed, particularly from fishers and other local community members who will be responsible for the management of aquaculture and coastal resources.

5.1.5 Key coastal aquaculture management issues

Coastal areas contain high productivity potential for future aquaculture operations, and with investment it is relatively easy for coastal communities to access the sector. The coastal area plays an important role in the recycling of nutrients, and filtration of pollutants. It also influences flash flooding, coastal erosion, and protection from storm surges and tsunamis. Therefore, coastal areas need to be managed carefully and sustainably to preserve these ecosystem functions.

The holistic management of ecosystem functions can be achieved through Integrated Coastal Management (ICM). Polyculture is thought to be a promising way of integrating aquatic and land-based resources. For example, combining the farming of milkfish and *Holothuria scabra* will improve land use effectiveness. Mangrove-friendly aquaculture technologies are most appropriate for small-scale aquaculture operations, such as at the household level, and are also suitable in some mangrove conservation and restoration sites. For example, mud crab (*Scylla serrata*) farming within mangrove areas can be sustainably carried out without delivering environmental damage.

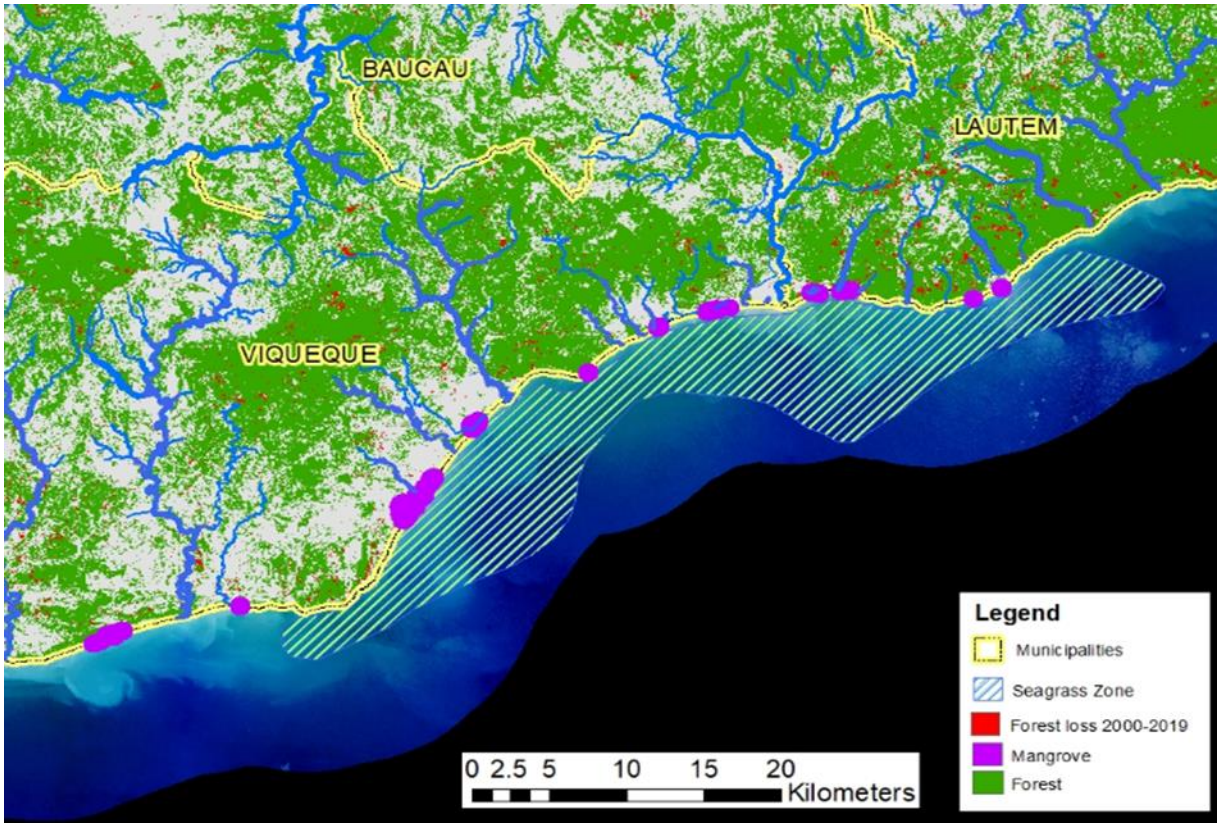
The use of ICM in coastal aquaculture will help to preserve environmental functions and deliver food security and poverty alleviation to coastal communities. It is hoped that on the southern coast, small-scale aquaculture operation will be piloted along with ideas about polyculture and Integrated Coastal Management.

5.2 Condition and Status of Coastal and Marine Habitats

5.2.1 Mangroves

The total area of mangrove cover in Timor-Leste has decreased from 9,000ha in 1940 to 1,802ha in 2008 (PEMSEA, 2019). The report has further affirmed that around 80% of mangroves have been lost since 2008, with an estimated 290 ha remaining in 2015. The significant degradation of mangrove habitats was mainly due to illegal harvest for house construction, cooking and for cash. Additionally, some mangrove habitats have been modified for the purpose of salt processing and distillation.

Mangrove species distribution on the northern and southern coast is connected to the biophysical condition of the coastal areas. Species of *Rhizophora conjugate* and *Bruguira parvifolia* have been identified as the main species on the northern coast and are also found on the southern coast – particularly within the Nino Konis Santana National Park, Beaço (Viqueque) see Figure 54, Barique (Manatuto), Betano (Manufahi) and Suai in Covalima.



Source: UNEP WCMC, 2020

Figure 54 – Source of mangrove on southern coast

Aside from *Rhizophora* sp. and *Bruguira* sp. which grow well on both the northern and southern coastline, other species can be found alongside them. For example, *Avicenia marina* is commonly found in stagnant water with high salinity. *Aegiceras corniculatum*, *Acanthus ilicifolius, Lumnitzera racemosa*, and *Heritiera litoralis* also occur in Timor-Leste (PEMSEA, 2019). Among mangrove species seagrass can usually also be found. These ecosystems are known as feeding grounds for marine mammals such as crocodiles, sea turtles and marine invertebrates. These areas have high levels of productivity, which can support a rich diversity of marine organisms.

The Directorate of Fisheries, Aquaculture and Marine Resources Management has affirmed that by 2030, Timor-Leste will have an extensive network of land and marine national parks, with the aim to protect marine and coastal biodiversity. The participation of women in the management of resources, and their equal rights and access to marine and coastal resources is being promoted as part of this effort. Because the patriarchal system and related social norms are strong in Timor-Leste, men tend to have greater control over access to resources. The principal objective of engaging women in marine and coastal resources management is to ensure that conservation towards fisheries resources become more inclusive, effective, and sustainable.

Coastal resources such as mangrove forest play an important role in the seascape and coastal habitat mosaic. Boggs et al. (2009) identified 19 mangrove species in Timor-Leste, with clear patterns of zonation in almost all coastal areas. The study demonstrated that most mangrove communities occupying large areas are *Rhizophora* dominated, followed by *Sonneratia alba* and *Ceriops*. It was found that *Avicennia* is the least abundant species. These mangrove trees provide

a valuable ecological role such as providing habitat for fish and non-fish species, while also supporting coastal livelihoods (USAID, 2014).

Currently, there are two main drivers of mangrove forest degradation in Timor-Leste. Firstly, land soil erosion brings sediments and other gravels during flash flooding into mangrove areas, concentrating sandy materials in the landward side of mangroves. This situation prevents mangrove seedlings from maturing and transforms mangroves to sandy ecosystems. Another serious threat to mangrove trees is related to inundation/sea level rise, as observed alongside coastal areas in Metinaro (northern coast) and in Suai on the southern coast. There is strong indication that higher sea level was the principal cause of mortality of many *Sonneratia* sp. which typically has high survival rates in low-inundated water areas and low fertility of soil (Ilman, 2017). Conversely, Rhizophora sp. is better adapted to higher levels of inundation. Mangroves on the northern and southern coasts require strong, immediate protection. This should not only include fencing to protect them from animals, but the application of strict regulations and traditional wisdom. Table 44 shows species abundance, location and management recommendations.

Table 44 – Species of mangroves in Timor-Leste and their management measures

Species	Location	National Status	Management Recommendation
Acanthus ilicifolius	All locations	Abundant	Regular monitoring
Acrostichum speciosum	Hera and Metinaro	Very rare, threatened	Strict protection of the mother trees, nursery and replanting to maintain the population
Aegiceras floridium	Hera	Very rare	Strict protection of the habitat in
Avicennia marina	All locations in North Coast	Abundant, vulnerable	Regular monitoring
Bruguiera parviflora	North Coast	Rare	Regular monitoring
Bruguiera sexangula	Hera and Metinaro	Very rare, Endanger (IUCN Red List)	Strict protection of its habitat in Metinaro
Ceriops tagal	All locations	Abundant	Regular monitoring
Dolichandrone spathacea	Hera	Very rare	Strict protection of its habitat in Hera
Exoecaria agallocha	All locations	Abundant	Regular monitoring
Lumnitzera racemosa	North coast	Rare	Regular monitoring, strict prohibition for cutting
Rhizophora apiculata	All locations	Abundant	Regular monitoring
Rhizophora mucronata	North coast	Rare	Strict protection, nursery, replanting
Sonneratia alba	All locations	Abundant	Regular monitoring

Pemphis acidula	North coast	Very rare	Regular monitoring
Xylocarpus	South coast	Rare	Regular monitoring
Nypa	South coast	Rare	Regular monitoring

Source: Ilman, 2017

A study conducted by PSIFSC-NOAA (2017) has described and classified eight habitat types found on Timor-Leste's coastline. The habitat types identified are:

1. Hard substrate
2. Soft substrate
3. Seagrass
4. Mangrove
5. Macro-algae
6. Intertidal
7. Emergent rocks
8. Lagoon

Table 45 explains detailed information relating to these habitat types.

Table 45 – Habitat types in shallow water in Timor-Leste

Region	Derived Bathymetry (km²)	Benthic Habitat (km²)	Hard Substrate (km²)	Soft Substrate (km²)	Seagrass (km²)	Mangrove (km²)	Macroalgae (km²)	Intertidal (km²)	Emergent Rocks (km²)	Lagoon (km²)	Unknown (km²)
Atauro Island	15.1	13.1	7.1	3.6	2.4	0.1	–	–	–	–	7.7
Oecusse	19.3	12.6	3.8	6.8	2.0	0.1	–	–	–	–	16.8
North Shore	85.6	76.9	35.1	16.3	10.5	2.7	6.2	3.3	0.5	2.3	249.1
South Shore	–	32.7	14.3	15.3	3.0	0.1	–	–	–	–	120.0
Total	**120.0**	**135.3**	**60.3**	**41.9**	**17.9**	**2.9**	**6.2**	**3.3**	**0.5**	**2.3**	**393.6**

km² = square kilometres

Note: 'Derived Bathymetry' and 'Benthic Habitat' are the areas mapped by region (km²). The columns in green colour show the benthic habitat characterised for each region (km²) that are included in the 'Benthic Habitat' area.

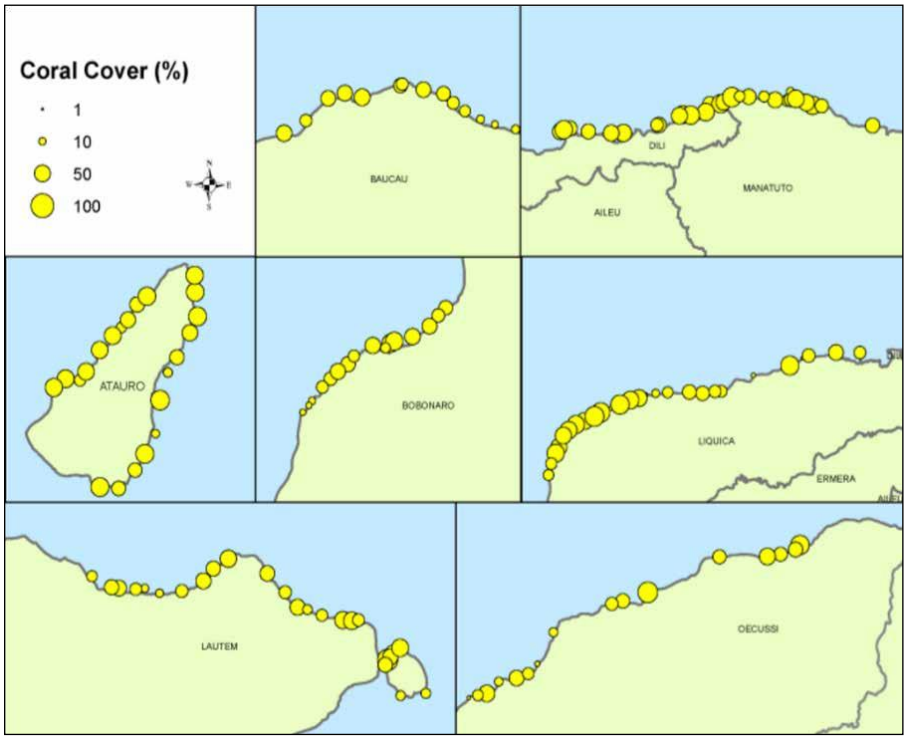
Source: PSIFSC-NOAA, 2017

5.2.2 Coral reefs

Coral reefs, both hard and soft corals, are relatively "pristine" as observed during the primary data collection stage of this report. These corals are essential for marine life. The nearshore zone is characterised by a narrow reef flat, often up to 1 km wide (PSIFSC-NOAA, 2017). This area is normally dominated by seagrass in shallower water. Corals, seagrass and mangrove habitats are limited on the northern coast, in comparison to the southern coast, and this influences the available marine and coastal resources which ultimately affects harvest levels. In contrast, the southern coast has abundant resources and low exploitation rates.

PSIFSC-NOAA (2017) confirmed that identified benthic communities are affected by a diverse range of biological and physical factors, including anthropogenic influences. The hard coral

cover ranged from 0% to 42.3% across sites, with an average of 15.6%. The study also found that Lautem and Atauro Island possess the highest mean coral cover at 20.3%. Conversely, Baucau and Liquiça had the lowest mean cover at 10.4% (see Figure 55). There is no coral cover monitoring program currently being exercised, but it is believed that Timor-Leste's corals are relatively "pristine" as observed during the primary data collection.



Source: http://www.pifsc.noaa.gov/pubs/credpub.php.

Figure 55 – Mean coral cover at all sites surveyed by PSIFSC-NOAA, 2017

5.2.3 Seagrasses

Seagrass is found in areas along Timor-Leste's coastline where the substrate is sandy, from muddy bottoms to rocky shores. There are seven known species of seagrass in Timor-Leste: *Halophila ovalis, Enhalus acoroides, Halodule univervis, Syringodium isoetifolium, Thalassodendron cillatum*, *Thalassia hermprichi,* and *Halohila ovalis* (McKenzie & Arifin, 2019). However, seagrass on the southern coast remains relatively unknown and undocumented. Tomascik et al. (1997) also observed at least seven species (mixed seagrasses) growing in Timor-Leste and noted that they are often associated with fringing reefs. They tend to grow in shallow-water areas on the reef flats. This is very similar to those reefs that are found in Indonesia (Lombok) and Northern Australia (Roelofsr et al., 2005). The relatively low level of diversity amongst seagrasses may be influenced by seawater temperature, which is relatively homogenous.

Seagrass plays an important role in coastal areas as they have the ability to help stabilise coastlines, serving as a shelter to an array of ecologically and economically important species. Seagrass is also an important habitat for a diverse assemblage of fish and non-fish species e.g., dugong and Cheloniamydas. In addition, seagrasses also support faunal diversity in coastal areas (Tomascik et al., 1997). Undocumented seagrass species are predominately growing on the

southern coast of the island, particularly on the narrow reef flats and shallow waters that occupy around 2,200 ha. In total, seagrass occupies an area of 17.9 km^2 in Timor-Leste (PIFSC, 2017). Extensive seagrass cover can be observed in Atauro, particularly in Vila village within proximity to the aquatic natural reserve.

Seagrass ecosystems provide suitable feeding grounds for marine mammals and sea turtles, because of the very potential for high organic productivity. To support robust seagrass growth, optimal levels of nutrients, CO_2, temperature and pH, and sufficient light from the sun is required (Waycott et al., 2011). That said, different species of seagrass vary in their life cycles and growth strategies, reflecting specific and diverse requirements.

As noted by previous studies (Waycott et al., 2011), sea cucumber and sea urchins are dominant in seagrass habitats. Sea cucumber plays an important ecological role in benthic seagrass communities. Sea cucumber and sea urchins are mainly found alongside northern coast including Nino Konis Santana National Park.

As noted by PSIFSC-NOAA (2017), there are no significant issues related to seagrasses. All seagrasses are in good condition. However, future monitoring plans need to be considered, particularly in relation to anthropogenic pressures such as climate change vulnerability and impacts.

5.2.4 Key coastal habitat management issues

Many mangrove tree stands are under threat along Timor-Leste's coastline (north and south). Coastal communities are cutting mangroves trees for heating, cooking, house construction and cash income. On the northern coast mangrove areas are converted for salt distillation in Ulmera (Liquiça), while in Metinaro they converted it into milkfish and shrimp ponds. Other habitat management issues relate to the collection of coral for cultural purposes, which regularly happens in Suai, Lospalos and Baucau. The management of these issues will require careful consideration as they are tied to the sociocultural practices and wellbeing of Timor-Leste's coastal communities. In relation to seagrass beds, there is a perceived threat from the digging and trampling that occurs during gleaning activities. The management issues relating to key coastal habitats and coastal communities can be categorised into six different categories:

1. Biophysical issues that are more related to declining fishery resources through IUU fishing typically on the southern coast,
2. Marine and land-based pollution and their impacts – as indicated by previous investigations (north and south coast), including coastal erosion, inundation and flash flooding
3. Socio-economic issues are those that relate to lack of alternative livelihoods, post-harvest losses
4. Existing laws, policies and regulations that are not compatible with socioeconomic circumstance
5. Weak capacity of the government agencies to work in partnership with development partners, NGOs/CBOs and lack of harmonisation between programs and plans both at national and municipality levels,
6. Coastal habitat conservation issues are not part of village development plans.

Some success in coastal management so far includes:

1. Community mobilisation for beach clean-ups

2. Some coastal conservation which covers mangrove reforestation in Hera and Metinaro – Dili
3. Education and public awareness done by government in joint cooperation with local communities, CBOs and local leaders
4. Program on waste recycling, re-use and reduction along northern coastal areas
5. MPAs and LMMAs measures include prohibitions on catching of threatened species and seasonal closures
6. Promotion of economic measures which covers livelihoods promotion (income diversification and job opportunity) via eco-tourism activities
7. Supporting economic measures, law enforcement, capacity building, policy and management planning

The promotion of coastal management is not just to conserve natural resources, but also to support economic measures such as income diversification, which has been underlined by almost all government agencies and development partners. Fisheries and eco-tourism sectors have highlighted one of their main objectives as being the creation of income and jobs. The National Oceans Policy will help to guide policy toward the sustainable use of marine and coastal resources for both current and future generations.

To help maintain coastal resources sustainably, technical capacity building for district level fishery officers and coastal communities is strongly recommended. Training and capacity building efforts should cover livelihoods, habitat restoration, IUU fishing, and pollution control. The ICM framework and ecosystem-based approach to fisheries management should be part of the capacity building program. It is important that all these different components related to coastal habitat management be harmonised, in order to attain maximum benefits for all people engaged, including development partners and external donors. Policy direction for effective communication and coordination is needed. Academic institutions such as UNTL must be fully involved to help generate the necessary data needed to support decision making, effective policy making, and implementation of the policies on the ground.

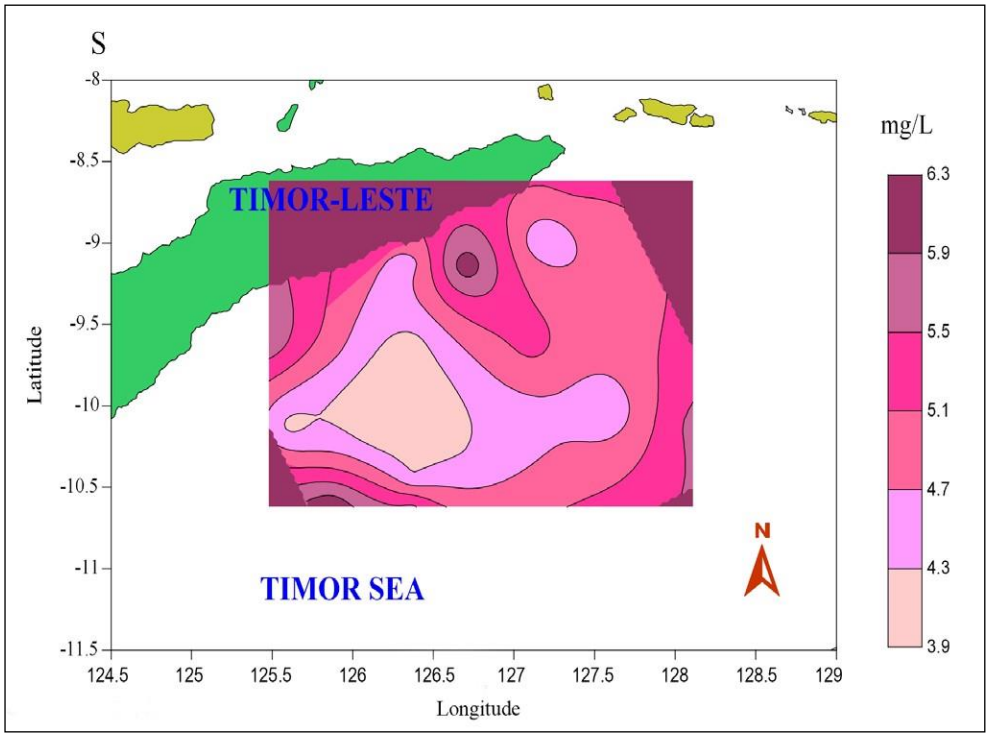
5.3 Water Quality, Marine and Land-based Pollution

5.3.1 Water quality

Salinity:

The water salinity along the southern coast ranges from 30 to 34 ppt near shore, while offshore measurements demonstrate lower levels (27 to 30 ppt). In comparison, salinity on the northern coast is much higher (>36 ppt) than on the southern coast, likely correlated with the longer dry season on the northern coast (5-6 months). In general, the northern coast is shallower and much hotter than the southern coast, further contributing to the different distributions of salinity. In general, distribution of salinity in offshore waters fluctuates more as depths reach >50 m. Salinity of the southern water mass is much lower than of the northern water mass (ATSEA, 2011 and PEMSEA, 2019).

Dissolved oxygen (DO) is a dynamic aspect of water quality, as it depends on water temperature and salinity. The DO in the water column varies with location. For example, DO near to the coast is much higher, particularly at the surface. In contrast, DO will decrease with increasing depth (ATSEA, 2011). Figure 56 shows the distribution of DO at the surface layer. In the future water quality monitoring systems need to be implemented.



Source: ATSEA, 2011

Figure 56 – Distribution of dissolved oxygen at the surface layer

Chlorophyll:

Chlorophyll and primary production were not measured in the primary data collection stage due to limited equipment, so secondary data collected by ATSEA-1 in 2011 has been utilised. It was revealed that upwelling of cold water supports nutrient rich waters in the reefs of the Sahul Banks, along the entire edge of the southern Timorese shelf. The nutrient rich waters have enhanced primary production due to upwelling intrusions.

The report (ATSEA-1, 2011) acknowledged that the seabed along the southern coast is particularly dominated by huge deposits of mud that are generated from flash flooding through river catchments. These sediment composts filled with many organic materials are potentially helping plankton to grow-up. This can help to explain why the southern coast is a key migratory pathway for large pelagic fish and non-fish species, including tuna, dolphins and whales.

There is no recent data collected regarding chlorophyll. It requires gradual data monitoring, particularly in relation to chlorophyll as a factor of primary production, and an indicator of water productivity.

Harmful Algae Blooms (HABs):

HABs were part of the primary data collection along the southern coast. As visually observed, there were no HABs found. There were no physical indicators such as colour (white, brown, or red) and smells. Algae blooms are caused by cyanobacteria (blue-green algae) that reproduce quickly and bloom. Normally HABs form in warm, slow-moving waters that are full of nutrients (Berdalet, Vila, & Abos-Herrandiz, 2015). These nutrients support the growth of algae and cyanobacteria. And it makes the watercolour change to green, blue, brown and red etc. The HABs are biological events that can have potentially negative impacts to marine and coastal ecosystems, drinking water, human health and coastal economies (Paerl, 2018). The impact to human health is related to neurotoxins which can affect the nervous, digestive, respiratory, hepatic, dermatological, and cardiac systems. In addition, algae toxins in fish can produce ciguatera fish poisoning (Berdalet, Vila, & Abos-Herrandiz, 2015).

Timor-Leste is cautiously aware of the HABs as experienced by other countries, because HABs can pose a serious problem for tourism, the natural beauty of coastal areas, and can potentially contaminate drinking water supply systems. Mariculture has also been affected in some countries, and while the socio-economic impact is difficult to quantify, they are considerable as reported by Berdalet, Vila, & Abos-Herrandiz (2015).

As visually observed, marine and coastal conditions in Timor-Leste do not favour the development of harmful algae blooms. With plans to develop the Blue Economy and coastal areas in general, Timor-Leste will need to ensure that appropriate planning and mitigation efforts are made to avoid HABs. Below is a list of some conditions which promote the occurrence of HABs in marine and fresh water (Paerl, 2018).

1. Higher pressure – the optimal growth of diatoms occurs at relatively low temperature, whilst flagellates and cyanobacteria require high temperature
2. A high ratio of dissolved nitrogen (N) versus phosphorus P. This is more related to small cells e.g., picocyanobacteria have a lower requirement for P due to smaller structural components
3. Increasing proportion of N in the form of ammonium and urea ($CO(NH_2)_2$). This can potentially support harmful flagellates and cyanobacteria grow better on ammonium ($NH4^+$), where diatoms prefer nitrate (NO_3^-).
4. Reduction of the Si:N ratio. Diatoms require Si for growth; Si limitation favours non-Si species such as flagellates and cyanobacteria,
5. Effects of climate change that will increase sea temperature and will result in sea water stratification including Peak River discharge which corresponds to an increase in nitrogen supply on coastal waters.

Management measures for reducing the risk of HABs

Key factors that potentially contribute to the occurrence of HABs are expected to become more relevant in the near future. The potential issue is global warming and eutrophication, particularly the nitrogen component of the eutrophication process. Collaborative effort to combat HABs is essential. The main idea is to mitigate climate change and to reduce nitrogen emissions from

agriculture. Every country must implement conventions and protocols obligations including the SDGs of the 2030 Agenda for Sustainable Development.

According to Berdale et al. (2016), local reduction of HABs can be made through the following measures:

1. Enhance public understanding of fundamental aspects of HABs species in terms of toxin production and its impacts to human health and marine biodiversity and aquaculture farm
2. Management measures for aquaculture farm to reduce HAB development e.g., timing for harvest, by enhanced flushing and relocation to offshore areas where excess N concentrations are low or less likely to build up,
3. Development of tangible action plan with appropriate technology for monitoring HABs and biotoxins and monitoring of the marine environment conditions that is favourable for the development of HABs.

5.3.2 Sedimentation

The ATS region is characterised by strong land-sea connectivity, with high standing islands in Timor and Papua New Guinea and large catchment areas in northern Australia, resulting in high river discharge of freshwater and sediments to coastal waters. Such discharges can have significant impacts on coastal and offshore ecosystems. These topographies transport a disproportionately large amount of sediment to the ocean because of their generally small drainage basin areas, high topographic relief, relatively young and erodible strata (often impacted by human activities such as deforestation and agriculture), and seasonally heavy rainfall (Milliman & Farnsworth, 2011). Rivers on the islands of Sumatra, Java, Borneo, Sulawesi, Timor and New Guinea are estimated to discharge about 4.2x109 tons/year of sediment. The strong coupling of land-sea processes underscores the critical need to address integrated catchment management in the ATS region (Alongi et al., 2011).

The main cause of sedimentation is erosion that is imposed by shifting agriculture, mangrove conversion to brackish water, and salt distillation. River catchments are larger on the southern coast than the northern coast, likely because flash flooding is greater in the southern coast, imposed by the longer rainy season. Most of the transported sediment to deltas eventually end up in the nearshore environment, which is what occurs along the southern coast of Timor-Leste (Wasson et al. , 1996). The sedimentation mass is then transported further to offshore areas, where it can degrade water quality, particularly on seagrass beds and corals and ultimately affecting the population of marine species.

Sediment can also submerge mangroves, coral reefs, and coastal freshwater swamps on the southern coast in Timor-Leste. This can occur where there is little or no excess nutrient input, and no industrial pollution (Alongi et al, 2012). Sedimentation is expected to increase as population growth is experienced as the demand for more space and resources might disrupt the environment in ways that could increase sediment load or reduce the resilience of habitats to shocks such as flash flooding. Sediment pollution has a twofold effect on the topsoil where it is lost through erosion, ultimately depleting the fertility of the land. Water quality also suffers as sediment lowers the quality of water (Dong-Guo, 2017).

5.3.3 Marine debris (including ocean plastics, fishing debris)

Marine debris can be defined as the introduction of waste disposed of or abandoned in the water body (NOAA, 2021). This type of waste or marine debris is connected to human activities both on the land and at sea and can decrease the quality of water and coastal areas (Dong-Guo, 2017).

As estimated, single-use plastics account for 40% of the plastic produced every year. Many of these plastic products are generated from land-based activities. For example, plastic bags and food wrappers. Use of plastic bags has a duration of mere minutes to hours, yet they will persist in the marine and coastal environment for many years. Some of the plastics will be degraded into small fractions, forming micro-plastics and nano-plastics. These small fractions of plastics have the potential to attach to micro-algae, and later be ingested by marine animals, potentially interfering with the reproduction cycle of fish and other mammals. Marine debris can be detected by satellites, and the countries of origin can be examined through ocean current patterns (Dong-Guo, 2017).

The population of Timor-Leste is 1.3 million (National Estimated Census, 2020), distributed across southern and northern coasts. Most of the communities (>800,000 people) are living on the northern coast and the rest (~500,000) are living on the southern coast. Among them approx. 600,000 are living in coastal and lowland areas within 500m of distance from the beach. These people living within such proximity have been affected by marine debris through inundation and currents. Two studies (DaCruz, 2015; Lopes and Jonctan, 2017) have synopsised that winds and inundation, or currents, have carried derelict fishing and marine debris both from marine and land-based activities that significantly impacted on marine biodiversity and human health.

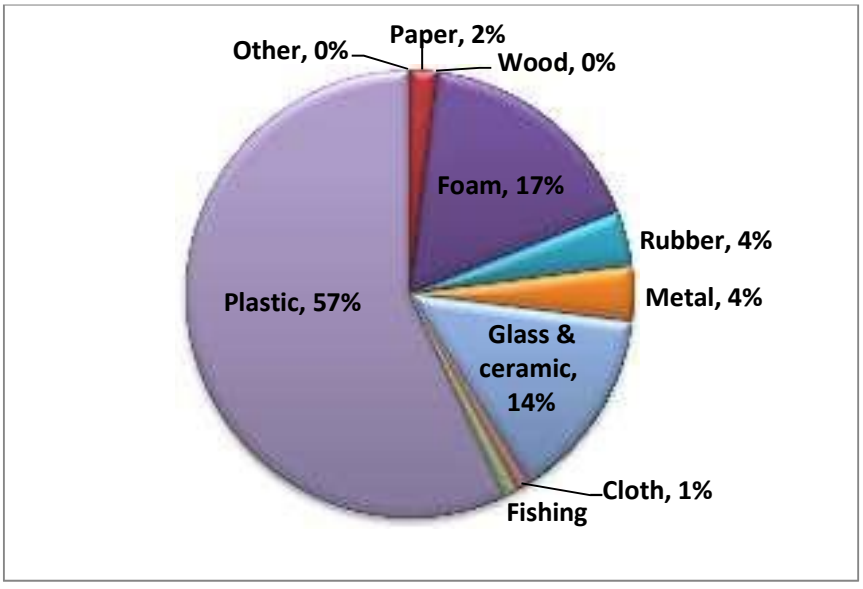
Unmanaged waste pollution, including marine debris, is transported to the sea through the rivers. The type of marine debris found might include fish nets, floats and rope. Ghost nets threaten marine mammals, sea turtles and big fish. It is believed that most of the debris from derelict fishing nets originates from illegal fishing boats which operate in Timor-Leste water. Marine debris or waste pollution is managed by the Dili city authority. Waste (solid) is collected daily by commercial operators and then transported to the Tibar (Western part off Dili) landfill for disposal. As observed, land-based pollution mostly comes from the domestic waste generated by coastal communities. The local government has initiated some waste recycling and reuse activities, but they are in a very early stage. They require more effort and close cooperation with relevant institutions, NGOs and universities to deal with waste pollution.

Most of the marine debris/pollution includes inorganics waste such as bottles, bags, cans, shoes/sandals, pieces of clothing, and fishnet (see Figure 57). This debris is swept to the water body (sea water), especially after heavy rains and flash flooding in December to May.

Source: Lopes, 2017

Figure 57 – Beach debris on the northern coast identified between 2015 and 2017

Based on a report from DaCosta (2015), 99% of beach debris collected on the northern coast came from a land-based source, including 57% plastic and 1% of fishing gear materials (see Figure 58). Two years later, Lopes and Jonctan (2017) conducted research to examine and identify marine debris and found 25% came from sea-based nets and floats, with the other 75% land-based plastics.



Source: DaCosta, 2015

Figure 58 – Debris collected and its composition on the northern coast, 2015

Sea-based debris sources for marine pollution were identified on the southern coast during 2020 to 2021 (DaFonseca & Spiller, 2021). The data collection was made through household interviews, Focus Group Discussions, and direct observation. The study found fourteen hotspots' areas of marine and river pollution or debris accumulation that include four Municipalities of Viqueque (Beaço), Manatuto (Barique), Manufahi (Betano), and Covalima (Suai-Loro). Total debris found is presented in Table 46 below. The sea-based sources of marine pollution found along the southern coast consisted of floating debris and derelict fishing nets that were illegally dumped into the ocean or accidentally lost from vessels. This source of debris significantly impacts marine life, either from entanglement in ghost nets or ingestion (Gregory, 2009; DaFonseca & Spiller, 2021). There is a need for the local government to organise a systematic waste collection and disposal system in Timor-Leste.

Coastal communities on the southern coast e.g., Viqueque, Manatuto, Manufahi and Covalima are becoming aware of the threats posed by marine debris washed ashore by inundation, storm and currents. Most abandoned fish nets, floats and gill nets, ropes and plastics interfere with fishing activities.

Table 46 – Total solid waste items collected between 2020 and 2021

Municipality	Sub-District	Village Hamlet	Total Debris (number of items) Aug-Oct 2020	Total Debris (number of items) July 2021	Ocean Debris
Viqueque	Viqueque	Beaço	1425	600	31
Manatuto	Barique	Aubeon	164	1000	52
Manufahi	Same	Betano	232	2500	41
Covalima	Covalima	Suai Loro	417	1500	44
Total			**2238**	**5600**	**168**

Source: DaFonseca and Spiller, 2021

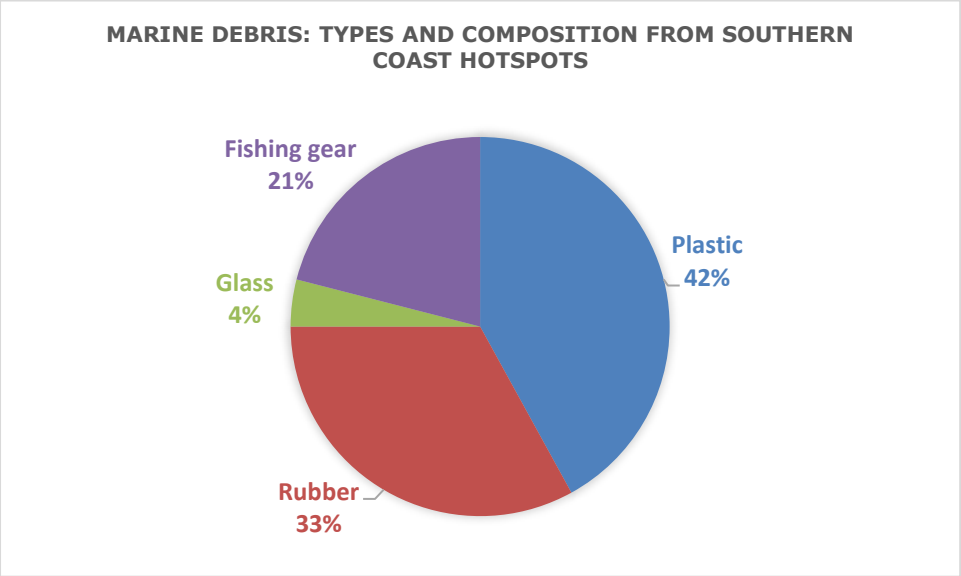
Total weight of items collected and total coastal line on each coast is presented in Table 47. The average items collected were lower than on the northern coast (collected in 2015). This is believed to be because the southern coast is less populated; hence, they consume and produce less debris or waste items. The southern coast communities are more vulnerable to the impacts of climate change and related risks, but there is less fishing effort than on the northern coast.

Table 47 – Total weight of debris found at different hotspots on the southern coast

Municipality	Sub-District	Village Hamlet	Total Debris Wt kg Aug-Oct 2020	Total Debris Wt kg July 2021	km of coastline (per village)
Viqueque	Viqueque	Beaço	12.78	51.1	3.459 km
Manatuto	Barique	Aubeon	20.62	4.16	8.359 km
Manufahi	Same	Betano	7	9.74	13.559 km
Covalima	Covalima	Suai Loro	14.3	9.46	7.122 km
Total			**54.7**	**74.5**	**32.499 km**

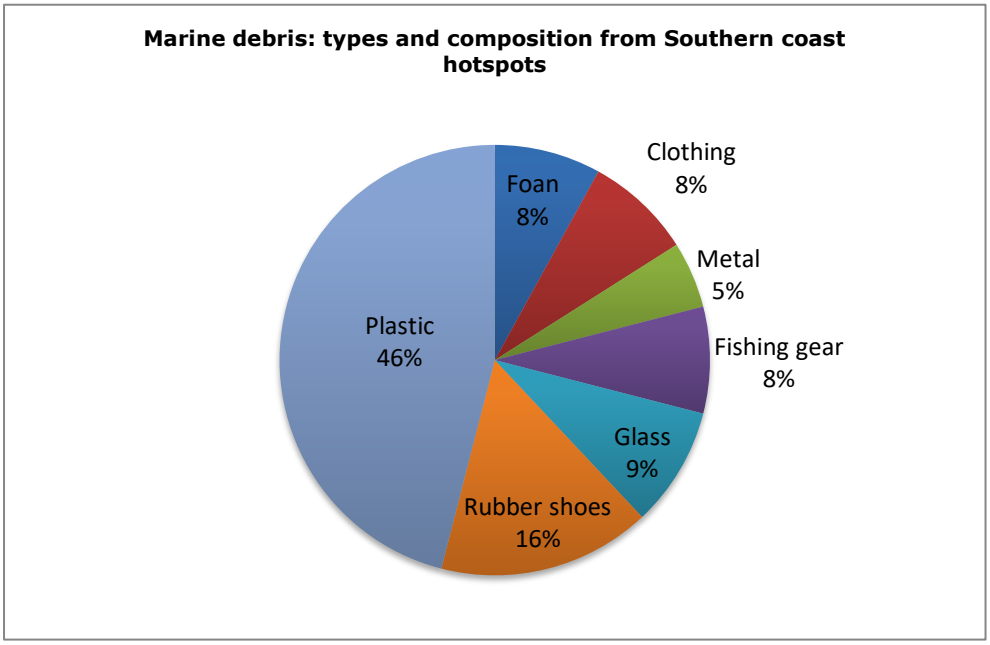
Source: DaFonseca and Spiller, 2021 and MAF, 2018 (km of coastline per village)

Marine debris identified and collected mostly is dominated by plastics and rubber, especially from river discharge, whereas pieces of fishing nets are debris that originated from the sea. The plastics items contributed 42%, followed by rubber (33%) and fishing gear (21%) (see Figure 59). Figure 60**Error! Reference source not found.** shows the proportion of items, and more diverse sources of debris, collected in 2020.



Source: DaFonseca and Spiller, 2021

Figure 59 – Proportion of marine debris composition collected from southern coast hotspots (OCTOBER 2020)



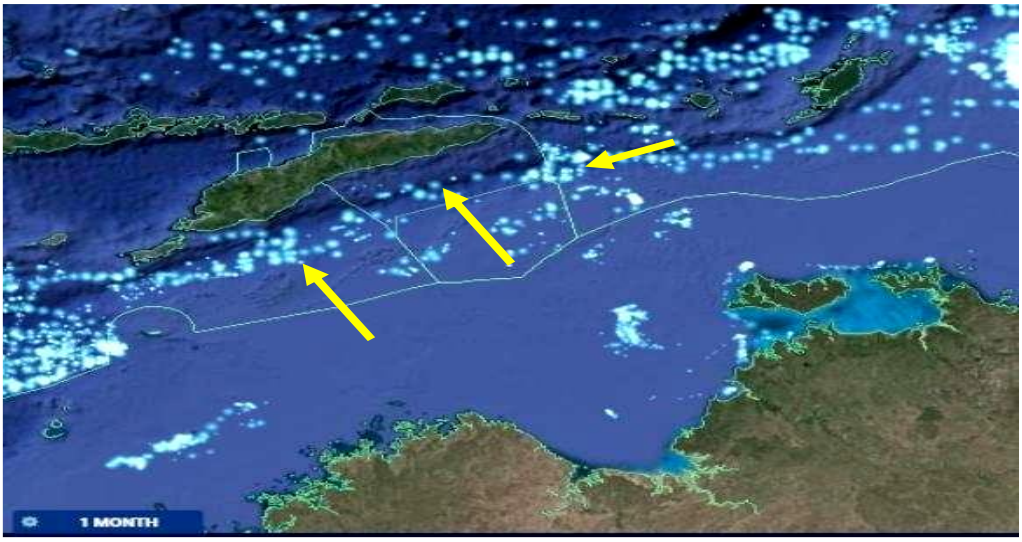
Source: DaFonseca and Spiller, 2021

Figure 60 – Proportion of waste and its composition collected on the southern coast in 2021

Overall, plastic items are the main source of marine debris found in Timor-Leste. In addition, fishing gear materials are one of the main sources of marine debris originating from the sea. It has been suggested that most marine-based debris is generated from offshore fisheries. The potential sources from the inshore fishery are presented in Figure 61, while the offshore fishery is presented in Figure 62 from satellite and transponder data (Global Fishing Watch).

Source: https://globalfishingwatch.org/map/?locale=en

Figure 61 – Source of marine debris from the inshore fishery, as indicated by arrow



[EEZ and JPDA waters (IUU) (15 April to 20 May 2020 (more than 30 boats)]
Source: https://globalfishingwatch.org/map/?locale=en
Figure 62 – IUU fishing and marine debris sources from the offshore fishery

5.3.4 Heavy metals, persistent organic pollutants

There is no recent data on heavy metals in fish and sea water on the southern coast. Research consultants were unable to take samples for laboratory analysis during the site visits because there are no adequate equipment and no laboratory to do so. The consultants referred to secondary data that was generated by SEAFDEC (2011). The report outlines the concentration of cadmium (Cd) and other heavy metals both in fish and within the water body. The report confirmed that there are heavy metals present in the tissue of at least 31 fish species - cadmium (Cd), copper (Cu), Iron (Fe) and lead (Pb). The concentration of each heavy metal varies. For example, Cd in fish tissue ranges from 0.128 to 0.519 µg/g wet weight, while Fe ranges from 2.980 to 14.37 µg/g wet weight. Table 48 shows in more detail the heavy metal concentrations measured in fish tissue. Further assessment needs to be done to determine the current levels of heavy metals in fish tissue, and to compare these with recommended limits in fish for human consumption.

Table 48 – Concentrations of heavy metals in fish tissue µg/g wet weight

Species	Weight (g)	Total Length (cm)	Cadmium (Cd)	Lead (Pb)	Copper (Cu)	Iron (Fe)
Argyrops spinifer	500	31.50	0.275	0.696	0.374	5.282
Auxis thazard	400	32.00	0.452	0.426	0.374	8.630
Auxis rochei	220	25.70	0.368	0.696	0.720	2.980
Cephalopholis sonnerati	190.0	23.70	0.448	0.704	0.358	4.154
Cephalopholis aurantius	205.0	25.00	0.175	0.636	0.329	3.466
Cephalopholis sexmaculatus	410.0	30.40	0.519	0.724	0.253	9.585
Cephalopholis igarashiensis	560.0	28.40	0.262	0.739	0.342	5.368

Choerodon robustus	445.0	28.00	0.380	0.719	0.259	5.642
Diagramma pictum	2,500.0	60.00	0.381	0.709	2.929	3.815
Epinephelus areolatus	580.0	33.50	0.154	0.716	0.319	4.936
Epinephelus morrhua	670.0	35.50	0.270	0.425	0.198	6.800
Epinephelus latifasciatus	965.0	41.50	0.408	0.570	0.481	4.020
Euthynnus affinis	4,000.0	73.00	0.148	0.703	0.540	7.820
Gymnocranius japonicus	900.0	39.60	0.128	0.703	0.431	9.385
Hapalogenys kishinougei	460.0	26.00	0.689	0.852	0.260	3.033
Istiophorus platypterus	2,800.0	247.00	0.580	0.739	0.342	4.630
Lethrinus semicinctus	420.0	29.00	0.278	0.685	0.357	3.427
Lutjanus malabaricus	840.0	36.00	0.390	0.719	0.353	5.475
Lutjanus madras	300.0	27.20	0.275	0.696	0.374	5.282
Lutjanus vitta	490.0	33.70	0.159	0.781	0.791	14.374
Parascolopsis eriomma	600.0	41.00	0.192	0.766	0.718	9.620
Parascolopsis inermis	500.0	36.00	0.381	0.709	2.929	3.815
Pristipomoides multidens	400.0	34.00	0.381	0.709	2.929	4.520
Pristipomoides typus	1,100.0	47.60	0.115	0.738	0.536	5.914
Pristipomoides sieboldii	450.0	36.00	0.158	0.670	0.465	5.321
Saurida elongata	700.0	45.00	0.510	0.650	0.595	7.400
Sthenoteuthis ounlaniensis	280.0	16.72	0.381	0.709	2.929	3.815
Thunnus albacares	5,000.0	72.00	0.096	0.766	0.718	13.861
Thunnus obesus	2,000.0	109.00	0.128	0.703	0.431	9.385
Wattsia mossambica	960.0	37.50	0.233	0.593	0.177	3.197
Xiphias gladius	206.8	86.00	0.170	0.694	0.545	5.206

Source: SEAFDEC, 2011.

Heavy metal concentrations in seawater were also measured in 2011. Samples were collected from 19 stations as illustrated in Table 49. Permissible limits of heavy metals in aquatic environments for fish health are presented in Table 49. Considering these values, the heavy metal concentrations measured in seawater in 2011 are within the permissible limits. However, there is a need to conduct further assessment to obtain up-to-date data.

Table 49 – Heavy metal concentrations in seawater

Station (ST)	Depth (m)	Heavy metal (mg/L)			
		Cadmium (Cd)	Lead (Pb)	Copper (Cu)	Iron (Fe)
ST1	5	< 0.0004	< 0.0086	<0.0011	< 0.0014
	50	< 0.0004	< 0.0086	0.0020	< 0.0014
	100	< 0.0004	< 0.0086	<0.0011	< 0.0014
ST2	5	< 0.0004	< 0.0086	0.002	< 0.0014
	50	< 0.0004	< 0.0086	0.002	< 0.0014
	100	< 0.0004	< 0.0086	0.002	< 0.0014
ST3	5	< 0.0004	< 0.0086	0.004	< 0.0014
	50	< 0.0004	< 0.0086	0.002	< 0.0014
	100	< 0.0004	< 0.0086	0.002	< 0.0014
ST4	5	< 0.0004	< 0.0086	0.002	< 0.0014
	50	< 0.0004	< 0.0086	0.002	< 0.0014
	100	< 0.0004	< 0.0086	0.002	< 0.0014
ST5	5	< 0.0004	< 0.0086	0.002	< 0.0014
	50	< 0.0004	< 0.0086	0.002	< 0.0014
	100	< 0.0004	< 0.0086	0.002	< 0.0014
ST6	5	< 0.0004	< 0.0086	0.002	< 0.0014
	50	< 0.0004	< 0.0086	0.002	< 0.0014
	100	< 0.0004	< 0.0086	0.002	< 0.0014
ST7	5	< 0.0004	< 0.0086	0.002	< 0.0014
	50	< 0.0004	< 0.0086	0.002	< 0.0014
	100	< 0.0004	< 0.0086	0.002	< 0.0014
ST8	5	< 0.0004	< 0.0086	0.002	< 0.0014
	50	< 0.0004	< 0.0086	0.002	< 0.0014
	100	< 0.0004	< 0.0086	0.002	< 0.0014
ST9	5	< 0.0004	< 0.0086	0.002	< 0.0014
	50	< 0.0004	< 0.0086	0.002	< 0.0014
	100	< 0.0004	< 0.0086	0.002	< 0.0014
ST10	5	< 0.0004	< 0.0086	0.002	< 0.0014
	50	< 0.0004	< 0.0086	0.002	< 0.0014
	100	< 0.0004	< 0.0086	0.002	< 0.0014
ST11	5	< 0.0004	< 0.0086	0.002	< 0.0014
	15	< 0.0004	< 0.0086	0.002	< 0.0014

	50	< 0.0004	< 0.0086	0.002	< 0.0014
ST12	5	< 0.0004	< 0.0086	< 0.0011	< 0.0014
	30	< 0.0004	< 0.0086	< 0.0011	< 0.0014
	50	< 0.0004	< 0.0086	< 0.0011	< 0.0014
ST13	5	< 0.0004	< 0.0086	0.002	< 0.0014
	15	< 0.0004	< 0.0086	0.002	< 0.0014
	30	< 0.0004	< 0.0086	0.002	< 0.0014
ST14	5	< 0.0004	< 0.0086	0.002	< 0.0014
	50	< 0.0004	< 0.0086	0.002	< 0.0014
	100	< 0.0004	< 0.0086	0.002	< 0.0014
ST15	5	< 0.0004	< 0.0086	< 0.0011	< 0.0014
	30	< 0.0004	< 0.0086	< 0.0011	< 0.0014
	50	< 0.0004	< 0.0086	0.002	< 0.0014
ST16	5	< 0.0004	< 0.0086	0.002	< 0.0014
	50	< 0.0004	< 0.0086	0.002	< 0.0014
	100	< 0.0004	< 0.0086	0.002	< 0.0014
ST17	5	< 0.0004	< 0.0086	0.002	< 0.0014
	30	< 0.0004	< 0.0086	0.002	< 0.0014
	100	< 0.0004	< 0.0086	0.002	< 0.0014
ST18	5	< 0.0004	< 0.0086	0.002	< 0.0014
	50	< 0.0004	< 0.0086	0.002	< 0.0014
	100	< 0.0004	< 0.0086	0.002	< 0.0014
ST19	5	< 0.0004	< 0.0086	0.002	< 0.0014
	50	< 0.0004	< 0.0086	< 0.0011	< 0.0014

Source: SEAFDEC, 2011.

Table 50 – The most common permissible limits of heavy metals in aquatic environment for fish health

Heavy metal	Fresh water (µg/L)	Seawater (µg/L)	References
Lead	0.18 – 1.00	0.02 – 0.05	International Lead Association
Mercury	0.02	0.02	Anzecc
Cadmium	0.05	1.0	NWQMS
Chromium	5	5	EPA
Copper	0.1	2	EPA & FAO
Nickel	0.1	2	NSW
Lead	0.5	2	FAO & WHO
Iron	333.3	?	WHO

5.3.5 Invasive species, marine pests

There were no invasive species and marine pests visually observed or recorded through an interview with coastal communities during the field visits for primary data gathering in July-August 2022. Marine pests are plants and animals that are not native to a particular country or place. A marine pest can be introduced by human activities and from vessels moving from one region to another. Marine pests can harm marine and coastal resources, human health, potable water, and the natural environment. But undocumented invasive species such as *Bufo melanostictus* (in Timor-Leste called Manduku INTERFET) were introduced by the Australian army from Australia during the post-referendum period in Timor-Leste. The *Bufo melanostictus* has dominated all territories, particularly affecting freshwater aquaculture. The species has high rates of fertility and fecundity, creating a difficult challenge for future management. Local knowledge of managing the Asian black-spined toad population is limited. Further assessment is required to examine the current distribution of the invasive species' impact to environment including aquaculture. The results of the assessment can be used to develop control plans, thereby improving management measures in reducing the population of the Asian black-spined toad. Currently there are many data gaps, not just their distribution but also their ability to invade new ecosystems and what impact they have on the native composition of Timor-Leste's environment. Theoretical predictions should look toward complex interactions between the Asian Black-spined toad and its receiving environment.

5.3.6 Oil spills, ballast water

In Betano (Manufahi) on the southern coast, heavy oil is used to generate electricity. Often the oil accidentally spills into the water body, as observed by local fishers. During the primary data collection phase, it was observed that marine biodiversity and fish life within 500m of the oil spill area has been depleted. Sound science and solutions are needed to clean up oil spills, measure the impacts of their pollution, and to help the ecosystem recover.

There does not appear to be any comprehensive analysis of ballast water in Timor-Leste. Due to the nature of most Timorese vessels, there is no specific ballast water data to report. Ballast water is fresh or saltwater held in the ballast tanks and cargo holds of vessels, so it is still relevant to Timor-Leste as incoming ships from other regions enter national ports. Dirty ballast water may contain residual fuel and other constituents as a result of sea water being stored in fuel tanks. So untreated ballast water, when released in a coastal area can negatively impact the coastal ecosystem. As experienced in some countries, many species of bacteria, plants, and animals could survive in the ballast water and sediment carried in vessels, even after journeys of several months (Senthil, 2021).

According to Senthil (2021), ballast water is dangerous because it contains biological and chemical sources of pollution, which can spread human pathogens and other harmful diseases and toxins. These toxins are potential health risks for humans and marine life alike and are also believed to affect marine plants and micro-organisms, altering growth patterns, disrupting hormone cycles, and causing genetic abnormalities or even death (Gollasch & David, 2019). Toxins produced by ballast water can contaminate water and food chains, creating a source of risk to humans that consume aquatic foods.

5.3.7 Key marine and land-based pollution management issues

The coastal and marine environment of Timor-Leste is rich with fauna and flora, including commercially exploitable fish and non-fish species. Most coastal communities are directly dependent on marine and coastal resources for income generation and livelihoods. These marine and coastal resources have been affected by marine and land-based pollution (DaFonseca and Spiller, 2021). Marine pollution is divided into two categories (i) land-based pollution and (ii) marine-based pollution. Marine-based pollution has become the major contributor of pollution and contamination in the marine and coastal environment.

Research carried out by DaFonseca and Spiller (2021) has described marine-based pollution as being highest on the southern coast. In contrast, Da Cruz (2015) has affirmed that the major rivers on the northern coast, particularly in Dili, bring millions of tons of solid waste including sediments into marine environments. Da Cruz (2015) has further confirmed that the most common form of solid waste is plastics, accounting for 70-80%. These figures are similar to the composition of solid waste identified on the southern coast. Marine-based pollution both on the northern and southern coast are generated from ships (IUUF) and from neighbouring countries, brought by strong winds, current and sea level rise.

This waste pollution is not managed properly, primarily due to a lack of waste treatment facilities and urban planning. The limited management of solid waste contributes to the deterioration of marine and coastal resources, which undermines the economic development of the nation. It is extremely important to protect marine and coastal resources from any form of pollution. The government of Timor-Leste has enacted some laws and regulations to act upon the global and regional demand for the protection and conservation of marine and coastal ecosystems. For example, SDG 13 (combat climate change) and Goal 14 (conserve and sustainably use of seas and marine resources), and Goal 14.1 (prevent and significantly reduce marine pollution of all kinds). Key stakeholders both from government and private sectors should work hand in hand to protect the marine and coastal environment.

Policy makers and other key stakeholders can implement a side-by-side national comprehensive policy for the protection of the marine and coastal environment and their ecosystems. However, so far public and private sectors have been unwilling to invest significantly in pollution control. The government has drafted the National Oceans Policy, but it has not been approved yet by the Council of Ministers. The MARPOL convention needs to be ratified by the government of Timor-Leste, as it is important to strengthen port regulations to exercise state jurisdiction. The port rules provide measures for protecting ports that mainly focus on rules and regulations for entry. Marine and coastal protection in Timor-Leste has not yet taken any serious steps to enact national laws with its international commitments, even though fisheries and environmental laws exist to control and mitigate marine and coastal environmental pollution. The government has taken some legal measures by utilising Decree Law No 26/2012 (Basic Law on the Environment) to manage pollution. This serves as a critical foundation for marine and coastal environmental protection, including the control and management of marine and land-based pollution.

Timor-Leste has one domestic waste treatment facility that is in Dili, and there are no waste treatment facilities outside of Dili. Today, human settlements are increasing because of population growth, both in urban and rural areas. With inadequate waste treatment facilities, increasing pollutants end up in coastal areas. Generally, the solid waste of big city areas (e.g., Dili) is washed by rainwater into drains and canals, ultimately mixing into the river systems and migrating to the ocean.

Solid waste needs to be managed through interactive governance and the collective effort of different actors such as government agencies, private sector and civil society (Kooiman, 2008). All actors engaged should understand the evidence and data required to facilitate equitable solutions to the diverse and complex problem of pollution. Collaboration from different actors can be done through formal and non-formal means – in formulating and implementing laws and regulations and creating programs to respond to the demands and input from coastal communities related to marine and coastal environment (Partelow, Bavinck, Gruby, & Van-Assche, 2020).

The government must take the lead in collaborative action. The interactive governance of the government should capture in a conceptual framework how governance entities are involved in the operational parts of marine debris issues to ensure that marine debris concerns become part of government plan and efforts (Viana, 2021). The government plan is part of an instrument which links these ideas to the action on the ground, and can also assist the implementation of policies, regulations and finance.

Holistic and interactive governance is an appropriate tool to facilitate minimising marine and land-based pollution and at the end can enable a balance between marine and coastal environmental integrity and socio-economic viability (Viana, 2021). Up to this stage, the necessary effort made by the government does not match and/or harmonise with local communities' behaviour. It means people still have low awareness to manage their own pollution at household level. Lack of education and public awareness are the key issues that the government must underline. This is part of a key challenge impeding the implementation of existing laws and regulations. And it becomes more of a challenge in conserving and protecting marine and coastal resources from pollution both from the sea and from the land.

5.4 Condition and Status of Marine Biodiversity and Key Marine Species

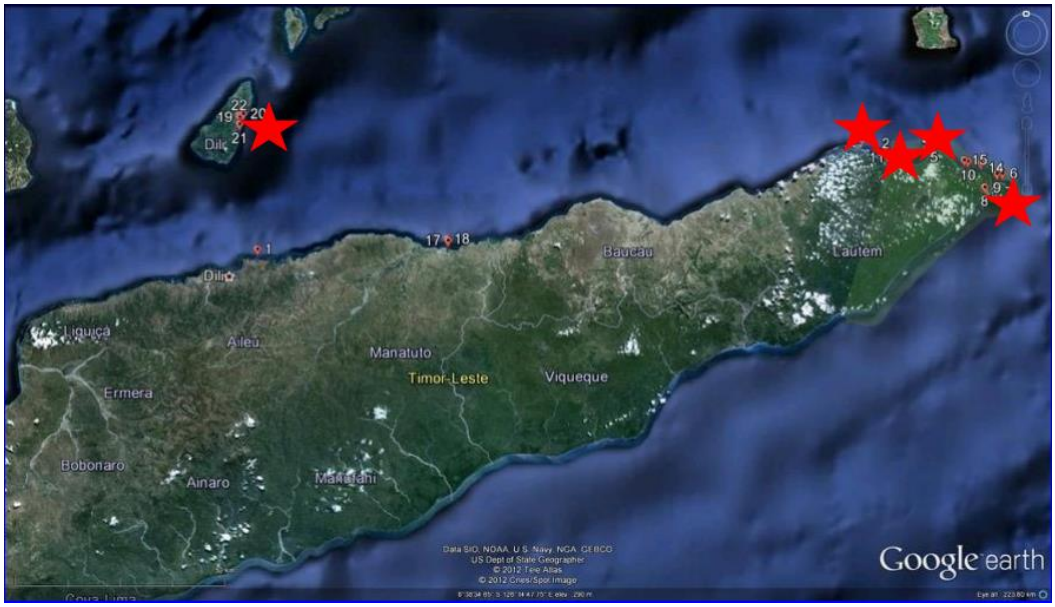
5.4.1 Marine biodiversity

The Lee Kong Chian Natural History Museum (LKCNHM) of National University of Singapore, in close cooperation with the Ministry of Agriculture and Fisheries and Conservation International, have recently strengthened their alliance in fostering and promoting Timor-Leste's biodiversity. Based on survey results from their joint study, there remain some relatively understudied ecosystems which are threatened by deforestation, resource extraction activities and land degradation *[https://lkcnhm.nus.edu.sg/biodiversity-research-in-timor-leste/].*

The Conservation International team conducted a Marine Rapid Assessment Survey to understand the status of marine biodiversity and its distribution (refer to section 2.2. for detailed

results). Figure 63 shows the 39 sites (adjacent deep and shallow areas) at 20 stations (individual GPS locations) which were surveyed along the north-east coast of Timor-Leste, and on Atauro Island. Coral communities were assessed in a range of wave exposure, current and sea temperature regimes, and habitat types. Due to logistical and weather constraints, the coral communities of the southern coast, known to be of differing structure because of the different environmental regime, were not assessed.

The key challenges to marine biodiversity in Timor-Leste are related to the following issues: 1) Pollution of marine and coastal environment (e.g., Land-based pollution and sedimentation), 2) Ecosystem, habitat and biodiversity decline (e.g., Climate impacts on ecosystems, ecological communities and critical habitats), and 3) Unsustainable capture fisheries (e.g., Unsustainable harvest levels-overfishing).



Source: CI Timor-Leste, 2016
Figure 63 – Marine Rapid Assessment Survey Map (2016)

5.4.2 Key marine species, rare, threatened, endangered and vulnerable species

Marine Turtle

There are 5 species of turtle recorded in Timor-Leste's waters (Sandaland et al. 2001). They are *Eretmochelys imbricata* (Hawksbill turtle), *Dermochelys coriacea* (Leatherback turtle), *Chelonia mydas* (Green turtle), *Carreta caretta* (Loggerhead turtle), and *Lepidochelys olivacea* (Olive Ridley turtle). Based on the IUCN Red List, the Hawksbill and Leatherback turtles are 'critically endangered', and the Green, Loggerhead, and Olive Ridley turtles are 'endangered'. The regional marine turtle action plan, and marine turtle status and protection plan were conducted by the Marine Research Foundation on behalf of PEMSEA in the ATS region [*https://mrf-asia.org*].

The regional marine turtle action plan was developed based on existing data and information. The action plan covers the ecology and biology of turtles and their threats including habitat destruction. However, according to Pilcher and Welly (2022), some areas within the ATS have limited information and knowledge gaps and lack understanding of the sea turtle and their

trends. The report has affirmed that marine turtle conservation needs to be managed at the regional level to make it more effective. There are some fundamental ideas behind the management effectiveness which include:
1. *Having a clear logical pathway that maps the routes from implementation to conservation outcomes;*
2. *Setting realistic outputs, measurable deliverables, long-term objectives;*
3. *Engaging the appropriate stakeholders to implement the actions;*
4. *Being cooperative, inclusive, adaptable and sharing; and*
5. *Being acceptable to local communities and the general public* (Pilcher and Welly, 2022).

The management measures at regional level require integrated approaches from different countries and should be realistic. This will help determine realistic outputs as well. For that reason, Pilcher and Welly (2022) have reaffirmed that designing and implementing management measures for sea turtles needs to ask some fundamental questions as follows:
"*What are we trying to achieve and how can we get there?" "Can we really conclude this project?"; "Will we be able to use the results?"; "Will the results be long lasting?" and "Can success be evaluated"?* These questions will help frame the outputs and outcomes in a "logical pathway from action, solution to outcomes".

Saltwater Crocodile

The saltwater crocodile (*Crocodylus porosus*) is one of the largest predators inhabiting Timor-Leste's waters (subtidal zone, tidal swamp, lagoon, and river). This famous predator carries cultural significance for Timorese as a sacred ancestor figure. In terms of Western scientific knowledge, the saltwater crocodile population has been surveyed several times although there is still no clear estimate of population size. Therefore, it is quite difficult to establish a conservation plan or determine their status as endangered or in need of protection.

5.4.3 Key marine species and biodiversity management issues

The Government of Timor-Leste has taken steps toward the management of key marine species and biodiversity by enacting the joint ministerial act List of Protected Aquatic Species, which was proclaimed on April 12, 2017. The most important article highlighted the protection of aquatic species, which is essential to preserve biodiversity in national waters. These following marine species are protected: maori wrasse, dolphins, whales, marine turtles, corals, dugongs, pearl oyster, giant clam, and others. The full list of protected aquatic species is illustrated in Table 51.

Table 51 – List of protected marine species

NAME				STATUS	COMMENTS
LOCAL	PORTUGESE	ENGLISH	LATIN		
Niru baliun	*Bodião napoleão*	Maori wrasse	*Cheilinus Undulatus*	Threatened	
Toninho	*Golfinho*	Dolphin	*Delphinidae*	Threatened	*All Species Except for authorised recreational activities.*
Baleia	*Bâleia, Cachalote, Baleote*	Whale	*Balaenidae*	Threatened	*All Species*
Lenuk Tasi	*Tartaruga*	Sea turtle	*Chelonioidea*	Threatened	*All Species*
Ahu Ruin (funan no isin) / Ai-metan Tasi / Esponja	*Coral*	Coral	*Anthozoa*	Threatened	*All Species*
Duju/Karau-Tasi	*Dugongo*	Dugong	*Dugong dugong*	Threatened	*All Species*
Sipu mutiara	*Ostra perlifera*	Pearl oyster	*Pinctada maxima*	Threatened	*Except pearl oysters from properly authorized commercial holdings.*
Sipu kima	*Ostra gigante*	Giant Clam	*Tridacna gigas*	Threatened	
Sipu bo'ot	*Ameijoa gigante*	Small Giant Clam	*Tridacna maxima*	Threatened	
Sipu Kuda Ain-Fatin	*Ameijoa gigante*	Horse hof	*Hippopus hippopus*	Threatened	
Sipu Tarak	*Ameijoa gigante de escamas*	Scaly Clam	*Tridacna squamosa*	Threatened	
Sipu Sul	*Ameijoa gigante do sul*	Southem Giant Clam	*Tridacna derasa*	Threatened	
Sipu Asafraun/kinur	*Ameijoa gigante cor de açafrão*	Saffron-Colored Giant Clam	*Tridacna crocoa*	Threatened	
Tubaraun Kadó	*Tubarão serra*	Sawfish	*Pristis microdon*	Critically Endangered	
Tubaraun Makikit	*Tubarão águia*	Porbeagle Shark	*Lamna nasus*	Threatened	
Tubaraun Mutin	*Tubarão branco*	Great White Shark	*Carcharodon Carcharias*	Threatened	

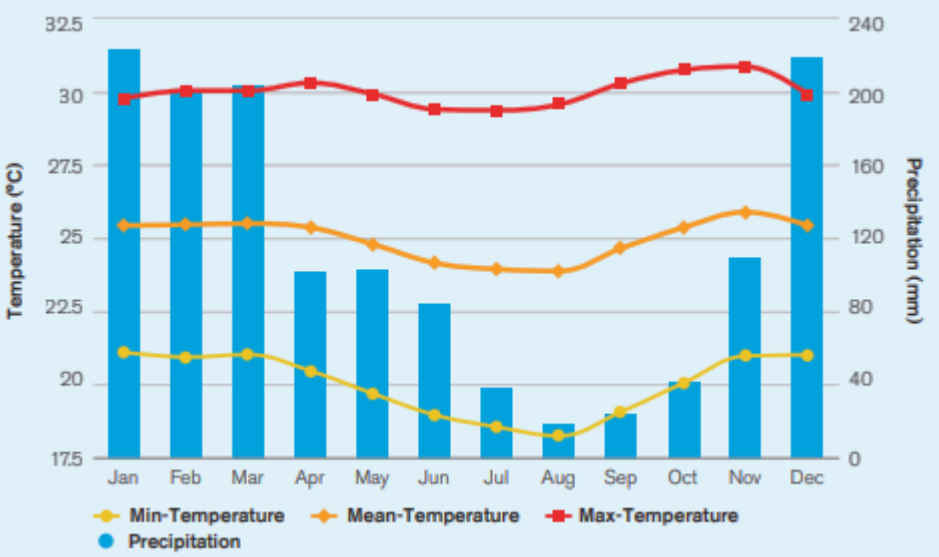
Tubaraun Koboy	*Galha–branca–oceânico*	Oceanic White tip Shark	*Carcharinus Longimanus*	Threatened	
	Tubarão martelo	Scalloped Hammerhead Shark	*Sphyrna lewini*	Threatened	
	Tubarão martelo	Great Hammerhead Shark	*Sphyrna mokarran*	Threatened	
	Tubarão martelo	Smooth Hammerhead Shark	*Sphyrna zygaena*	Threatened	
	Tubarão baleia	Whale shark	*Rhincodon typus*	Threatened	
	Tubarão fera	Breaking Shark	*Cetorhinus maximus*	Threatened	
	Tubarão Espada	Pelagic Thresher Shark	*Alopias pelagicus*	Threatened	
		Bigeye Thresher	*Alopias superciliosus*	Threatened	
		Common Thresher	*Alopias vulpinus*	Threatened	
Pari bo'ot tasi klean	*Raia Manta/ Jamanta gigante*	Giant Manta Ray	*Manta birostris*	Threatened	
Pari bo'ot tasi badak	*Manta/Jamanta Princepe Alfred*	Manta Ray (Alfredi)	*Manta alfredi*	Threatened	
Pari makerek	*Ratão pintado*	Spotted Eagle Ray	*Aetobatus narinari*	Threatened	
Nautilus	*Náutilo*	Nautilus	*Nautilidae*	Threatened	*All Species*
Crocodilo/Lafaek	*Crocodilo*	Crocodile	*Crocodylidae*	Threatened	*All Species Except crocodiles from properly authorized commercial farms.*

From *Jornal da Republica* (Serie1, No.4), 12 April 2017.

5.5 Impacts of Climate Change

5.5.1 Local, regional climate change trends

Tropical climate change in Timor-Leste has been heavily influenced by the West Pacific Monsoon and its mountainous climate. The wet season occurs between December and May, and the dry season between June and November each year, with the southern parts of the country experiencing a longer wet season of seven to nine months. Rainfall is variable across the country with the northern areas receiving less rainfall than the south *[https://climateknowledgeportal.worldbank.org]*. Timor-Leste's climate is strongly impacted by the El Niño Southern Oscillation (ENSO), and the inter-annual extent and timing of rainfall can vary up to 50%. Figure 64 shows that there is relatively little seasonal variability in average monthly temperature, ranging 1.3°C between a minimum of 24.1°C in July and maximum of 25.4°C in November. June, July, and August are the coldest months of the year. Average monthly precipitation varies throughout the year, ranging between approximately 12 and 18mm during the driest months of August and September and between 222 and 252 mm in wettest months of December to March (WB Group, 2021).



Source: WB Group, 2021

Figure 64 – Timor-Leste's average monthly mean, minimum and maximum temperatures and rainfall recorded during 1991-2020

Timor-Leste's wind-wave climate is mostly influenced by the West Pacific Monsoon winds in December through to March, and south-easterly trade winds in June to September. Wind-waves around Timor-Leste are quite small, typically less than 1m high. Annual wave height Dili is a dynamic example of wave height and direction (see Figure 65). Slightly larger than average waves are directed from the east-northeast during June to September (see Figure 65). Meanwhile, during December to March, smaller than average waves from monsoon systems are directed from the north-west and west *[https://climateknowledgeportal.worldbank.org]*.

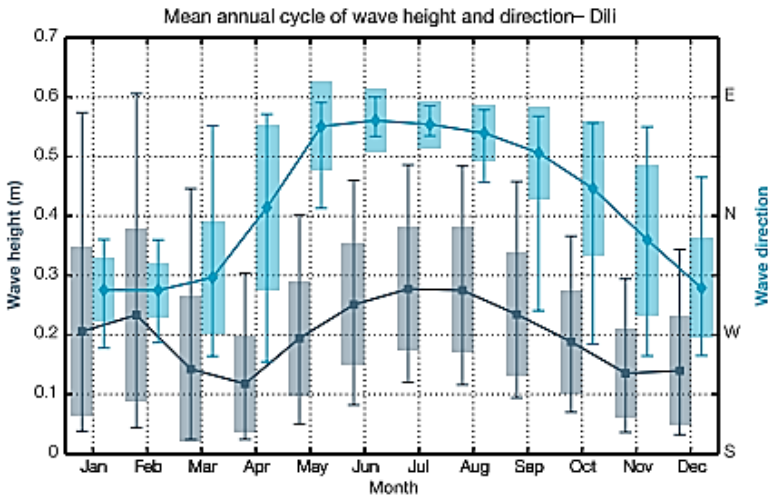
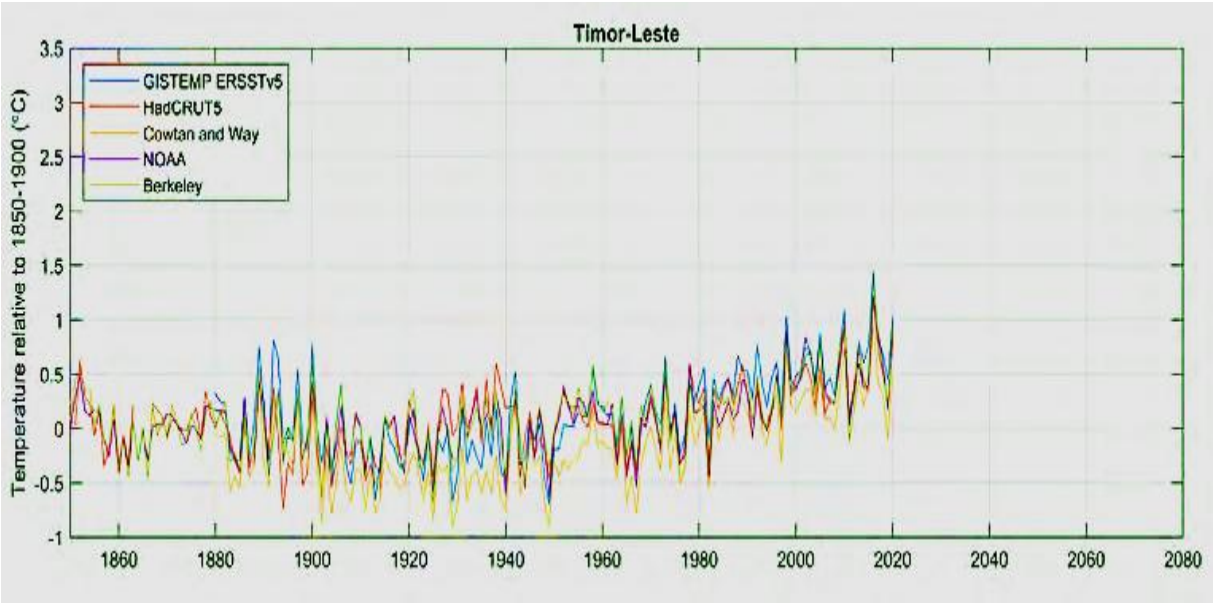


Figure 65 – Dili annual wave height (grey) cycle and wave direction (blue) in the period of 1979-2009

Observed and projected warming suggests that 2°C global warming relates to 1.5 – 2.0°C in Timor-Leste (PACCSAP, 2021). The report confirms that Timor-Leste will warm marginally less than the average global warming rate, but the impacts will be significant. Timor-Leste is vulnerable to climate change in many aspects, particularly coastal erosion, inundation, drought, and flash flooding.

"Historical change and observed variability (Figure 66), average annual temperature shows year-to-year variability, with cool years such as 1982 and warm years such as 2016, but it has showed a warming trend over the 1850-2020 period. It appears likely that all years since 2000 are warmer than the pre-industrial climate average. Be aware that weather station data in the region are sparse before 1952, so the data from these earlier periods are less reliable" (PACCSAP, 2021).



Source: PACCSAP, 2021

Figure 66 – Average annual temperature of the Timor-Leste region relative to 1850 in five global datasets

Climate change is a major concern in Timor-Leste, particularly the impacts on people's livelihoods, basic infrastructures, access to clean water, and food security (DaFonseca A., 2015). Timor-Leste is a Small Island Developing State that is vulnerable to inundation, sea level rise, flash flooding, tropical cyclones, and related extreme weather events (Barnett et al., 2007). Timor-Leste is also categorised as the 11th most at risk country for drought, land erosion and landslides. These extreme weather events will have catastrophic consequences on rural communities who rely on small-scale agriculture and subsistence fisheries for their livelihoods and wellbeing.

Additionally, the catastrophic consequences of climate change are gendered. Women and girls are more vulnerable to the impacts of drought and flash flood than men (Barnett et al., 2007 and DaFonseca, A, 2015). It is important to recognise that men and women, girls and boys, play different roles in times of climate disaster, and experience different immediate and long-term needs. Strong collaboration among all civil society, government, universities, and NGOs is needed to strengthen climate change mitigation efforts and understand the related risks, particularly in terms of Goal 1, 2, 3, 13, and 14 of the SDGs, the 2030 agenda. Women associations in each municipality should be engaged to ensure women's full and effective participation, providing with equal opportunities to participate in decision-making processes related to climate change vulnerability and mitigation efforts.

Climate change impacts are multi-hazard environment in Timor-Leste. These multi-hazards expose households to a broad range of climate shocks and related risks - for example, flash flood, sea level rise, drought, and higher temperatures. Climate change trends in Timor-Leste are

illustrated in Table 52. These climate trends are deeply connected to climate-sensitive natural resource dependent activities such as rainfed farming and fisheries-based livelihoods. Dependence on these activities will increase communities' vulnerability, and the ability of low-income households to mitigate climate change impacts and related shocks (WBCCKP, 2020).

Table 52 – Climate change trends in Timor-Leste

Climate change	Temperature	Rainfall	Sea level rise	Drought
Observed changes	Temperature has increased by 0.5–0.8°C over the past century and temperature change is accelerating (WBCCKP 2020). Timor-Leste is already a hot country, and the historical trend indicates increasing high daily temperatures	Annual rainfall has decreased at the rate of 40mm per decade (UNDP 2013) and the decline is mostly observed in the principal wet season of December–February (WBCCKP 2020). Natural climatic variability such as El Niño events historically determines rainfall (PACCSAP 2015; SNC 2020)	Since 1993, a sea level in Timor-Leste has been rising at the rate 9 mm per year – above the global average of 2.8–3.6 mm per year (PACCSAP 2015).	Historically drought conditions occur frequently, often during El Niño events (SNC 2020). No historical trends are available
Short-term projection (2020-2039)	For monthly average, minimum and maximum temperature, all models predict a slight increase of 0.60–0.75°C across all months in the short-term under the high global emissions scenario, resulting in slightly higher	Projections for annual rainfall are difficult to establish due to natural variability and large model uncertainty (PACCSAP 2015; SNC 2020). In the near-term, a minor decrease in precipitation for the wet season (December–	Under a high emission scenario, the projected absolute changes in the annual mean sea level will be in the range 9–18 cm by2030 (PACCSAP 2015).	Drought projections differ across climate scenarios because of rainfall and El Niño projection uncertainty. In the Short-term drought frequency and intensity is expected to

	monthly changes (WBCCKP 2020).	May) is projected, but this is determined by climate variability more than climate change (SNC 2020; WBCCKP 2020). The difference between the driest and the wettest month is projected to increase (WBCCKP 2020).		remain stable (PACCSAP 2015).
Long-term projections up to 20100	Average air temperatures will continue to increase. Under a high emission scenario, the annual mean temperature is projected to increase in the range of 1.0–2.0°C by 2050, 1.7–3.1°C by 2070s and 4.0–4.2°C by 2090 (PACCSAP 2015).	Long-term projections suggest annual rainfall by 2050–2080 may increase slightly (4–6 per cent) (NAPA 2010; UNDP 2013) or decrease (SNC 2020). By the end of the century, there may be an increase in wet season rainfall, especially in the mountainous inland (USAID 2017). A decrease in dry season rainfall with a mild drying effect over the June–August period may lead to a	Sea level is expected to continue to rise to 18–34cm by 2050, 30–58cm by 2070 and 43–88cm by 2090 compared to the baseline (PACCSAP 2015).	Long-term trends indicate a drying climate with a higher likelihood of drought (WBCCKP 2020). The decrease in the dry season rainfall may bring longer dry periods, mostly affecting the already drier northern part of the country (PACCSAP 2015). Droughts may also become more severe (SNC 2020).

		prolonged drought season (UNDP 2013; WBCCKP, 2020).		

Source: Timor-Leste Assessment +CIFRC, 2021

According to Johonson et al. (2021) climate change impacts at the regional level (Arafura Timor Seas) are believed to be high. It will impact habitats, fish and non-fish species, their relative level of vulnerability, and drivers of vulnerability. However, the effects are spatially varied. For example, coral reefs with shallow water are more vulnerable than deep water habitats because corals are sensitive to high temperatures.

Johonson et al. (2021) also predicts that in the coming years, coral reef habitats will experience reduced cover, or that macroalgae is likely to become more dominant. Coral diversity is expected to decline due to ocean acidification, which will affect reef dependent species and potentially cause a decline in fish stocks. Subsequently, these effects will be felt by local fishers who rely on these stocks as a source of income and food.

5.5.2 Extreme events (cyclones, heavy rainfall)

Over the last decade, the number of tropical cyclones has decreased in the region (SNC, 2020). Short-term projections for cyclone frequency and intensity are not available. However, strong cyclones are expected to occur with global climate change. Cyclone activity is influenced by sea-surface temperature, air temperature, sea level rise, and several regional and global climate systems. According to a USAID (2017) report, the number of tropical cyclones is predicted to decrease in coming years, but those cyclones that do occur will be of strong, of higher intensity, particularly on the southern coast of Timor-Leste.

Normally, rainfall is higher on the southern coast than on the northern coast. For example, from December to May, there are heavy raining on the southern coast while concurrently the northern coast receives less rainfall. The heavy rainfall period on the southern coast is also longer (seven to nine months) than on the northern coast. These patterns, both on the northern and southern coastline, are strongly determined by the western Pacific monsoon.

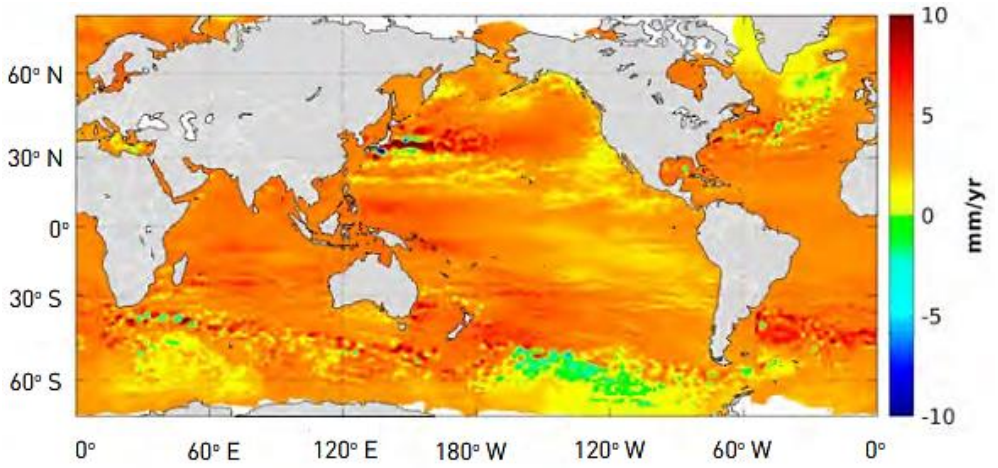
El-Niño and La Niña conditions, as part of the Southern Oscillation (ENSO) index, greatly affect the wet season across Timor-Leste. For example, El-Niño events are strongly associated with drought in Timor-Leste. The northern coast of Timor-Leste is very prone to drought, and this stretch of coastline experiences less rainfall and a shorter wet season. However, during La-Niña events the wet season is extended on the northern coast. It means more rainfall, higher winds, flash floods and landslides (PACCSAP, 2015). La-Niña events have increased the magnitude of the flash flooding within the last ten years. Flash flooding has affected not only agricultural production but also impacted livestock. This statement was expressed by almost all coastal communities along southern coast during the consultation. The events of El-Niño and La-Niña will continue to happen in near future, but there is little consensus on whether these events will change frequency and/or intensity (State Secretary of Environment Timor-Leste, 2020).

5.5.3 Sea-level rise, coastal inundation

The level of warming projected is significantly lower than the global mean surface warming over the land, because of the moderating influence of sea surface temperature (Timor-Leste Red Cross, 2021). The Climate Change Impacts on Health and Livelihoods in Timor-Leste report (2021) has confirmed that seasonal temperatures are projected to increase from 1.0 – 1.5 degrees C by 2050, under a moderate emissions scenario. If the temperatures increase then the intensity of coastal inundation will substantially affect coastal communities, basic infrastructures, and wellbeing.

Most coastal communities are already experiencing sea level rise and/or coastal inundation, as confirmed during the consultation (FGD). The impacts are significant, from the destruction of basic infrastructure such as housing and roads, to the disrupted access to clean water, as well as harm to physical and psychological wellbeing.

Sea level is one of the best indicators of climate change due to it being an integrated variable, because of the sea level changes occurring in the ocean's mass and density fields. These changes in the mass and density fields are happening in response to forced and unforced climate variability mechanisms such as ocean warming, the melting of grounded ice, and changes in land water storage systems. Sea levels have been monitored by tide gauges since the late eighteenth century, and by tide gauges and satellite altimeters since the early 1990s (Figure 67). The global mean sea level rise rate as observed by satellite altimeters has increased from 2.1 mm/year over 1993–2002 to 4.7 mm/year over 2013–2021 (IOC-UNESCO, 2022).



Source: IOC-UNESCO, 2022
Figure 67 – Regional sea level trends from January 1993 to August 2021

Figure 67 shows sea level trends at a global level. Based on the multi mission of satellite altimetry, it is shown that the global sea level trends were recorded at 3.3 mm/year. In the context of climate change impacts felt by Timor-Leste, sea level has on average, been rising around 9 mm/year compared to the global average ranges of 2.8 mm up to 3.6 mm *[www.pacificclimatechangescience.org]*. Other research demonstrated that there has been on average, from 5mm up to 7mm/year, which corresponds to the origin formation of Timor Island indicating a tectonic uplifting velocity of 0.5 mm/year.

5.5.4 Coastal vulnerability & adaptation

Climate change vulnerability and associated environmental impacts has extensively affected coastal habitats both on the northern and southern side of the island. The coastal structure and composition are being altered, which will subsequently affect the landing of small boats (canoes). As observed during the consultation, inundation, flash flooding and coastal erosion were rated as the priority climate events on the southern coast with the highest impact to community resources - fisheries, rice field, maize, livestock, and wellbeing. The rating is based on their frequency, severity, and impacts (DaFonseca, 2015).

Given the relatively heavy reliance on coastal livelihoods, the highest priority adaptation actions should involve mangrove rehabilitation, education, and public awareness to build community resilience toward climate change vulnerability. It would be helpful if local communities could improve irrigation canals and divert heavy water movement during wet season, to reduce the impact of flash flooding on agricultural fields and community houses in coastal areas.

To reduce inundation, flash flooding and coastal erosion, education and public awareness is another climate change adaptation measure that should be explored. Materials for education and public awareness could include halting cutting mangroves trees for house construction, firewood, and cash. In the agricultural sector, more focus on mix-farming and treatment of post-harvest systems are considered vital components in preserving the agricultural production and food supply in the face of climate change impacts and related shocks. This is an important measure which is paramount to increase knowledge and awareness amongst coastal communities.

Climate change adaptation measures are challenging in almost all coastal areas across the country because most coastal communities heavily rely on marine and coastal resources for their livelihoods. Many coastal communities pay less attention to marine and coastal management, as they are focused on subsistence and community development. Formal regulations, local knowledge and governance systems are being implemented in some locations, but they are not always effective as conservation and environmental issues are not always considered a priority in relation to the immediate socioeconomic needs of coastal communities.

All communities have recognised the impact of cutting mangrove trees and its consequences. This was voiced during the consultation through Focus Group Discussions. Community members argued that they felt they had no choice as they needed these marine and coastal resources to support their daily lives. They also affirmed that hunting wild animals is an important source of cash income. The main wild animals hunted include deer (*Cervus timorensis*), wild pig (*Sus scrofa*) and cuscus (*Phalanger orientalis*). It seems that climate change adaptation is challenging, and they believe it will worsen in the near future if there is no action taken soon.

Timor-Leste's National Adaptation Programme, (2010), has proposed the following priority areas for climate change adaptation by 2020:

1. 'Increasing food security by reducing agricultural vulnerability to food and drought
2. Securing water resources by emphasising integrated water resources management
3. Protecting human health through enhanced capacity to anticipate and respond to changes in distribution of climate sensitive diseases

4. Improving institutional and community capacity to prepare for and respond to natural disasters
5. Maintaining and restoring forests, biodiversity, and coastal ecosystems
6. Developing and ensuring coherence in national institutional capacity for managing climate change'

The adaptation priorities listed above are implemented partially in collaboration with development partners, CBOs, academia, and local communities. However, greater effort is required to implement them in a sustainable and effective way. Detailed assessment of climate change vulnerability at village and hamlet levels is necessary to facilitate climate change adaptation and mitigations.

5.6 Status of Ecosystem-based Management (status, programs, issues, gaps/priorities)

5.6.1 EBFM and EAA

Ecosystem-based Fisheries Management (EBFM) is a holistic approach to managing fisheries and marine resources, as it considers the entire ecosystem of the species being managed. The goal of EBFM is to maintain ecosystems in a healthy, productive, and resilient condition so they can provide the services humans want and need [*https://www.fisheries.noaa.gov*]. For the south coast of Timor-Leste, an Ecosystem Approach to Fisheries Management (EAFM) plan for Red Snapper fisheries was developed (aside from the integration of fisheries issues in the ICM program in Barique). This EAFM plan serves as a good example for the ATSEA-2 project in the southern regions of 5 coastal municipalities (Covalima, Manufahi, Manatuto, Viqueque, and Lautem). Figure 68 presents the management framework of EBM, SS, EBFM and EAFM.

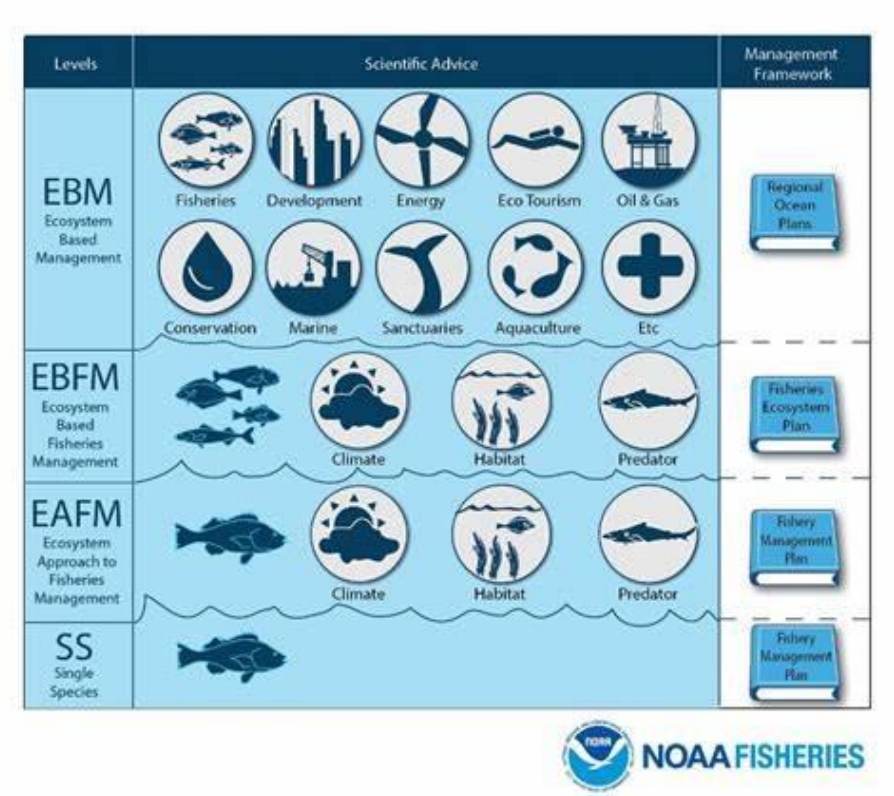


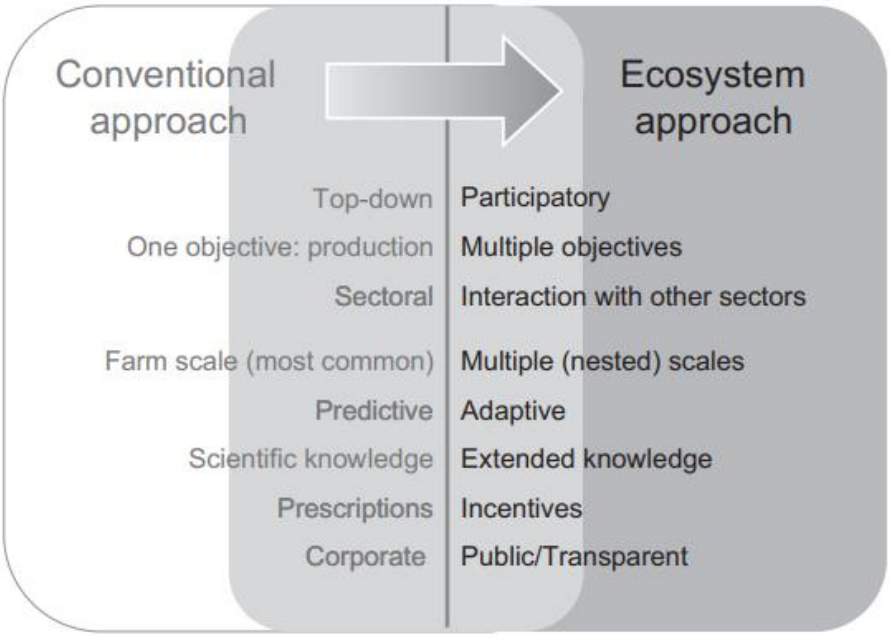
Figure 68 – Management framework of EBM, EBFM, EAFM and SS

The Ecosystem Approach to Aquaculture (EAA) is a strategy for the integration of the activity within the wider ecosystem such that it promotes sustainable development, equity, and the resilience of interlinked social-ecological systems [*https://onlinelibrary.wiley.com/doi/epdf/10.1111/raq.12242*].

The EAA is guided by three strategic principles:

1) Aquaculture development and management should take account of the full range of ecosystem functions and services and should not threaten the sustained delivery of these to society.
2) Aquaculture should improve human well-being and equity for all relevant stakeholders.
3) Aquaculture should be developed in the context of other sectors, policies, and goals, as appropriate.

EAA Planning and Implementation process in Timor-Leste has been implemented under the FAO Project on Indonesian Seas Large Marine Ecosystem (ISLME) since 2018 until presently, in Metinaro Sub-District, Dili Municipality. The conventional framework for EAA is illustrated in Figure 69 below.



Source: FAO, 2010
Figure 69 – Management framework of EAA

5.6.2 MSP and ICM

The Government of Timor-Leste under the Ministry of Planning and Territory through the Directorate General for Spatial Planning launched the National Spatial Planning program on February 10, 2022. This legal framework (Decree-Law No. 6/2017) will serve as the foundation of a national land use policy, which is necessary to facilitate the promotion of a harmonious and integrated development sector [*https://en.tatoli.tl/*].

The Marine Spatial Planning framework serves as a "public process of analysing and allocating the spatial and temporal distribution of human activities in marine areas to achieve ecological, economic, and social objectives that usually have been specified through a political process" [*https://marineplanning.org*]. It can be said that MSP is not an end in itself, but a practical way to create and establish the rational use of marine space and manage interactions among its different uses, to balance demands for development with the need to protect the environment, and to deliver social and economic outcomes in an open and planned way. The MSP framework has not been applied in practice yet, although its conception and implementation agency has been developed under the Ministry of Agriculture and Fisheries, Directorate General of Fisheries. It was officially launched by the National Directorate of Marine Spatial Planning in 2021.

Integrated Coastal Management (ICM) addresses the governance of human activities affecting the sustainable use of goods and services generated by coastal and marine ecosystems. The ICM approach is well-recognised in the region and was introduced to Timor-Leste in 2009. It was

initially explored in two municipalities, Manatuto and Liquiça, later followed by Dili Municipality in 2015. The ICM approach [*https://www.pemsea.org*] is applied to:

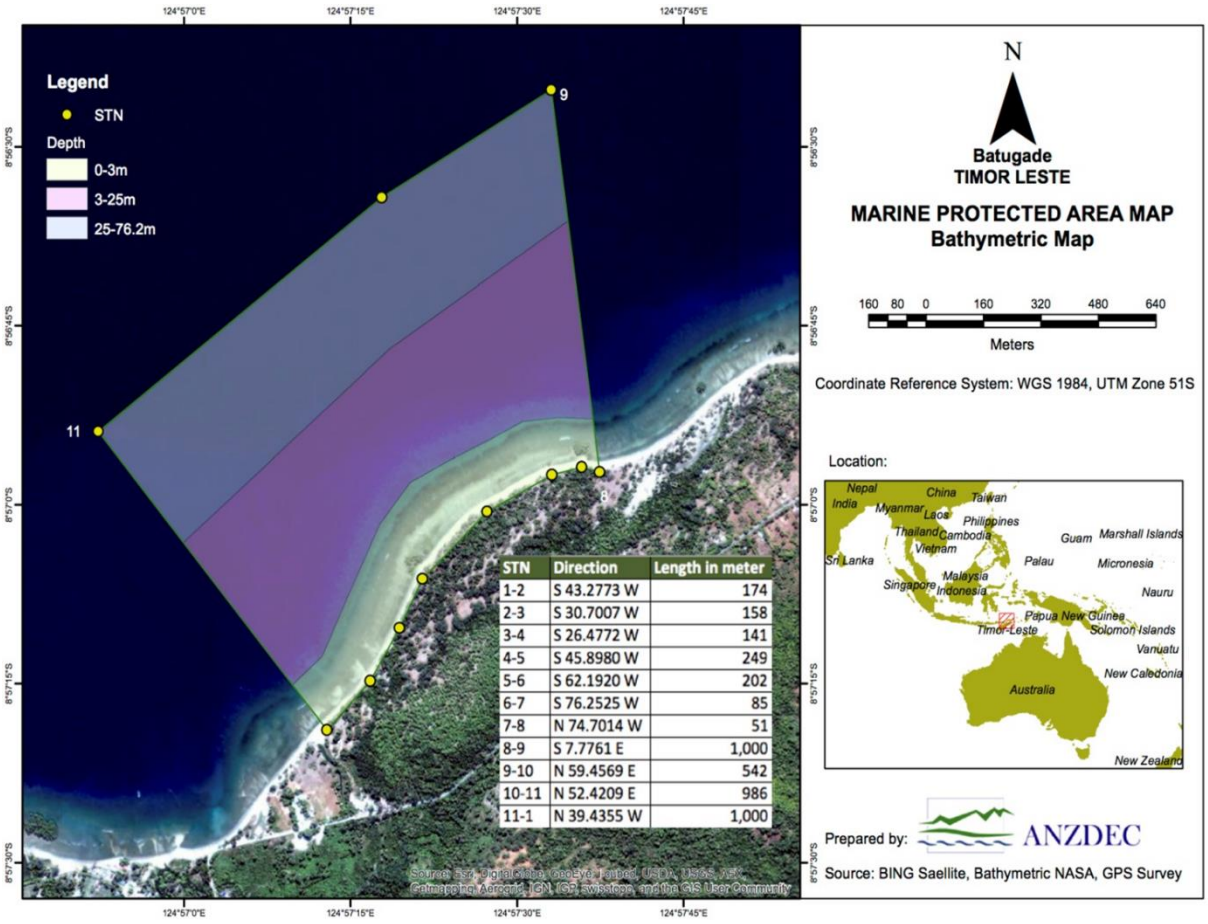
1) Facilitate better understanding of the uniqueness of the coastal resource system. Through an integrated management approach, ICM reminds the various stakeholders that diverse sectors are involved in ensuring coastal areas' sustainability, since their collective activities affect the overall ecosystem. In contrast, single-sector management often fails to consider the various impacts of multiple uses of coastal resources.
2) Integrate ecological, social, and economic information to ensure that management strategies formulated under ICM are responsive to the multiple users and uses of coastal resource systems.
3) Promote interdisciplinary approaches and cooperation among users and beneficiaries to address complex development issues. Through coordination, coastal management efforts by various stakeholders are not duplicated or conflicting, ensuring a more efficient and effective management system.

An example of current ICM implementation under the ATSEA-2 Project is demonstrated at Suco Uma Boco, Posto Administrativo Barique, Municipality of Manatuto.

5.6.3 MPAs and LMMAs

The history of MPAs in Timor-Leste began in 2005 under the FAO project, Strengthening Fisheries Data Gathering for Management, which was implemented in close cooperation with the Ministry of Agriculture, Forestry, and Fisheries (MAFF). During the project's implementation, the concept of a Community Based-Marine Sanctuary (CB-MS) was introduced to all 11 coastal districts (Aileu and Ermera districts do not include coastal areas). The concept of CB-MS was socialised along with a local governance institution locally known as *tara bandu*. As part of that momentum, MPAs were being piloted at Batugade (Bobonaro District) and Vila-Maumeta in Atauro Island (Dili District). After 10 years since MPAs were first introduced to Timor-Leste the Government of Timor-Leste, under the Ministry of Agriculture and Fisheries (MAF), officially adopted MPAs in 2015 through the CTP project (although the CB-MS concept was originally introduced alongside the concept of LMMAs).

In 2015, the Government of Timor-Leste enacted Ministerial Diploma No. 5/GM/I/2015 dated February 25, 2015, by launching the 'Aquatic Natural Reserve' which was located on the coast of Batugade Village in Balibo Sub-District, Bobonaro District (Longitude 124°57'12.8880 E" and Longitude -08°57'18.9036"S), covering an area of 112.59 ha (including 18.95ha of coral reef, 3.49ha of sea grass beds, 0.60ha of mangrove, 2.83ha of beach area and 86.72ha of deep water) (See Figure 70).

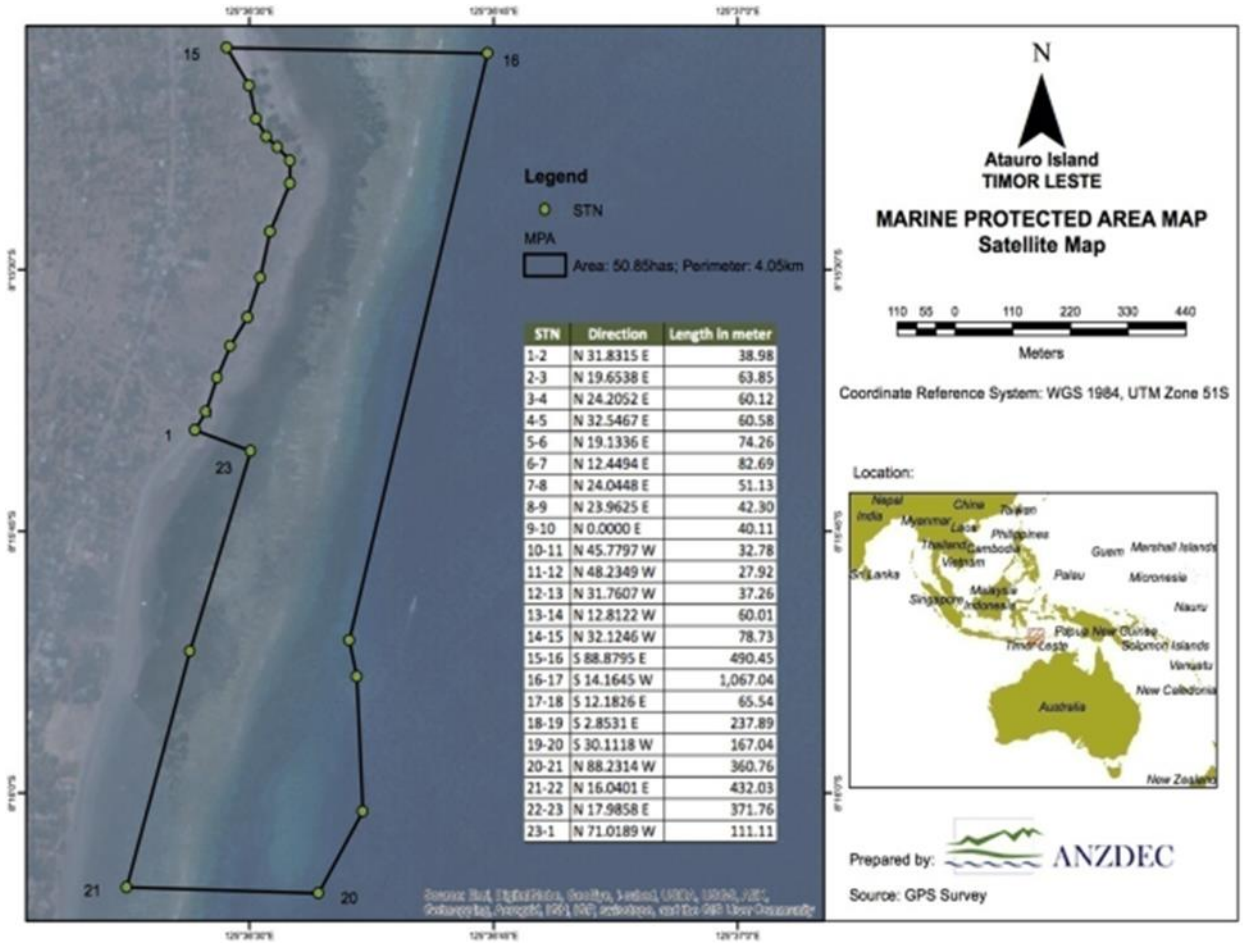


STN	Direction	Length in meter
1-2	S 43.2773 W	174
2-3	S 30.7007 W	158
3-4	S 26.4772 W	141
4-5	S 45.8980 W	249
5-6	S 62.1920 W	202
6-7	S 76.2525 W	85
7-8	N 74.7014 W	51
8-9	S 7.7761 E	1,000
9-10	N 59.4569 E	542
10-11	N 52.4209 E	986
11-1	N 39.4355 W	1,000

Source: Ministerial Order No. 5/GM/I/2015

Figure 70 – MPA map in Batugade

Ministerial Order No. 6/GM/I/2015 was launched concurrently to Batugade's Aquatic Natural Reserve, located at the coast of Vila-Maumeta (Figure 71) in Atauro Sub-District, Dili District (Latitude 125°36'26.6616"E and Longitude -08°15'39.2076"S) covering a total seascape area of 50.85ha – including 31.34ha of coral reef, 18.36ha of seagrass beds, 0.97ha of mangrove and 0.18ha of beach area.



STN	Direction	Length in meter
1-2	N 31.8315 E	38.98
2-3	N 19.6538 E	63.85
3-4	N 24.2052 E	60.12
4-5	N 32.5467 E	60.58
5-6	N 19.1336 E	74.26
6-7	N 12.4494 E	82.69
7-8	N 24.0448 E	51.13
8-9	N 23.9625 E	42.30
9-10	N 0.0000 E	40.11
10-11	N 45.7797 W	32.78
11-12	N 48.2349 W	27.92
12-13	N 31.7607 W	37.26
13-14	N 12.8122 W	60.01
14-15	N 32.1246 W	78.73
15-16	S 88.8795 E	490.45
16-17	S 14.1645 W	1,067.04
17-18	S 12.1826 E	65.54
18-19	S 2.8531 E	237.89
19-20	S 30.1118 W	167.04
20-21	N 88.2314 W	360.76
21-22	N 16.0401 E	432.03
22-23	N 17.9858 E	371.76
23-1	N 71.0189 W	111.11

Source: Ministerial Order No. 6/GM/I/2015

Figure 71 – MPA map in Atauro

An **LMMA** is an area defined by the community to be managed under a set of rules and regulations by the people who live in and own that area [*www.mahomianadari.org*]. In Timor-Leste the first LMMA was established on July 12, 2012. Whereas the first *Tara Bandu* in the context of marine conservation, was launched on March 13, 2013. It was applied at the Lamsana Protected Area in Manatuto municipality, covering an area of 8ha. ***Tara Bandu*** is a traditional, customary law related to local knowledge practices that allow communities to manage their resources to ensure their availability for future generations. In 2009, the local government of Manatuto adopted *tara bandu* as part of the ICM approach to its marine resource management. The LMMA concept and *tara bandu* and their application in Manatuto was presented at the International Conference on ICM and Marine Biotechnology held in Bogor-Indonesia (Cabral M. M., 2016).

Current and proposed (as of 2018) MPAs and LMMAs are described in Table 53, categorised as either national park, aquatic natural reserves, no-take zones, and LMMAs. This list demonstrates that there are common constraints encountered by the government of Timor-Leste when it comes to the implementation, planning, financial management, and overall effective management of MPAs. However, the government of Timor-Leste, particularly the municipality of Atauro, has demonstrated willingness to apply the IUCN-Red List framework to an existing MPA located at Vila-Maumeta.

Table 53 – List of current/proposed MPAs and LMMAs

CURRENT / PROPOSED MPAs AND LMMAs IN TIMOR-LESTE

Name, Municipality	TOTAL AREA (HA)	DATE OF DECLARATION	PARTNERS	PROGRESS
NATIONAL PARKS				
Parque Nacional Nino Konis Santana (marine) (Lautem)	55,600	1 August 2007	NSW Parks & Wildlife, BirdLife International, Charles Darwin University	surveys, gazetted, management plan
AQUATIC NATURAL RESERVES				
Vila Reserva Natural Aquatica (Atauro Island)	5,085	25 February 2015	ADB-ANZDEC	surveys, *tara bandu* ceremony, gazetted, management plan
Batugade Reserva Natural Aquatica (Bobonaro)	11,259	25 February 2015	ADB-ANZDEC	surveys, *tara bandu* ceremony, gazetted, management plan
TOTAL AREA	**71,944**			
LOCALLY MARINE MANAGED AREAS				
Nino Konis Santana LMMAs (3) – Tutuala Lore Com	 1,600 270 100	 2016 2016 2016	USAID-CTSP (CI)	*tara bandu* ceremonies, management plans (3), no gazettals
Subtotal	**1,970**			
Atauro Island LMMA network (5)* – Beloi (& 3 NTZs)@ Uaro-ana Akrema Adara Vila#	 537 32 45 25 138	 15 December 2017 20 September 2017 20 September 2017 15 December 2017 21 September 2017	ADB-CI (LMMAs), Coral Triangle Center (network), WorldFish, BV	*tara bandu* ceremonies 4 Suco regulations - Adara, Vila, Beloi, Bikeli (Uaro-ana, Akrema), no gazettal or management plans
Subtotal	**777**			
TOTAL AREA	**2,747**			
NO-TAKE ZONES (FISHERIES REGULATIONS)				
Nino Konis Santana - 7 NTZs (Lautem)	207 km²	2 June 2013	USAID-CTSP (CI)	Fisheries Regulation
PROPOSED MPAS & LMMAS				

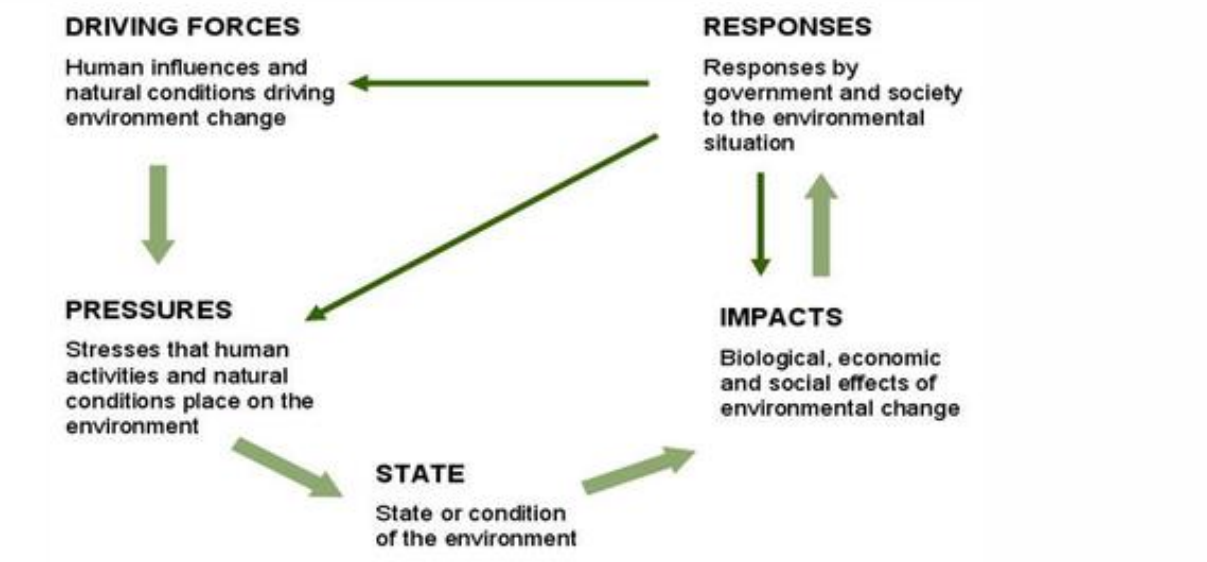
Name, Municipality	TOTAL AREA (HA)	DATE OF DECLARATION	PARTNERS	PROGRESS
Batugade-Atapupu (FMA 714) (Bobonaro)	-	-	FAO	Transboundary MPA (Indonesia-Timor-Leste) proposed under ISLME project (FAO)
Ilik-namu, Biqueli (Atauro)	45		BV, Darwin Initiative	Suco regulations finalized, but not formalised.
Kaitehu-Ulmera (Liquica)	-	-	CTC (TNC)	MPA being progressed by TL CTI NCC
Ilimanu, Behau (Dili)	20	-	BV, KFF, Darwin Initiative	Suco regulations at consultation stage.
Lamsanak or Ma'abat (Manatuto)^	-	-	BV, Oriental University, KFF, Lighthouse Foundation, PEMSEA	Mangrove restoration, 'tara bandu' consultations
Betano-Clacuc (Manufahi)	90,000	-	PEMSEA	MPA proposed under ATSEA2

Vila LMMA is based on the Vila Aquatic Natural Reserve, but has extended the boundary. It is expected that the new extended boundary will be updated for the Aquatic Natural Reserve.
* LSE MPA Network proposed a MPA on the east of the island (10,882 ha), but this has been superseded by 'whole of island' approach and LMMA network . With the support of CI and CTC, a network of 13 LMMAs are proposed for Atauro Island. Whole of island' protected area (marine-terrestrial) currently been proposed under ADB CTP2 program – incorporating the network of LMMAs.
@ Beloi MPA (537 ha), with 3 No-Take Zones (NTZs) in Usubemaso and Lagoa aldeias.
^Original MPA (8ha) regulations formalised in 2013 on Iulik land and waters, but now degraded. Regulations now obsolete. New *tara bandu* discussions underway. Lamsanak MPA (15,242 ha) proposed under LSE MPA Network.

Source: Edyvane, 2018

5.6.4 Causal Chain Analysis

Causal Chain Analysis (CCA), often called a Root Cause Analysis (RCA), is closely related to systems of thinking, and the Driving process, Pressures, State, Impacts and Responses (DPSIR) approach. The method of DPSIR is showed in Figure 72.



Source: [*https://en.wikipedia.org/wiki/DPSIR*]

Figure 72 – Process of Pressure state impacts and responses

At its most basic, a causal chain is an ordered sequence of events linking the causes of a problem with its effects. The linkages in the causal chain are created to be repeatedly answering the question 'Why?' A simple schematic showing the major components of a CCA are shown below in Figure 73 *[https://iwlearn.net]* below.

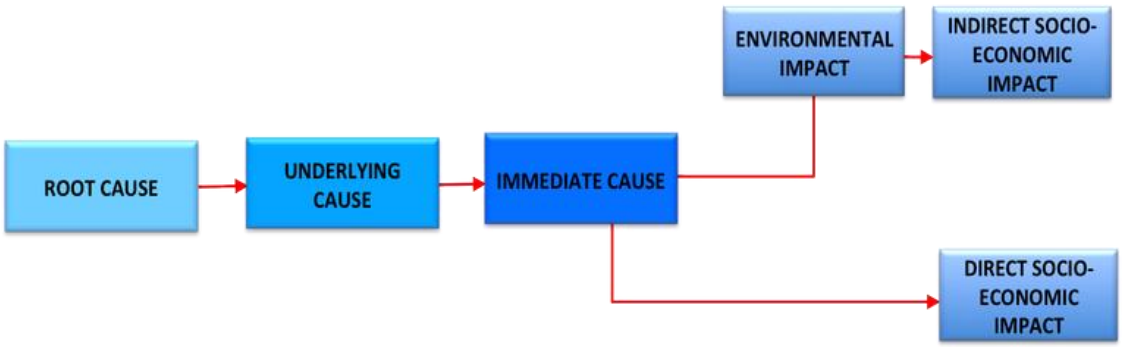
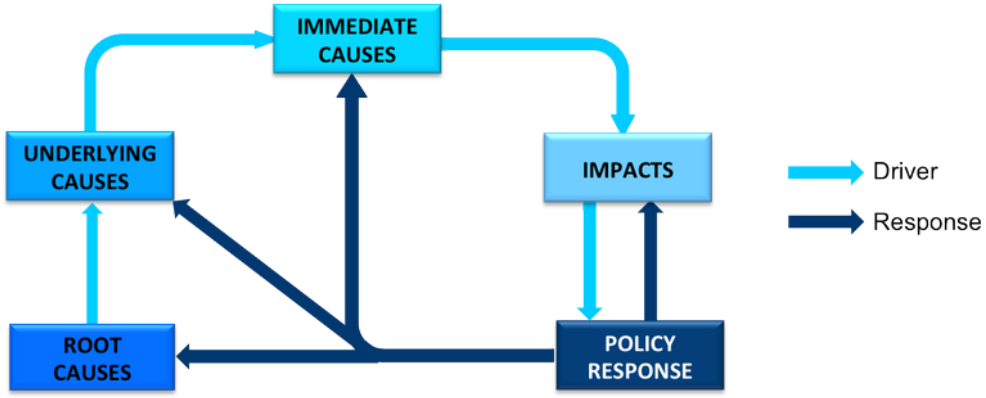


Figure 73 – Causal Chain analysis

CCA is predicated on the belief that problems are best solved by attempting to address, correct or eliminate root causes, as opposed to addressing the immediately obvious symptoms. Directing corrective measures toward root causes will decrease the likelihood that the problem will reoccur. However, it is recognised that complete prevention of recurrence by one corrective action is not always possible.

Unlike systems thinking, which focuses on the dynamic and complex whole system interacting as a structured functional unit, CCA approaches have historically tended to be used in a linear manner, examining cause and effect. Although often displayed in a linear fashion, it should be remembered that a causal chain is a component of a policy response system, which by its very nature is cyclical, as illustrated in Figure 74.



Source: [https://iwlearn.net]

Figure 74 – Causal chain components and its inter-link

In the Timor-Leste context, CCA diagnosed 4 root causes of priority marine and coastal environmental concerns such as unsustainable fisheries, unsustainable fisheries on socio-economic impacts, marine and land-based pollution, and climate change impacts. This root causes summary was presented on 23 September 2022, during a stakeholder consultation held in MAF (Table 54).

Table 54 – Solution of priority marine and coastal environmental concerns

Priority marine and coastal environmental concerns	Main causes	Underlying causes	Solution
Unsustainable fisheries	Unsustainable use and exploitation of marine and coastal resources by locals and by illegal fishing (IUU fishing)	Lack of coordination among littoral countries to manage and control all marine resources across transboundary area	Needs to strengthen diplomacy channel with littoral countries to solve the maritime boundary and reduce IUU fishing on transboundary area
Unsustainable fisheries on Socio-economic impacts	Conservation and management programs of fisheries are not integrated into local-based development or village development plan that	There is no community-based marine and coastal planning and conservation, associated with the identification of local	Need to develop community-based planning for marine resources conservation incorporated with

	utilises local resources in an ecologically sustainable manner to generate community benefits	development options that are compatible with livelihoods options or income diversification	income diversification and job opportunity
Marine and land-based pollution	Deforestation leads to habitat destruction and sedimentation which disturb coastal habitat when leaching occurs to main rivers	Unsustainable agricultural and logging practices and unplanned development such as road construction that affects catchment areas	Regulate illegal logging and ban shifting agriculture to reduce erosion and road construction requires proper planning
	Increasing pollution of coastal and near-shore environments from land-based development	There is a general lack of appreciation of the change in quality of marine and fresh water caused by human activities such as high population concentration, shifting agriculture, infrastructure development (road and houses)	Needs proper training, education and public awareness to coastal communities and other stakeholders to reduce shifting agriculture and design proper infrastructure development
	Increasing loads of sediments, wastes and other contaminants entering coastal systems from domestic waste (liquid and solid)	Improper solid waste disposal litter, household, and small industry waste	Lack of environmental awareness of the impacts of these pollutants of marine and coastal environment and its resources. Therefore, it needs to raise pollution awareness
Climate change impacts	Drought has greatly affected water resources, both for human and animal husbandry (cattle and water buffalos	Alteration of local weather patterns due to climate change	Management and sustainability of natural resources

5.6.5 Status of ecosystem knowledge, MER and data systems

The MER (Monitoring, Evaluation and Reporting) programs, data portals, and decision-support systems are under development at the Prime Minister's Office, but not yet integrated in the sense that data is scattered among different institutions, there are issues regarding access, and data not being utilised optimally to support policy, decision-making and management. However, the current status of ecosystem knowledge has already revealed a few scopes of scientific works have been undertaken to mapping the near habitats using satellite and rapid assessment in a certain location. For example, the summary results showed by PIFSC (2017) at approximately 15-m depths around national territory of Atauro Island, Oecusse, and most of the north shore of Timor-Leste with relatively few spatial gaps. Furthermore, it has covered of 190 square kilometres shallow water habitats were classified into hard and soft substrate, mangrove, seagrass, intertidal, rock and lagoon habitats as follows:

Coral Reef Ecosystem Assessments:

a) The average fish species richness for all sectors was extremely high in Timor-Leste (averaging 57 species per site) compared to any other Pacific region in NOAA-CREP surveys.
b) Small-bodied fish biomass in Timor-Leste was similar to remote, unpopulated areas in the Pacific Islands, while medium- and large-bodied fish biomass (including fisheries target species) was comparable to values from other human-populated areas in the Pacific.
c) Fish biomass was greatest in West Atauro compared to other remote areas in the Pacific, suggesting that West Atauro fish assemblages are relatively unimpacted by human activities and/or this is an area of high productivity.
d) The surgeonfish family had the highest biomass, accounting for 20% of the total fish biomass.
e) With respect to benthic cover, hard coral cover averaged 15.6% among the eight survey districts. Hard and soft corals as well as crustose coralline algae were more dominant than turf and macroalgae in Atauro, Liquiça, and Manatuto districts, favouring reef structure and integrity. In the remaining survey sites, turf and macroalgae were more dominant than corals and crustose coralline algae.
f) Live hard coral cover reached 40% within the recently designated Nino Konis Santana National Marine Park and 38% in the Belio Barrier Reef complex, reflecting some of the highest quality reefs in the country.
g) A diverse number of crustaceans have been found in the biodiversity assessments conducted using autonomous reef monitoring structures (ARMS), including important fishery targets, such as shrimp, crab, and lobster, with the highest mean cryptobiota diversity at the Biaucou and Tutuala sites.

Ecological Baselines for Climate Change:

a) Net calcium carbonate accretion rates (used to track early responses to acidifying seawater conditions) were among the lowest recorded among NOAA-CREP's Pacific monitoring sites and fell below predicted values based on water chemistry parameters.

b) Recorded reef seawater temperatures from Oct 2012 to Oct 2014 exceeded the previously reported maximum for northern Timor-Leste from the NOAA Reynolds Optimal Interpolation Sea Surface Temperature (OISST) dataset.
c) Timor-Leste's reefs have lower pH, aragonite saturation state, and net carbonate accretion values than many Pacific reefs monitored by NOAA-CREP. These low measurements recorded by MER suggest that ocean acidification impacts are part of a suite of already of Timor-Leste's reefs.

The Ministry of Agriculture and Fisheries (MAF), and other key stakeholders can use the data collected by NOAA-CREP as a baseline data for long-term monitoring of the status and trends of the habitats, marine resources, and biodiversity of Timor-Leste with the objective of informing coastal management decisions and evaluating the effectiveness of the resulting actions for sustainably managing coastal fisheries and development for the long-term benefits of the people of Timor-Leste. These benefits include improving food security, sustaining marine-based livelihoods, and ensuring coastal protection.

The information provided in the report by PIFSC (2017) provides a robust foundation for MAF and other coastal stakeholders to implement various types of Marine Spatial Planning for responsible use of Timor-Leste's nearshore habitats and ecosystem resources. The successful delineation of nearshore habitats and bathymetry and their associated mapping products will build upon these baseline datasets and help MAF understand how the nearshore and coral reef ecosystems of Timor-Leste change through time under differing management and climate change scenarios.

Below in Table 55, a summary of existing (and potential) national-scale, coastal and marine spatial datasets in Timor-Leste is presented, which are relevant to HCV and ecosystem-management.

Table 55 – List of HCVS of Timor-Leste

Data	Source	Scale	Date Acquired	Publication
Bathymetry	NOAA-CREP – bathymetry derived from WorldView2	National	2010-14	NOAA-PISC (2017)
	GEBCO bathymetric data - 5 broad marine depth classes	Global		Grantham et al. (2011)
Coastline	ALGIS	National		
Rivers	ALGIS	National		Grantham et al. (2011)
Estuaries	The Nature Conservancy	Regional		Grantham et al. (2011)
Land types	ALGIS (Geoformations), UNDP SLM project (landcover)	National		Grantham et al. (2011)
Habitat Mapping				
Benthic Habitats	NOAA-CREP – using WorldView2 imagery, includes substrates by depth (shallow, mid and deep) and 8 habitat classes: soft (sand or mud), hard (rubble, boulders, etc.), seagrass, mangrove, macroalgae-dominated areas; intertidal zones; lagoons; and emergent rocks.	National	2010-14	NOAA-PISC (2017)
Seascapes	Seascapes of the Lesser Sunda Ecoregion, including 7 'seascapes' (expert-based)	Regional	2008	DeVantier et al. (2008)
Coral Reefscapes	Seascapes of the Lesser Sunda Ecoregion, including 24 'coral reefscapes' (expert-based)	Regional	2008	DeVantier et al. (2008)
Coral Reefs	Millennium Ecosystem Mapping Project (Landstat derived) – 7 coral reef categories, based on geomorphology (http://imars.marine.usf.edu/MC/index.html)	Global		Grantham et al. (2011)
	Charles Darwin University, Northern Territory Government (Landstat 5TM)	National	2004-8	Boggs et al. (2009), Lieper et al. (2011).
	NOAA-CREP (WorldView2)	National	2010-14	NOAA-PISC (2017)
Mangroves	The Nature Conservancy	Regional		Grantham et al. (2011)
	Charles Darwin University, Northern Territory Government (Landstat 5TM)	National	2004-8	Boggs et al. (2009), Lieper et al. (2011).
	NOAA-CREP (WorldView2	National	2010-14	NOAA-PISC (2017)
Seagrasses	The Nature Conservancy	Regional		Grantham et al. (2011)
	Charles Darwin University, Northern Territory Government	Landstat 5TM	2004-8	Boggs et al. (2009), Lieper et al. (2011).
	NOAA-CREP (WorldView2)	National	2010-14	NOAA-PISC (2017)
Areas of Conservation Value				
Existing & Proposed MPAs/LMMAs	Ministry of Agriculture & Fisheries (MAF), TL CTI NCC	National	present	MAF-Fisheries
Existing/Proposed MPAs/AOIs	Lesser Sunda Ecoregion MPA Network (The Nature Conservancy)	Regional	2011	Wilson et al. (2011)
Key Biodiversity Areas (KBAs)	Critical Ecosystem Partnership Fund (CEPF) –KBAs identified as part of Ecosystem Profile of the Wallacea Biodiversity Hotspot	Regional	2014	Burung Indonesia (CEPF 2014)

Customary Protection	areas with 'tara bandu' regulations	National		MAF
	areas with local suco regulations	National		MAF
Important Bird Areas (IBAs)	BirdLife International	Global		BirdLife International Data Zone
Endemic Bird Areas (EBAs)	BirdLife International	Global		BirdLife International Data Zone
Important wetlands for birds	Colin Trainor (Charles Darwin University) – 24 wetland sites of national importance in Timor-Leste (expert-based)	National		Trainor et al. (2007), NBSAP (2012)
Biological surveys of protected areas	Fernando Santana (DPANP)	National		Grantham et al. (2011)
Records of birds of conservation concern	Colin Trainor (Charles Darwin University)	National		Grantham et al. (2011)
Community Monitoring Datasets				
Seagrasses	'SeagrassWatch' data – Beloi, Com	Sub-national		BV,
Mangroves	'MangroveWatch' data -	Sub-national		BV, UNDP, KFF,
Coral Reefs	'Reef Check' data –Atauro, Com	Sub-national		BV, Shane Penny (NT Government)
Dugongs	Dugong sightings - CMS Dugong & Seagrass Project (Beloi, Com)	Sub-national	2017-present	CI-Timor Leste
Cetaceans	Whales & Dolphins of Timor-Leste (CDU-UNTL-MTAC)	National	2014-present	Karen Edyvane (CDU-UNTL)
Ecosystem Assessments				
Reef Fish Surveys	NOAA-CREP – north coast (150 sites)	Sub-national	2013	PISC (2017)
Benthic Images	NOAA-CREP – north coast (139 sites)	Sub-national	2013	PISC (2017)
Benthic Cover	NOAA-CREP – north coast (139 sites)	Sub-national	2013	PISC (2017)
Climate Monitoring	NOAA-CREP climate monitoring (10 sites)- temperature, seawater chemistry calcification rates, invertebrate biodiversity (ARMS data), benthic images		2012-2014	PISC (2017)
Coastal Vulnerability	National hazard assessment and mapping (UNDP-NDMD-ADCP) – flood risk, landslide susceptibility, coastal erosion, strong wind, drought risk, earthquake, tsunami risk	National	2010-2012	UNDP-NDMD, UNDP (2010), ADCP (2012)
	Coastal Vulnerablity Assessment (UNDP)	National	2017	UNDP (2017)
Marine Species				
Seagrasses	Species distribution data – from benthic surveys (north coast)	Sub-national	2008-2013	Ayling etal (2009), CI MRAP (2012), PISC (2017)
Mangroves	Species distribution data – from benthic surveys (north coast)	Sub-national	2008-2013	Ayling etal (2009), CI MRAP (2012), PISC (2017)
Coral Reefs	Species distribution data – from benthic surveys (north coast)	Sub-national	2008-2013	Ayling etal (2009), CI MRAP (2012), PISC (2017)
Marine Megafauna	CDU-AIMS – marine megafauna aerial surveys- cetaceans, sea turtles, dugongs, sharks, rays	National	2008	Dethmers et al. (2009)
	CDU-UNTL-MTAC – marine megafauna aerial surveys- cetaceans, turtles, dugongs, sharks, rays	National	2014-present	Karen Edyvane (CDU-UNTL)
Marine Turtles	Kiki Dethmers (CDU-AIMS) – nesting sites, potential feeding areas	National	2008-present	Kiki Dethmers (CDU-AIMS)
	Whales & Dolphins of Timor-Leste (CDU-UNTL-MTAC)	National	2014-present	Karen Edyvane (CDU-UNTL)
Fish Species (distribution)	WorldFish – reef fish surveys (Atauro Island, Vemasse, Viqueque)	Sub-national	2017	

	NOAA-CRED – reef fish surveys (north coast)	Sub-national	2013	PISC (2017)
	CI-MRAP – reef fish surveys (NKS Park, Atauro Island)	Sub-national	2012, 2016	CI MRAP (2013)
	Australian Museum (north coast) – Barry Russell (NT Museum)	Sub-national	2012	Australian Museum
	CDU-NTG – reef fish surveys (north coast	Sub-national	2008	Ayling et al. (2009)
Crateroscephalus Laisapi (fish)	Helen K. Larson (NT Museum)	National		Grantham et al. (2011)
Socio-Economic, Cultural				
Aquaculture	MAF-Fisheries – sites of pond aquaculture, fish cages, FADs	National		MAF-Fisheries
Fisheries	'The National Fisheries Statistics System of Timor-Leste' - Peskador (FAO-funded) - http://peskador.org/ – data on fishing grounds, dangerous areas and fishers' movements, accidents at sea or in coastal areas	National		MAF-Fisheries, FAO RFLP program.
	WorldFish – data on boats, FADS, fisheries catches, fisheries production,	Sub-national		Mills et al. (2011), WorldFish, MAF
Customary Protection	areas with 'tara bandu' regulations	National		MAF
	areas with local suco regulations	National		MAF
Households	ALGIS – coastal households	National		Grantham et al. (2011)

Source: Edyvane, 2018

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