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STATUS OF MARINE INFORMATION FOR CONSERVATION MANAGEMENT IN TIMOR-LESTE

REVIEW AND INVENTORY OF HIGH CONSERVATION VALUE
MARINE DATASETS, PROGRAMS, ACTIVITIES AND FUTURE
PRIORITIES, DIRECTIONS

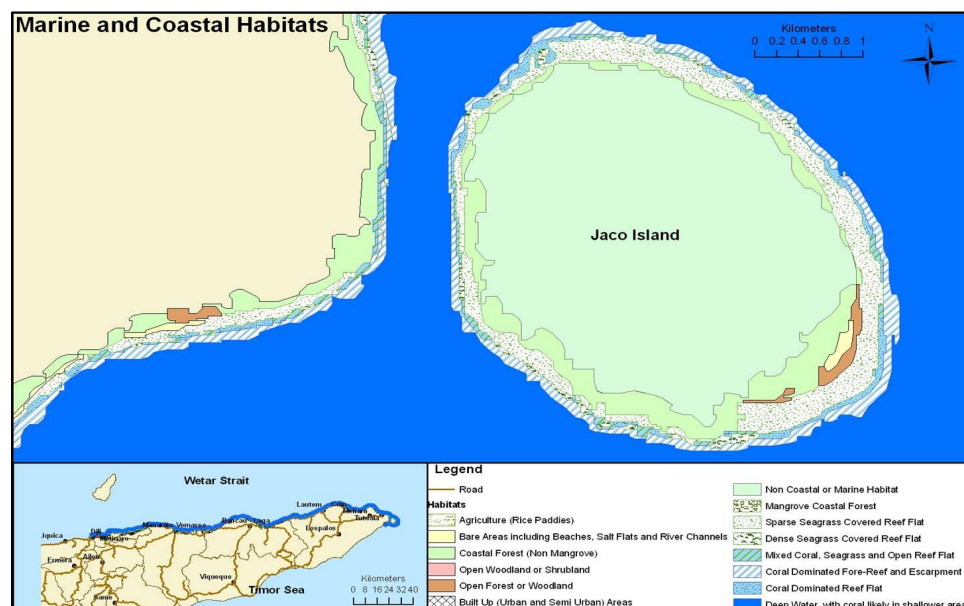


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Author(s): Dr Karen Edyvane for Chemonics International
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ACRONYMS

ADB	Asian Development Bank
ALGIS	Agricultural Land Use Geographical Information System (MAF)
ATSEF	Arafura Timor Seas Experts Forum
ATSEA	Arafura Timor Seas Ecosystem Action program
AusAID/DFAT	Department of Foreign Affairs and Trade (Australia)
BV	Blue Ventures
CBD	UN Convention on Biological Diversity
CBM	Community-Based Management
CDU	Charles Darwin University
CEPF	Critical Ecosystem Partnership Fund
CHM	Clearing House Mechanism
CI	Conservation International
CITES	Convention on the International Trade in Endangered Species
CMS	Convention on Migratory Species
CTC	Coral Triangle Centre (Bali-based)
CTI	Coral Triangle Initiative
CTI-CFF	Coral Triangle Initiative on Coral Reefs, Fisheries, and Food Security
CTI RPOA	Coral Triangle Initiative Regional Plan of Action
CTSP	Coral Triangle Support Partnership
DEE	Department of the Environment and Energy (Australia)
DPANP	Department of Protected Areas and National Parks
EAA	Ecosystem Approach to Aquaculture
EAFM	Ecosystem Approach to Fisheries Management
EBM	Ecosystem-Based Management
FAO	UN Food & Agriculture Organisation
GEF	Global Environment Facility
IBA	Important Bird Areas (Birdlife International)
ICM	Integrated Catchment Management
IOM	Integrated Ocean Management
ISLME	Indonesian Seas Large Marine Ecosystem

ISOE	Indian Ocean-South East Asian Marine Turtle Memorandum of Understanding
JICA	Japan International Cooperation Agency
KBA	Key Biodiversity Area
LMMA	Locally Managed Marine Area
LSE	Lesser Sunda Ecoregion
MAP	Ministry of Agriculture and Fisheries
MCIA	Ministry of Commerce, Industry and Environment
MCRM	Millenium Coral Reef Mapping Project
MMAF	Ministry of Maritime Affairs and Fisheries (Indonesia)
MPA	Marine Protected Area
MPW	Ministry for Public Works
MSP	Marine Spatial Planning
MSSI	Ministry of Social Solidarity and Inclusion
MTTI	Ministry of Tourism, Trade and Industry
NAP	National Action Plan
NBSAP	National Biodiversity Strategy and Action Plan 2011-2020
NDFA	National Directorate of Fisheries and Aquaculture
NEGA	National Ecological Gap Assessment
NOAA-CREP	National Oceanic and Atmospheric Administration-Coral Reef Ecosystem Program
NOP	National Oceans Policy
NORAD	Norwegian Agency for Development Cooperation
NTT	Nusa Tenggara Timur province (Indonesia)
NZAID	New Zealand AID
NUS	National University of Singapore
PEMSEA	Partnerships in Environmental Management for the Seas of East Asia
PIFSC	Pacific Islands Fisheries Science Center (NOAA)
PoWPA	UNDP Program of Work on Protected Areas
PAN	Protected Areas Network
RAMSAR	Convention on Wetlands (Ramsar, Iran, 1971)
RDTL	Republica Democratica Timor-Leste
RFLP	Regional Fisheries Livelihoods Programme for South and Southeast Asia (FAO)
ROLU	Roman Luan

SAP	Strategic Action Plan
SDP	Strategic Development Plan of Timor-Leste 2011-2030
SEA	Sekretaria Estado Ambiente (Secretary of State for the Environment)
TDA	Transboundary Diagnostic Analysis
TL CTI NCC	Timor-Leste CTI National Coordinating Committee
TNC	The Nature Conservancy
UNDP	United Nations Development Program
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNTAET	United Nations Transitional Administration in East Timor
UNWTO	United Nations World Tourism Organisation
USAID	United States Agency for International Development
WF	WorldFish
WWF	World Wildlife Fund

EXECUTIVE SUMMARY

The vision behind USAID's investment in the tourism sector through USAID's Tourism for All Project (Tetun: *USAID nia Projetu Turizmu Ba Ema Hotu*) is to promote Timor-Leste's competitiveness as an international tourism destination while preserving its unique environmental and cultural heritage. It also recognizes that effective conservation, planning and management systems are essential to protect areas of high conservation value (HCV) and national/global significance – and also essential to the future growth and success of the tourism sector.

Similarly, without integrated coastal management (ICM), poorly planned coastal developments, marine pollution, over-fishing, rising sea levels pose major threats to local communities and coastal ecosystems – and also, to local tourism.

While there has been many HCV development partners, program and activities in Timor-Leste, much still needs to be done. Including an formal assessment of the current status of marine HCV knowledge and management (particularly for protected areas)– and also, the identification of future marine HCV investment priorities.

This review aims to provide an updated, and living, national inventory of key marine HCV datasets (including identified HCV areas and data gaps); and a review / assessment of the current state of HCV information systems and HCV management (particularly for protected areas).

Specifically, under the USAID's Tourism for All Project and Scope of Works, this report aims to:

- a) review the current state of marine HCV management in Timor-Leste (including government, stakeholder engagement, coordination and management);
- b) review current, publicly-available marine HCV mapping, inventory and datasets (including data gaps, collection/mapping discrepancies and data priorities);
- c) review of current national, marine HCV mapping and existing marine GIS and data management systems, including identifying next steps and processes for establishing (and updating) a single, national marine HCV GIS database and inventory;
- d) identify options to support GoTL and key stakeholders in marine HCV management including specific tools, resources, and trainings; and
- e) provide a comprehensive annex and inventory of key HCV areas, list of coastal-marine HCV areas, relevant datasets and maps at a national scale - and relevant HCV programs, reports and plans.

Key HCV Issues, Gaps/Priorities

Status of IOM, ICM and EBM Management

1. Marine inventory and marine spatial data is not only essential for HCV management but is also the first step in implementing marine-Ecosystem-Based Management (EBM) , particularly Marine Spatial Planning (MSP).
2. With several major regional marine-EBM and MSP programs currently underway in Timor- Leste and few national coordination mechanisms for marine HCV (and ICM, IOM) management - there is an urgent need to ensure greater donor/partner coordination and alignment of marine HCV, ICM and IOM activities (including marine monitoring, data collation for coastal and marine spatial planning).
3. Many of the national/regional marine-EBM and IOM programs underway in Timor-Leste need marine spatial information. There is a critical need to review, consolidate current coastal and marine datasets (particularly at the national-scale) to support IOM, ICM and marine-HCV management.
4. Several national/regional marine data collation, inventory and integrated, accessible data platforms (GIS systems) are being considered under several major IOM-EBM programs. As such, there is also a need to coordinate (and centralise) national coastal and marine data management activities.
5. The National Oceans Policy (NOP) and Implementation Plan, with its focus on IOM and marine EBM governance framework for IOM, ICM and marine EBM in Timor-Leste (including inter-ministerial and cross-sectoral coordination) is an ideal vehicle to progress coordination of relevant IOM, ICM, EBM activities in the waters of Timor-Leste, including national marine data management, and marine-HCV related programs.
6. There is also a need to review or re-focus new IOM and spatial planning programs (ie. proposed national seascape planning in Timor-Leste), to focus national efforts (and limited resources) on the NOP Implementation Plan – and also to address critical, emerging, ICM issues (in light of the current national priority on major infrastructure development in the coastal zone).
7. Marine HCV management and EBM, IOM and would be considerably strengthened if the membership of the CTI-NCC TL was broadened to promote/facilitate greater inter-agency, cross-sectoral and also, donor/partner coordination.
8. While local, community-based, conservation and natural resource management approaches (eg. co-managed Locally Managed Marine Area LMMAs, fisheries, participatory monitoring) are appropriate and should continue to be supported - there is a critical need for national, coordination of these activities (particularly baseline assessments, monitoring and data management) and broader, EBM-scale management.

MPA Network Planning

1. Need to ensure marine-freshwater and terrestrial integration in planning and developing the Protected Areas Network and avoid duplication (where possible), particularly with strategies, management plans, gap analyses, training and capacity building plan.

2. Need to ensure that all relevant and available TL datasets are used to update the marine PAN in TL, as proposed Arafura Timor Sea MPA Network (under ATSEA2).
3. With additional data, additional marine-Key Biodiversity Areas may also be identified, particularly on the data-poor, southern coast.
4. With the proposed ATS MPA network (under ATSEA2), there is a critical need for a national, Marine Protected Areas Strategy and Plan, to help support the planning and establishment of an ecologically, representative network of MPAs in Timor-Leste, including identifying MPA/LMMA priorities, planning processes, monitoring and management tasks (including partnerships), and significantly, clarifying management and administrative arrangements.

Current MPA-LMMA Estate - Key Issues, Gaps/Priorities

1. With several major partners involved in supporting LMMAs/MPAs there is a critical need for a formal, national, coordinated approach to LMMA/MPA planning, establishment and management. Particularly data collection and monitoring activities, including standardized methods and data deposition, agreed training (level/type) and ongoing technical support (particularly for local communities). As a matter of priority, coral reef and fisheries monitoring in LMMAs, MPAs and across Timor-Leste needs to be coordinated (particularly on Atauro Island).
2. A large number of co-managed LMMAs/MPAs are currently being planned / implemented by MAF across Timor-Leste (32). However, there is an urgent need for prioritization and a cautious approach - due to the critical need for complementary, alternative livelihood development (to offset impacts from fishing restrictions), and also, a major lack of resources for training and ongoing technical support for co-management (to support communities with LMMA baseline surveys, ongoing monitoring, compliance).
3. With the large number of LMMAs and No-Take Zone's currently being progressed/established on Atauro Island (13) (with several development partners), a stocktake and review of activities is needed to assist with coordinated LMMA planning / monitoring / management and livelihood development.
4. Similarly, with the wide range of donors and activities in the Nino Konis Santana (NKS) Marine Park and the proposed update of the management plan – a stocktake and review of marine HCV MPA/LMMAs activities in the NKS marine park – would assist with identifying key information gaps, monitoring/management needs, areas for improved donor coordination and importantly, identify lessons learnt.
5. Poor coordination and a critical lack of data-sharing (particularly between development programs) continues to be a significant challenge for marine-HCV management in Timor-Leste. This has been exacerbated by major HCV investment and development partner activity focussed on a few key locations (ie. Atauro Island and Nino Konis Santana MP). This has resulted not only in overlap, duplication of effort (ie. coral reef surveys, habitat mapping), but also significant lost opportunities for marine data integration.

6. Importantly, a national Marine Protected Areas strategy and plan could assist with not only setting MPA/LMMA priorities, but also improving donor/partner coordination in MPA/LMMA planning, monitoring and management, and also, identifying and prioritizing complementary livelihood development programs.
7. Coordinated marine HCV monitoring and management efforts (including standardized data collection) could also be strengthened if the membership of the CTI NCC TL was broadened to include relevant donors/programs involved in LMMA/MPA establishment and management.

Priorities for Marine National Habitat Mapping, Surveys

1. Complete national-scale marine habitat mapping (coral reefs, seagrasses, mangroves) of Timor-Leste. Specifically, there is a need to undertake benthic surveys of nearshore habitats, particularly along the south and northwest coasts (both, to validate existing satellite-based habitat mapping by NOAA-CREP and Charles Darwin University, and to inform biodiversity/conservation planning). Surveys should utilise cost-effective, existing field survey methodologies already established for the north coast. For any additional finer-scale, marine surveys and mapping, existing or proposed MPAs / LMMAs should be prioritized.
2. Undertake finer-scale, mangrove community mapping (1:10,000) and floristics, on the south and northwest coast. Explore the use of recent UNDP mangrove floristics data (collected at 11 sites) and also ongoing mangrove monitoring data (including Mangrove Watch).
3. Undertake a 'stock-take', analysis and consolidation of existing nearshore habitat mapping and extensive benthic survey datasets – particularly nearshore coral reef surveys (ie. corals, seagrasses, invertebrates, fish) - to (a) validate and improve accuracy of existing (satellite-based) habitat mapping, and (b) generate additional valuable national-scale marine datasets.
4. Potential additional datasets include key marine species mapping and also indicators of marine ecosystem condition. For example, 'benthic substrate ratio', defined as the ratio of the sum of coral (hard and soft) and crustose coralline algae (CCA), divided by the sum of turf and fleshy macroalgae, is often used as a metric of 'coral reef condition' (Houk et al. 2010).
5. Globally available satellite remote sensing and model-assimilated data should be used to define and delineate biophysical environments particularly in deeper water habitats (to assist both HCV management, EBM and importantly, provide a foundation for marine spatial planning).

Marine Megafauna Datasets

1. There is very little spatial information and national datasets on marine rare and threatened, endangered or protected species (TEPS). Where data has been collected (ie. cetaceans, turtles, dugongs, crocodiles), there is an critical need for data collation, analysis and development of spatial datasets. Lack of information on ‘critical habitat’ for TEPS, ie. key nesting, foraging breeding sites, remains a major data gap.
2. Under ATSEA 2, several marine megafauna conservation activities are proposed, including a turtle Regional Plan Of Action and a Timor-Leste crocodile management plan. Baseline data collection (including critical habitat) and spatial datasets to support the development of these plans is a major priority.
3. No population census of crocodiles in Timor-Leste has ever been undertaken. Baseline crocodile population surveys, to complement the proposed national crocodile management plan (under ATSEA2) are urgently needed – including identifying nesting sites. As a migratory species, ongoing crocodile monitoring and management is best progressed through cooperation with the current West Timor crocodile program. Technical support can also be accessed under existing Timor-Leste-Northern Territory crocodile cooperation – including technical support for National Crocodile Taskforce. The Northern Territory is a recognized global leader in crocodile conservation and management.
4. With lack of data being a critical issue for marine megafauna, there is the potential to use of innovative modelling to identify ‘marine megafauna hotspots’, including identification of critical habitat.
5. Community-based monitoring of marine megafauna and TEPS holds great potential in Timor-Leste, particularly if integrated with community-based natural resource management. However, such activities need to be nationally coordinated and supported by training and ongoing technical support to communities, if valid datasets are to be generated.

Community-based Marine Monitoring

1. Community-based marine survey and monitoring datasets are generally not widely available/accessible. And data when collected, rarely gets collated, shared or analysed to develop broader-scale datasets. Data validation and accuracy and level of training and ongoing technical support, are also critical issues, when many persons or stakeholders are collecting data.
2. Guidelines and standards on community-based marine resource surveys, monitoring and mapping would greatly assist with marine HCV management, particularly LMMAs/MPAs. Agreed standards on training and ongoing technical support to local communities is also essential. Under CTI-CFF, Solomon Islands has produced an excellent technical guide to community-based marine monitoring, which should be considered for Timor-Leste.

3. Internationally-recognised community-based marine monitoring programs, ie. 'SeagrassWatch', 'ReefCheck' and 'MangroveWatch' provide standardized training, monitoring and technical support. But activities need to be nationally coordinated, with greater data availability/accessibility.
4. Innovative new technology exists to enable easy/direct data uploads from mobile phones – with technical support/supervision. Charles Darwin University turtle researchers have been developing this for community-based turtle monitoring in PNG. Such tools could easily be customized for community-based, marine megafauna monitoring in Timor-Leste.
5. Current Community-Based Marine (CBM) monitoring efforts in Timor-Leste, largely target local fishers. Students and youth remain a major, largely untapped, target audience for community-based, 'citizen science' programs. Environmental youth programs can also significantly support and strengthen 'citizen science' data collection programs.
6. For community-based marine species monitoring programs, there are also opportunities to explore 'electronic inventories' (ie. e-Bird) and public sightings/reporting programs (ie. Whales & Dolphins of Timor-Leste), and to support data collection, and also, promote community awareness, education and engagement.

Marine HCV Data Management, Inventory

1. No centralized, national marine information platform currently exists for Timor-Leste to support IOM (including HCV mapping and marine spatial planning). Several national and regional marine data management information systems (and/or GIS's) have been developed for Timor-Leste, under a range of development programs (ie. USAID-funded NOAA-CREP, MCIE-NORAD, FAO RFLP, CTI-CFF). However, several platforms are currently non-operational or non-supported.
2. Significantly, a range of national-scale marine datasets are currently available to support HCV mapping, inventory and management (and EBM, IOM). This includes marine datasets under previous protected area planning programs and also, analysis and/or integration of existing Timor-Leste, regional and global datasets.
3. In addition, the ATSEA2 program will bring together key marine spatial HCV datasets (marine habitats, key marine species, biodiversity hotspots, marine uses) for Timor-Leste, to assist with the identification of a regional ATS MPA network and priority conservation areas.
4. In developing a national marine GIS and data platform, agreement on a 'data management governance model' (including designated responsible agency, location of the data platform, role of key stakeholders and data providers) will be essential. Collaborative models, like the Sunda Banda Seascape GIS, provide a good case study on how data can be shared between governments, universities and NGOs.
5. GIS training of ALGIS and MAF/MCIA staff has been supported by several partners. However, a long-term capacity development plan is needed to support ongoing training and access to expertise and technical support. Supporting accredited training (at university level) will also significantly enhance long-term, local capacity development. Charles Darwin University's spatial science training programs in West Timor are a good

case study of long-term, training/capacity-building with government agencies, universities.

6. Improved inter-agency coordination mechanisms (including TL CTI NCC) and the establishment of a Biodiversity CHM and national CHM website for Timor-Leste (a commitment under the National Biodiversity Strategy and Action Plan(NBSAP) could greatly assist with the coordination of biodiversity, environmental and HCV-related programs and activities (including data collection and management).

NEXT STEPS

Marine HCV Management, Data Inventory and National Mapping

1. Develop a national, Marine Protected Areas Strategy and Plan, to help support the planning and establishment of an ecologically, representative network of MPAs in Timor-Leste, including identifying MPA/LMMA priorities, planning processes, monitoring and management tasks (including partnerships), and significantly, clarifying monitoring, management and administrative arrangements, including improving donor/partner coordination.
2. Undertake a stocktake and review of LMMA/MPA activities on Atauro Island and the NKS Marine Park - to identify key information gaps, monitoring/management needs and ensure national-scale and local-scale, coordinated LMMA planning / monitoring / management and livelihood development. Including areas for improved donor/partner coordination and lessons learnt.
3. Establish a Biodiversity CHM and national CHM website for Timor-Leste (a commitment under the NBSAP) to assist with the coordination of biodiversity, environmental and HCV-related programs and activities (including data collection and management).
4. Complete national-scale marine habitat mapping of Timor-Leste. Undertake benthic survey of nearshore habitats (including floristic survey of mangroves) of the southern coast (to validate satellite mapping) – using cost-effective, existing survey methodologies established for the north coast. For additional marine surveys and mapping, proposed MPAs/LMMAs should be prioritized.
5. Undertake a ‘stock-take’, analysis and consolidation of existing nearshore habitat mapping and extensive benthic survey datasets – particularly nearshore coral reef surveys (ie. corals, seagrasses, invertebrates, fish) - to (a) validate and improve accuracy of existing (satellite-based) habitat mapping, and (b) generate additional valuable national-scale marine datasets.
6. Develop Guidelines and standards on community-based marine resource surveys, monitoring and mapping to assist with marine HCV management, particularly LMMAs/MPAs. Include agreed standards on training and guidance on ongoing technical support to local communities. Under CTI-CFF, Solomon Islands has produced an excellent technical guide to community-based marine monitoring, which should be considered for Timor-Leste.
7. Support baseline information on marine threatened, endangered and protected (TEP) species in TL – particularly marine megafauna (eg. cetaceans, dugong, sea turtles, crocodiles). Particularly ‘critical habitat’ – nesting, foraging, breeding areas.
8. As a priority, support baseline crocodile surveys, to complement the proposed TL crocodile management plan (under ATSEA2) – including population census and identifying nesting sites. Support and extend existing TL-NT crocodile cooperation – including technical support for National Crocodile Taskforce. NT is a recognized global leader in crocodile conservation and management.

9. Assist community-based marine mapping, inventory and monitoring efforts through development of smart technology, including phone-based data collection applications, with opportunities for technical support, data validation and quality assurance.
10. Environmental youth programs can also significantly support and strengthen 'citizen science' data collection programs. Current CBM monitoring efforts in Timor-Leste, largely target local fishers. Students and youth remain a major, largely untapped, target audience for community-based, 'citizen science' programs. Prioritise marine megafauna and TEPs for CBM monitoring and development of smart technology and environmental youth programs.

Priorities for National Marine HCV Data Management, Inventory Update

1. Develop a long-term capacity development plan to support ongoing GIS training and access to expertise and technical support. Support the development of accredited training (at university level) to enhance long-term, local capacity development. CDU's spatial science training programs in West Timor are a good case study of long-term training/capacity-building with government agencies, universities.
2. In consultation with MAF-ALGIS and key stakeholders, develop a 'road map' for a national, centralized, marine data management system in Timor-Leste (Timor One Ocean Map) including:
 - (a) reviewing current and proposed national/regional marine GIS initiatives/commitments under related IOM, EBM and MSP programs
 - (b) identifying a proposed data management framework, governance model;
 - (c) identifying potential key steps in establishing a national marine data management framework, including (among others):
 - collate existing datasets and establish a centralised Timor-Leste national marine data inventory and create a national marine metadata database for Timor-Leste (including identifying data custodians)
 - conduct a comprehensive TL marine program/activity audit – to develop a national TL marine inventory – including identifying current and historical marine datasets.
 - marine HCV-related, environmental, fisheries and EBM datasets should be a first priority.
 - conduct stocktake and review of existing GIS platforms, data portals
 - define data-sharing obligations/responsibilities and clarify IP issues
 - define national mapping protocols (SOPs), including mapping classes/classification, accuracy/validation, metadata standards
 - promote public accessibility of data, including 'on-line' data portals
 - (d) identifying training needs and ongoing technical support; and
 - (e) defining ongoing administrative, data coordination and update/maintenance responsibilities.

SECTION I

BACKGROUND, DEFINITIONS, SCOPE OF REPORT

I.1 BACKGROUND, GOAL, OBJECTIVES AND SCOPE OF REPORT

Under the ‘Timor-Leste Strategic Development Plan 2011-2030’, tourism has been identified as a key pillar in economic diversification, economic rural development and particularly the growth of the non-oil economy. Both, the SDP and recent ‘Tourism Policy’ (2016) recognize the global significance of Timor-Leste’s natural heritage and highlight the potential for ecotourism development, particularly coastal and marine ecotourism. For a sustainable ecotourism sector in Timor-Leste, the protection and wise use of coastal and marine ecosystems is vital.

The vision behind USAID’s investment in the tourism sector through USAID’s Tourism for All Project (Tetun: *USAID nia Projetu Turizmu Ba Ema Hotu*) is to promote Timor-Leste’s competitiveness as an international tourism destination while preserving its unique environmental and cultural heritage. It also recognizes that effective conservation, planning and management systems are essential to protect areas of high conservation value (HCV) and national/global significance – and also essential to the future growth and success of the tourism sector.

Similarly, without integrated coastal management (ICM), poorly planned coastal developments, marine pollution, over-fishing, rising sea levels pose major threats to local communities and coastal ecosystems – and also, to local tourism.

The first steps in the effective protection and management of current and potential HCV areas is (1) an inventory of key biological and ecological resources, including key data gaps and identified HCV areas (both, recognized and potential); and (2) an review / assessment of current state of HCV management (including governance, policies, programs and activities).

While Timor-Leste is a newly, independent nation, its coastal and marine biodiversity and ecosystems are becoming increasingly recognized as globally significant - and vital for the well-being and livelihoods of coastal subsistence communities. Recent global, regional and national assessments (Burke et al. 2011) however, have also highlighted the limited extent and pronounced ecological and socio-economic vulnerability of these ecosystems - and potential serious impacts on coastal and marine ecosystems, resources, and the livelihoods of many coastal communities - if they are not protected or effectively managed.

With the support of development partners, Timor-Leste has made significant progress (particularly over the past decade), in identifying and managing its globally significant biodiversity and marine natural estate – particularly through its commitment and progress in planning and establishing a network of Marine Protected Areas.

While there has been many HCV development partners, program and activities, much still needs to be done. Including an formal assessment of the current status of HCV knowledge and management – also, future HCV investment priorities.

An updated, and living, national inventory of key biological and ecological resources (including identified HCV areas and data gaps), is needed to guide future HCV programs, activities and priorities. While a review / assessment of the current state of HCV information systems and HCV management (particularly for protected areas) - will assist with national, coordinated HCV information management and donor/partner coordination.

Under the USAID’s Tourism for All Project and Scope of Works (Annex A), this report aims to:

- f) review the current state of marine HCV management in Timor-Leste (including government, stakeholder engagement, coordination and management);
- g) review current, publicly-available marine HCV mapping, inventory and datasets (including data gaps, collection/mapping discrepancies and data priorities);
- h) review of current national, marine HCV mapping and existing marine GIS and data management systems, including identifying next steps and processes for establishing (and updating) a single, national marine HCV GIS database and inventory;
- i) identify options to support GoTL and key stakeholders in marine HCV management including specific tools, resources, and trainings; and
- j) provide a comprehensive annex and inventory of key HCV areas, list of coastal-marine HCV areas, relevant datasets and maps at a national scale - and relevant HCV programs, reports and plans.

1.2 METHODS

While much marine HCV activity has taken place in Timor-Leste, there is currently no one data platform or website that collates or provides an inventory of past or current activities and outputs. Further, publicly accessible reports for many of the activities are currently not available or difficult to access. To this end, information and datasets for this report relied heavily on published or accessible reports from web searches, interviews and also, direct requests to donors/partners, NGOs and particularly, government staff.

1.2.1 DEFINING 'HIGH CONSERVATION VALUES'

In defining and assessing the status of marine HCV datasets and management in Timor-Leste, this report adopts criteria of the concept of high conservation value (HCV) developed by the Forest Stewardship Council¹ (see Box 1) and also, the concept of Key Biodiversity Areas (or KBAs).

Box 1: Definitions of the six High Conservation Values (HCVs)

The concept of high conservation value (HCV) was developed by the Forest Stewardship Council with six criteria that indicate forests with significant biological, environment and social values, summarized below:

- HCV 1: Concentrations of biological diversity including endemic species, and rare, threatened or endangered species, that are significant at global, regional or national levels.
- HCV 2: Landscape-level ecosystems and mosaics. Intact forest landscapes and large landscape-level ecosystems and ecosystem mosaics that are significant at global, regional or national levels, and that contain viable populations of the great majority of the naturally occurring species in natural patterns of distribution and abundance.
- HCV 3: Rare, threatened, or endangered ecosystems, habitats or refugia.
- HCV 4: Basic ecosystem services in critical situations, including protection of water catchments and control of erosion of vulnerable soils and slopes.
- HCV 5: Sites and resources fundamental for satisfying the basic necessities of local communities or indigenous peoples (for livelihoods, health, nutrition, water, etc...), identified through engagement with these communities or indigenous peoples.
- HCV 6: Sites, resources, habitats and landscapes of global or national cultural, archaeological or historical significance, and/or of critical cultural, ecological, economic or religious/sacred importance for the traditional cultures of local communities or indigenous peoples, identified through engagement with these local communities or indigenous peoples.

— HCV RESOURCE NETWORK

¹ HCV Resource Network, <https://www.hcvnetwork.org/about-hcvf/the-six-high-conservation-values>
<https://www.hcvnetwork.org/about-hcvf>

In identifying recognized marine-HCV areas, this report focuses on the following internationally recognized protection instruments:

- *Key Biodiversity Areas (Annex 3.1)* - Key Biodiversity Areas (KBAs)² are nationally identified sites of global significance and directly address the first criterion of the High Conservation Value (HCV) approach to identifying environmentally sensitive areas, which is 'areas containing globally, regionally or nationally significant concentrations of biodiversity values'. KBAs include terrestrial, freshwater, and marine environments under national jurisdiction and significantly, and are recognised as seen an 'umbrella' designation, which include globally important sites for different taxa and realms (such as Important Bird and Biodiversity Areas (IBAs)³, and also, can assist with identification of protected areas.⁴ In Timor-Leste, terrestrial and marine KBAs have recently been identified in a critical biodiversity assessment of the broader Wallacea region (CEPF 2014).
- *Marine Protected Areas (Annexes 2.8, 2.9)* - An MPA is a coastal or offshore marine area where human activities are managed and regulated by authorities to preserve its ecosystem and cultural resources (Box 2). MPAs in Timor-Leste (and other Coral Triangle countries) are mandated under legal arrangements that range from national legal frameworks and laws to Local Marine-Managed Areas (LMMAs) established using local village level traditional law and practices. In all countries, the support and participation of local communities and local governments is essential for successful implementation of MPAs, regardless of what is the primary legal mandate supporting MPAs.
- *Important Bird Areas (IBAs) (Annex 3.2)* – based on country-wide assessments of Timor-Leste by BirdLife International (Trainor et al. 2007).
- *Globally Threatened Species (Annex 3.8)* – based on a recent assessment of marine (and terrestrial) threatened species in the Wallacea region, including Timor-Leste (CEPF 2014).

² <http://www.biodiversity-z.org/content/key-biodiversity-areas-kba#citation-3>

³ <http://biodiversity-z.org/content/important-bird-and-biodiversity-areas-iba>

⁴ While the identification of an area as a KBA does not necessarily lead to legal protection or recognition by national government, many . KBAs sites identified so far overlap with an existing protected area and hence have legal protection³. As such, the identification of KBAs can also support the designation of additional protected areas.

Box 2: What is a Marine Protected Area (MPA) ?

An MPA is a coastal or offshore marine area where human activities are managed and regulated by authorities to preserve its ecosystem and cultural resources. MPAs range from areas defined under national laws to community-managed local marine managed areas (or LMMAs). Well-managed MPAs can conserve biological diversity, protect fish spawning and nursery habitats, protect shorelines, serve as a platform for scientific research and eco-tourism, improve food security, and enhance the quality of life in surrounding communities. MPAs are often the cornerstone of coastal and marine resource management and essential strategies within the context of integrated coastal and fisheries management.

When inter-connected, networks of MPAs and LMMAs, can act synergistically, achieving significant ecosystem and community benefits.

The Coral Triangle Initiative (CTI) recognizes that MPAs are effective resource management tools. Under its Regional Plan of Action (2009), the CTI aims to place 20% of each major marine and coastal habitat in the Coral Triangle under protected status by 2020. Individual MPAs within and between countries will be scaled up and linked to form a connected, resilient and sustainably-financed Coral Triangle MPA System (or CTMPAS).

— CTI-CFF (2011)

And also, the following national HCV instruments and assessments:

- *Protected Aquatic Species (Annex 3.9)* – species protected under the recent Joint Ministerial Order No. 18/MAP/MCIA/II/2017 List of Protected Aquatic Species.
- *Wetlands of High Conservation Significance (Annex 3.3)* – recognised wetlands of national significance recognised by Trainor et al. (2007) and the National Biodiversity Strategy and Action Plan (NBSAP) (2012).

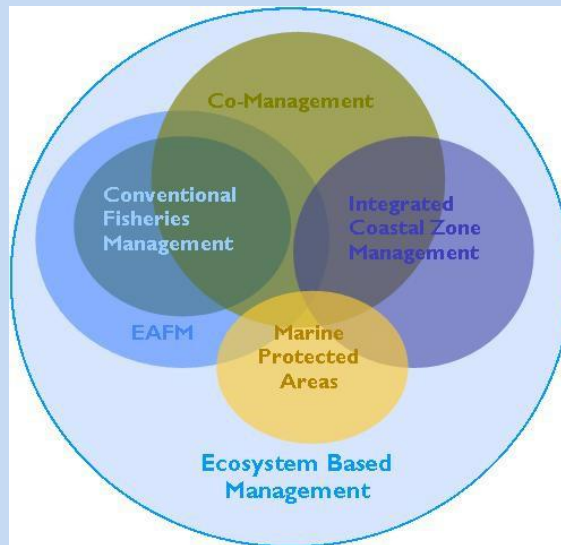
1.2.2 MPAS, HCVS AND INTEGRATED OCEAN MANAGEMENT

This report also recognises that MPAs and HCVs are an essential pillar in multi-sectoral ecosystem-based management (EBM), including integrated coastal management (ICM). MPAs, in line with the principles of EAFM, are likely to be used to address multiple objectives, covering both fisheries management and conservation objectives. Further, MPAs are often considered strategies within ICM, EAFM and EBM (see Box 3). Co-management is an approach used within sector and integrated management regimes.

Box 3: The Role of MPAs in Integrated Ocean Management

There is often confusion among managers about which, of the many marine resource management approaches to achieve sustainable development, they should be using - for eg. co-management, conventional fisheries management, integrated coastal management (ICM), marine protected areas (MPAs), ecosystem-based management (EBM), ecosystem approach to fisheries management (EAFM).

A distinction can be made between these approaches. Multi-sector approaches, such as EBM and ICM, deal with goals for sustainable development in a given region or ecosystem, including all sectors such as fisheries, mining, shipping, and tourism. In contrast, sector-based approaches, such as EAFM, focus on managing one sector, e.g. fisheries, in a way that is consistent with a wider, ecosystem well-being focus. The figure below shows the interface of the different approaches to marine resource and ecosystem management. Together, these strategies, when implemented, effectively and in coordination, add up to an ecosystem based management (EBM) regime.



— CTI-CFF (2011)

1.2.3 KEY FOCUS OF THE REPORT

The specific focus of this report is on reviewing marine HCV protection and biodiversity-related datasets (HCV 1-3) and data management in Timor-Leste - excluding socio-cultural values (HCV 5-6). Neither is it a detailed review of marine biodiversity taxa, assemblages, patterns or their current status. Further, while MPAs and marine HCVs undoubtedly contribute to, and support ICM, EAFM and EBM – reviewing broader ICM, EAFM-related datasets, including physical processes (ie. oceanography, coastal processes), human uses/activities (ie. fisheries, aquaculture, shipping, coastal protection, etc.) or human impacts (ie.) is not the focus of this report.

I.3 HOW TO USE THIS REPORT

This report is organized into 6 Sections, providing an overview of marine HCV management in Timor-Leste; current status/gaps and priorities in HCV datasets and mapping; and current status of HCV data management systems; and priorities, next steps for marine HCV data and HCV management:

- **Section 1** – *Background, Definitions, Scope of Report.*
- **Section 2** - *Status of Marine HCV Management* – including a review of current IOM and marine HCV management (status, issues, priorities) in Timor-Leste, together with the following inventories:

Coastal & Ocean Governance

- *Marine & Coastal Policies (Annex 1.1)*
- *Marine & Coastal Legislation (Annex 1.2)*
- *Marine Environmental Agreements, Forums, Areas of Cooperation (Annex 1.3)*
- *Major Marine and Coastal Environmental Programs (Annex 1.4)*

Marine HCV Management

- *National Conservation Targets in Timor-Leste (Annex 2.1)*
 - *Proposed Timor-Leste Protected Area Network (PAN) (Annex 2.2)*
 - *Gazetted Protected Areas in Timor-Leste (Annex 2.3)*
 - *CTI National Plan of Action for Timor-Leste (Annex 2.4)*
 - *Timor-Leste CTI National Coordinating Committee (Annex 2.5)*
 - *Marine Protected Area Planning Programs in Timor-Leste (Annex 2.6)*
 - *Proposed Lesser Sunda MPA Network (Annex 2.7)*
 - *Current Marine Conservation Estate in Timor-Leste (Annex 2.8)*
 - *Nino Konis Santana Marine Park (Annex 2.9)*
 - *Marine Programs, Activities in the Nino Konis Santana Marine Park (Annex 2.10)*
 - *Marine Programs, Activities on Atauro Island (Annex 2.11)*
 - *MPAs Management Effectiveness Assessment Tool (MEAT) (Annex 2.12)*
- **Section 3** - *Review and Inventory of Marine HCV Datasets* - including a review and available marine HCV datasets in Timor-Leste (ie. status, gaps, priorities) including the following inventories:
 - *Seascapes, Reefscapes and Ecosystems:*
 - *Identified Key Biodiversity Areas (KBAs) (Annex 3.1)*

- *Important Bird Areas (IBAs), Endemic Bird Areas (EBAs) (Annex 3.2)*
- *Wetlands of National Importance (Annex 3.3)*
- *Recognised 'Seascapes' and 'Reefscapes' (Annex 3.4)*
- *Marine Protected Areas (current, proposed) (Annex 2.7)*
- *Locally Marine Managed Areas (current, proposed) (Annex 2.7)*

- **Habitats and Biodiversity:**
 - *Coastal & Marine Habitats (Annexes 3.5, 3.6)*
 - *High Conservation Priority Coral Reefs (Annex 3.7)*
 - *Globally Threatened Species in Timor-Leste (Annex 3.8)*
 - *Aquatic Protected Species in Timor-Leste (Annex 3.9)*
 - *Diversity – Mangroves, Seagrasses, Coral Reefs*
 - *Protected Marine Megafauna – dugongs, cetaceans, sea turtles, crocodiles (Annex 3.10)*
 - *Other Marine Megafauna – whale sharks, rays, sailfish, tuna*

- **Indicators of Marine Ecosystem Condition (Annex 3.11)**

- **Section 5 - HCV and Coastal-Marine Data Management** - including a review of existing / potential marine data management systems in Timor-Leste and existing / potential marine datasets (ie. including the following inventories:
 - *Datasets Used in Previous MPA Planning (Annex 4.1)*
 - *Datasets from the NOAA-CREP Marine Ecosystem Program (Annex 4.2)*
 - *Potential Datasets for HCV/MPA Planning in Timor-Leste (Annex 4.3)*
 - *Existing GIS, Data Portals (Peskador, Coral Triangle Atlas) (Annexes 4.4-4.6)*
 - *Marine GIS Activities Proposed Under the ATSEA2 Program (Annex 4.7)*

- **Section 6 - Supporting Marine HCV Management, Next Steps.**

SECTION 2

STATUS OF HCV MARINE MANAGEMENT IN TIMOR-LESTE

2.1 GLOBAL MARINE BIODIVERSITY HOTSPOT

Timor-Leste's marine estate includes approximately 700 km of coastline (including several offshore islands). Located within the Coral Triangle, the recognised global epicentre of tropical marine biodiversity (see Box 4, Annex A2), the coastal and marine ecosystems of Timor-Leste are globally significant. As such, the waters of Timor-Leste are characterised by exceptional levels of marine biodiversity (corals, mangroves, fishes, invertebrates, cetaceans), including some of the highest levels of marine biodiversity ever recorded (Edyvane et al. 2009, Alongi et al. 2011, Turak and Devantier 2012, Allen and Erdmann 2012, CTI-NCC TL 2014). Timor-Leste's coral reefs are exceptionally species diverse - with the current known reef fish fauna of Timor-Leste estimated at 814 species (Allen and Erdmann 2012). Around Atauro Island, coral reef surveys in 2016 conducted by Conservation International, recorded the world's highest average fish diversity – with 254 reef fish species per site.

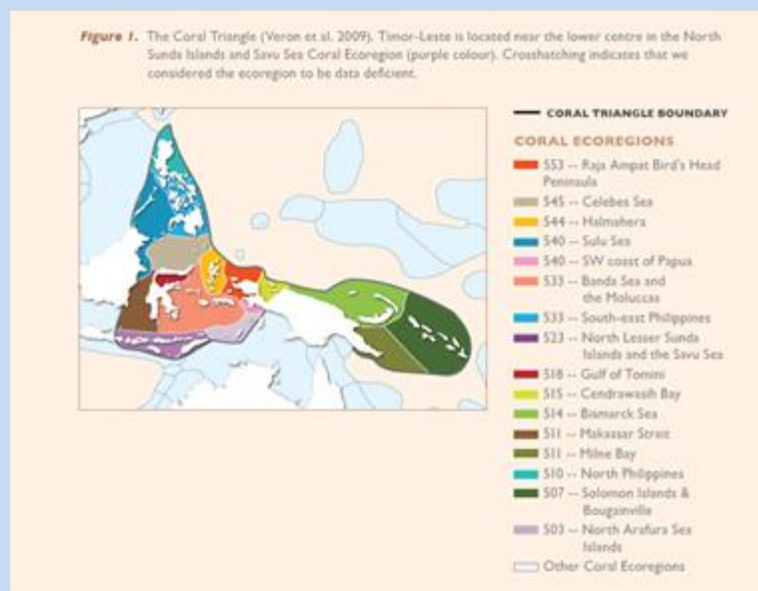
The coastal and marine biodiversity and ecosystems of Timor-Leste are under the pronounced influence of the Indonesian Throughflow (or ITF) (the major current system transporting warm water from the Pacific to the Indian Ocean) (see Box 5). With steep bathymetry, exceptionally strong and complex currents and also, seasonal upwellings (occurring within a few kilometres of the coast) bathing coral reefs and providing critical feeding habitat for a wide of marine megafauna.



Box 4: Why is Timor-Leste a Global Marine Biodiversity Hotspot ?

The Coral Triangle is a globally significant region and the recognised global center of tropical marine biodiversity. Covering just three per cent of the globe, it is home to 75% of all known coral species, more than 3,000 species of reef fish, six of the seven turtle species, whale sharks, manta rays and a diversity of marine mammals, including a third of all known species of whales and dolphins. The origin of the Coral Triangle's extraordinary biodiversity is unclear, but many believe the complex tectonics, evolution and geological history of the region, including climate history (and changing sea levels) have played a major part.

Timor Leste (and the island of Timor) lie within the Coral Triangle, in the Banda Sea, within the biogeographic region known as the Lesser Sunda Ecoregion, an important transition zone between Pacific and Indian Ocean marine biota (Veron et al. 2009) and one of 18 'global marine hotspots' prioritized for tropical coral reef conservation because of its outstanding species diversity, levels of endemism (particularly corals and fish) and range of marine habitats (Roberts et al. 2002, Allen 2007, Veron et al. 2009).



— CTI-CFF (2011)

2.2 STATUS OF COASTAL & MARINE ECOSYSTEMS

Timor-Leste's coastal and marine ecosystems include species-rich coral reefs, globally significant populations of marine wildlife (particularly cetaceans), coastal artisanal fisheries and also, diverse, coastal and cultural landscapes. However, recent studies reveal limited, shallow inshore habitats (mangroves, coral reefs, seagrasses) (Boggs et al. 2009, Leiper et al. 2013), including over-exploited, but relatively 'intact' fringing coral reefs (Ayling et al. 2009, Turak and Devantier 2012); flood-prone, low-lying coastlines (particularly on the northern coast); ongoing and major loss of mangrove habitat (ie. 80% since 1940) (Boggs et al. 2009); and pronounced catchment impacts on coastal ecosystems (Alongi et al. 2009). In a recent global re-assessment of coral reefs 'at risk', Timor-Leste was identified as being highly vulnerable, with high to very risk and reef dependence, and low to medium adaptive capacity (Burke et al. 2011). Similarly, mapping and assessment of the Timor-Leste's

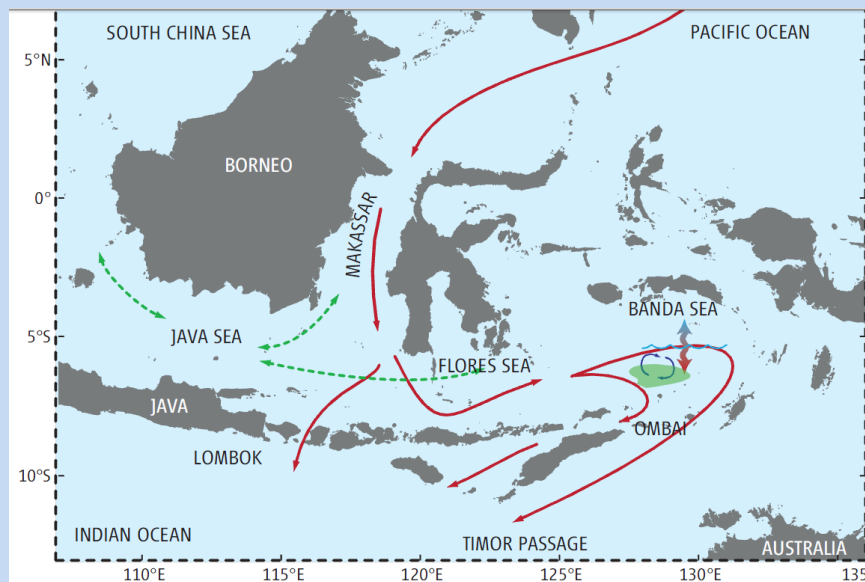
remaining tidal forests indicate ongoing degradation and major threats (Alongi & de Carvalho 2008, Alongi et al. 2014, Ilman 2017).

Box 5: Influence of the Indonesian Throughflow

The coastal and marine ecosystems of Timor Leste and the Lesser Sunda Ecoregion are under the pronounced influence of the Indonesian Throughflow (or ITF) - the major current system transporting warm water from the Pacific to the Indian Ocean. Under the influence of the ITF, the waters of Timor-Leste are characterised by steep bathymetry, exceptionally strong and complex currents and also, wind-driven seasonal upwellings - with deep-sea habitats occurring within a few kilometres of the coast. On the north and south coast of Timor Leste, lie 2 deep (>3km) ocean trenches, the Ombai Trough and the Timor Trough, respectively. On the north coast, the deep waters of the the Ombai Trough occur less than 10km from shore (Boggs et al. 2009).

Significantly, the island of Timor also lies in the direct pathway of the ITF - between two of the three major deep water outflow passages of the ITF: the Ombai-Wetar Strait and Timor Passage, adjacent to the north and south coast, respectively. Together, these 2 passages account for >80% of the total ITF transport (-15S Sv) of Pacific waters that enters the Indian Ocean (Gordon 2005).

Bathed by the waters of the ITF, these 'deep-nearshore habitats' and plankton-rich upwellings along the coast of Timor Leste, provide critical feeding habitat for resident and migratory, large marine megafauna such as whales, dolphins, dugongs, turtles and manta rays (Dethmers et al. 2009).



2.3 STATUS OF INTEGRATED OCEAN MANAGEMENT

2.3.1 HCV AND INTEGRATED COASTAL AND OCEAN MANAGEMENT

Marine HCV management is a key pillar in efforts towards achieving integrated ocean management (IOM), integrated coastal management (ICM) and ecosystem-based management (EBM) in Timor-Leste. However, as a small, newly-independent, fragile, post-conflict state (and recognized LDC and SID), Timor-Leste faces many development challenges – which constrain progress. Particularly the demands of both, nation-building, in addition to addressing complex human development challenges. Including weak governance, institutional capacity and limited resources (human, financial), together with a heavy dependence on international development partners and international advisors.

Within these development constraints, there remain ongoing and complex challenges for marine HCV management in Timor-Leste and particularly in integrating within broader IOM and ICM programs. A detailed and comprehensive review of these coastal-marine governance, sustainability and development challenges in Timor-Leste was recently completed under the ADB CTP2 program (Edyvane 2015)⁵.

2.3.2 COASTAL AND OCEAN GOVERNANCE

Integrated Coastal Management. While Timor-Leste's national laws and policies governing coastal and marine ecosystems are well-developed (Annex 1.1, 1.2), there remains key legislative gaps in coastal management, biodiversity management (including threatened species), spatial planning and ecosystem-based fisheries. Significantly, there is no single coastal agency responsible for coastal management and currently no national legislation to support integrated coastal management (ICM). And responsibilities for biodiversity, environment, marine resources, climate change, tourism, disaster management, finance and coastal infrastructure planning in the coastal zone, represented across a range of agencies - with few, inter-agency, institutional or administrative coordinating mechanisms (Table 2.1). Further, national spatial planning is largely driven by infrastructure planning (under MPW), with a limited focus on integrated, ecosystem-based planning and weak mechanisms for environmental inputs. However, there has been significant progress towards ICM with the recent completion of a national ICM plan (by UNDP, MAF) (including a national coastal vulnerability assessment and coastal climate change adaptation strategy). And also, the revision of National Forestry Policy (2017) to include catchment and watershed management.

Fragmented Coastal Governance. Coastal governance in Timor-Leste is also fragmented, with legislative overlap and unclear administrative responsibilities – particularly for HCV management. With no specific legislation for biodiversity and legislative overlaps for the Ministry for 'biological resources' (MAF) and the Ministry for 'environment & biodiversity

⁵ 'Strengthening Coastal and Marine Resource Management in Timor-Leste. ADB RETA Timor-Leste Terminal Report' (Edyvane 2015), for FZ ANZDEC Limited (New Zealand).

conservation’ (Sekretaria Estada Ambiente or SEA). While MAF is the designated the lead agency for ‘protected areas’, MAF-Fisheries is responsible for marine Protected Areas and aquatic conservation, while MAF-Forestry is responsible for terrestrial Protected Areas and terrestrial conservation⁶. Further, SEA’s proposed Decree Law on Biodiversity, which defines national biodiversity policy, including protection and conservation of ecosystems, habitats and species, including endangered species, is yet to be finalized and approved. However, a range of aquatic species have recently been listed and protected⁷.

Key Area of Coastal Activity	Responsible Ministry
aquaculture, fisheries, Marine Protected Areas, aquatic biodiversity	MAF-Fisheries
forestry and conservation (including mangroves), Protected Areas, watersheds, catchments	MAF-Forestry
environmental protection, biodiversity conservation, threatened species	SEA
climate change, climate adaptation	SEA
climate monitoring	MAF, SEA
tourism, natural and cultural heritage	MTTI, SEA
infrastructure planning, spatial planning	MPW
natural disasters	MPW, MSSI

Table 2.1. National-scale, coastal management responsibilities in Timor-Leste.

Lack of Coordination Mechanisms. Coastal governance is further challenged by the lack of intra- and inter-agency and cross-sectoral, coordination mechanisms for ICM and IOM. For instance, the Timor-Leste Coral Triangle Initiative National Coordination Committee (under the CTI-CFF program) (Annex 2.5) is currently one of the few coordination mechanism for addressing ICM, protected areas, fisheries, climate change and threatened species management in Timor-Leste.⁸ Without strong inter-agency and intra-agency coordination and cooperation this poses significant challenges for the effective management of coastal and marine ecosystems, particularly, biodiversity, protected areas, threatened species, ‘ridge-to-reef’ and integrated coastal management⁹.

Complex Donor Relationships. Timor-Leste has a plethora of development partners and bilateral, regional & multi-lateral environmental programs/partnerships, often with overlapping scopes of activity and few coordination mechanisms (Annex 1.3). Such complex donor and partner relations also presents a major challenge to effective and coordinated IOM and ICM in Timor-Leste, including marine-HCV management. Tmor-Leste is currently a partner in several major regional forums and bilateral programs.

⁶ Weaver, L. (2008). *Assessing Management Challenges and Options in the Coastal Zone of Timor-Leste*. Griffith Centre for Coastal Management Research Report No. 86. Griffith University.

⁷ Joint Ministerial Order No. 18/MAP/MCIA/II/2017 List of Protected Species (gazetted 12 April 2017).

⁸ However, membership of the 11-member government forum to-date has been limited, and largely MAF-based, with only one NGO (CI).

⁹ Previous donor assessments have also highlighted the lack of an adequate, environmental management framework in Timor-Leste (including legislation, regulation and adequately resourced institutions) (WB 2009).

The most significant bilateral and multilateral programs for marine-HCV management include:

- *regional forums and programs:*
 - Coral Triangle Initiative on Corals, Fisheries and Food Security (CTI-CFF)
 - Partnership for Environmental Management for Seas of East Asia (PEMSEA)
 - Arafura-Timor-Seas Forum (ATSEF)
 - Programme of Works on Protected Areas (PoWPA) (UNDP)
 - FAO Central (Rome), FAO Regional (Bangkok)
 - South Pacific Regional Environment Programme (SPREP)
- *bilateral partners, programs* – CTI (Conservation International, The Nature Conservancy, WWF, Coral Triangle Centre), Blue Ventures, WorldFish, universities (CDU, ANU, SCU, NUS).

Despite these governance challenges, Timor-Leste has progressed a wide range of coastal and marine resources, environmental programs, policies and action plans (Annex 1.1, 1.4). Probably the most significant of these for marine HCV management are the Coral Triangle National Plan of Action for Timor-Leste (2009-2014) (Annex 2.4) which identified a range of priority actions and targets specifically for marine HCV and EBM¹⁰, and national protected area and biodiversity conservation policies, particularly the establishment of a national protected areas network (or PAN)¹¹ and the National Biodiversity Strategy and Action Plan (2011-2020), the latter identifying priorities and setting critical national biodiversity conservation and protected area targets (Annex 2.1).

While coastal governance is ‘fragmented’ (particularly at national level) in Timor-Leste, there is overwhelming evidence globally that participatory, adaptive, local-scale, governance systems which recognise coastal ecosystems and fisheries as complex social-ecological systems - comprising people, livelihoods, formal/informal institutions, and external drivers – are a more appropriate model for developing countries (Pomeroy and Andrew, 2011, Mills et al. 2013). To this end, development and implementation of local-scale, community-based, conservation and natural resource management approaches have been very successful in Timor-Leste (eg. co-managed LMMAs, fisheries, participatory monitoring). However, with increasing number of local-scale, marine monitoring and management activities (and many development partners), there is a critical need for national, coordination (particularly of baseline assessments, monitoring and data management) and broader, EBM-scale management.

¹⁰ The CT NPOA for Timor-Leste (2009-2014) set national priorities, actions and targets), covering 5 focal areas of the CTI-CFF: priority areas (seascapes/ICM), MPAs, EAFM, climate change and threatened species.

¹¹ Timor-Leste Program of Works on Protected Areas (PoWPA) Strategic Action Plan (2011).

2.3.3 MAJOR COASTAL-MARINE ENVIRONMENTAL PROGRAMS

Since independence, Timor-Leste has undertaken a range of coastal and marine environmental programs (with the support of international development partners, especially GEF) - and particularly since 2007 (Annex I.4). There are currently 5 major GEF-funded programs assisting, supporting and/or implementing, national-scale, integrated ocean management (IOM) in Timor-Leste:

- National Oceans Policy and Implementation Plan (PEMSEA SDS-SEA)
- National Integrated Coastal Management Plan (UNDP)
- Arafura and Timor Seas Strategic Action Plan and National Action Plans (ATSEF), including regional ATS governance framework (ATSEA2)
- Transboundary Diagnostic Analysis and revision of Timor-Leste's National Action Plan under the Indonesian Seas Large Marine Ecosystem (IS LME) Strategic Action Plan (FAO ISLME)
- Proposed¹² 'Timor-Leste Seascape Plan', as part of a broader proposed Lesser Sunda Seascape planning (CTI-CFF Seascape Planning).

While these programs operate at different spatial scales, they all include the waters of Timor-Leste (see Figure 2.1) And significantly, all of these programs include elements of national-scale, EBM, IOM, ICM and marine spatial planning. For Timor-Leste, a major challenge (for both, government and development partners) is ensuring coordination and alignment of these major ocean planning programs (and reducing overlap and duplication).

Of all the ocean planning programs (underway or proposed), the new National Oceans Policy (NOP) – and proposed NOP Implementation Plan – specifically aims to provide a single, over-arching, policy and governance framework for IOM, ICM and marine EBM in Timor-Leste – including inter-ministerial and cross-sectoral coordination. And ideally, institutional mechanisms and processes for coordinating and aligning all relevant IOM, ICM, EBM activities in the waters of Timor-Leste, including major marine-HCV activities and programs.

Further, with Timor-Leste's prevalence of coastal subsistence activities and lack of major maritime industries (ie. semi-industrial or industrial fisheries, aquaculture, shipping, mining, etc.), proposed seascape planning in Timor-Leste is arguably not a current development priority. As such there is a need to focus national efforts (and resources) on the NOP Implementation plan, and also address critical, emerging, ICM issues. With the current national priority on major infrastructure development in the coastal zone, there is an urgent need to refocus efforts on sustainability and ICM, and particularly strengthening environmental and conservation inputs (MAF, SEA and MTTI) into development planning and proposed spatial planning, planning laws/regulations under the National Spatial Plan.

¹² With ADB CTP support, seascape planning for Timor-Leste (under the CTI-CFF) is currently being considered by the Government of Timor-Leste. Currently, Timor-Leste is considering its own roadmap for a national Timor-Leste Seascape.

2.3.4 MARINE SPATIAL INFORMATION, DATA MANAGEMENT FOR IOM

Marine spatial data is not only essential for marine HCV management, but also marine-EBM, IOM and ICM, and particularly marine spatial planning (MSP). In all these ocean management approaches, data collation and marine inventory is the first critical step.

As highlighted above, there are 5 major national and regional ocean planning initiatives underway in Timor-Leste (under PEMSEA, ATSEA, CTI-CFF, UNDP and FAO) - and all require spatial information. As such, there is a critical need to review, collate and consolidate current coastal and marine datasets in Timor-Leste to support ICM, IOM and HCV management. Significantly, there is also a need to coordinate and align data management activities – as importantly, national/regional marine data collation, inventory and data platforms are being considered under several major IOM-EBM programs (see Figure 2.1)¹³.

The National Oceans Policy, and particularly the NOP Implementation Plan is likely to play a key role in addressing many of these IOM-EBM program coordination and alignment issues, including potentially identifying the process for developing a national marine GIS platform, database and data management system for Timor-Leste. This would be assisted by the NOP IP undertaking a detailed stocktake of ICM, IOM activities, datasets and data platforms.

¹³ Collation of marine spatial datasets and establishment of data platforms are identified funded activities under the UNDP's ATSEA2 program, and also, the ADB and CTI-CFF's proposed Timor-Leste Seascape Plan.

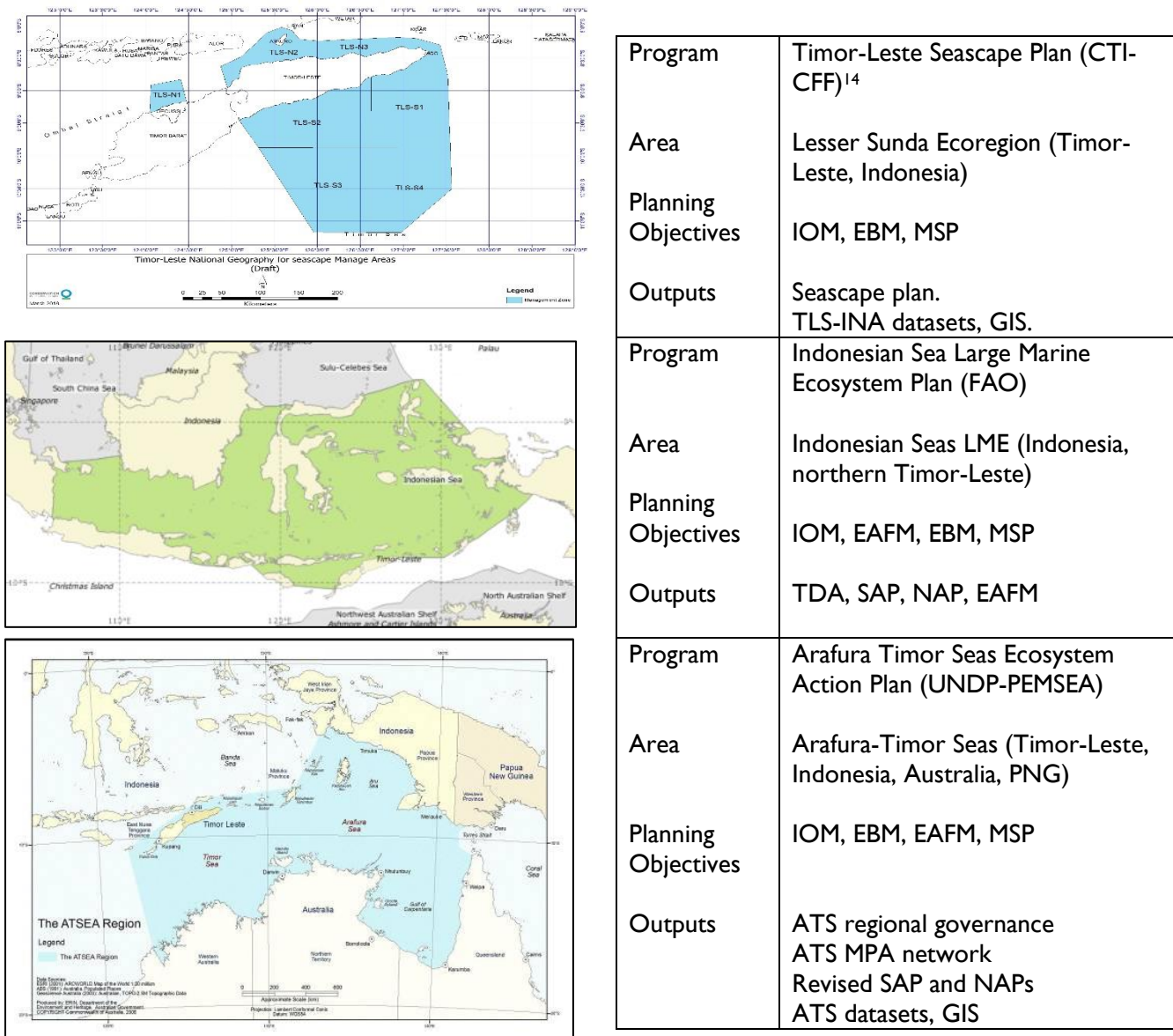


Figure 2.1. Examples of regional marine-EBM and /or MSP programs currently being implemented / proposed for the waters of Timor-Leste.

¹⁴ The proposed Timor-Leste Seascape Plan is part of a broader, seascape planning process with Indonesia, under a proposed Lesser Sunda Seascape Plan under the CTI-CFF.

2.4 IOM, ICM AND EBM MANAGEMENT – ISSUES, GAPS, PRIORITIES

Status of IOM, ICM and EBM Management - Key Issues, Gaps/Priorities

1. Marine inventory and marine spatial data is not only essential for HCV management but is also the first step in implementing marine-EBM (particularly MSP).
2. With several major regional marine-EBM and MSP programs currently underway in Timor-Leste and few national coordination mechanisms for marine HCV (and ICM, IOM) management - there is an urgent need to ensure greater donor/partner coordination and alignment of marine HCV, ICM and IOM activities (including marine monitoring, data collation for coastal and marine spatial planning).
3. Many of the national/regional marine-EBM and IOM programs underway in Timor-Leste need marine spatial information. There is a critical need to review, consolidate current coastal and marine datasets (particularly at the national-scale) to support IOM, ICM and marine-HCV management.
4. With several national/regional marine data collation, inventory and integrated, accessible data platforms (GIS systems) currently being considered under several major IOM-EBM programs - there is also a need to coordinate (and centralise) national coastal and marine data management activities.
5. The National Oceans Policy and Implementation Plan, with its focus on IOM and marine EBM governance framework for IOM, ICM and marine EBM in Timor-Leste (including inter-ministerial and cross-sectoral coordination) is an ideal vehicle to progress coordination of relevant IOM, ICM, EBM activities in the waters of Timor-Leste, including national marine data management, and marine-HCV related programs.
6. There is also a need to review or re-focus new IOM and spatial planning programs (ie. proposed national seascape planning in Timor-Leste), to focus national efforts (and limited resources) on the NOP Implementation Plan – and also to address critical, emerging, ICM issues (in light of the current national priority on major infrastructure development in the coastal zone).
7. Marine HCV management and EBM, IOM and would be considerably strengthened if the membership of the CTI-NCC TL was broadened to promote/facilitate greater inter-agency, cross-sectoral and also, donor/partner coordination.
8. While local, community-based, conservation and natural resource management approaches (eg. co-managed LMMAs, fisheries, participatory monitoring) are appropriate and should continue to be supported - there is a critical need for national, coordination of these activities (particularly baseline assessments, monitoring and data management) and broader, EBM-scale management.

2.5 MARINE HCV MANAGEMENT

Responsibilities for Marine Protected Areas. Marine conservation and the establishment of Marine Protected Areas (or MPAs) in Timor-Leste is the responsibility of the Ministry of Agriculture and Fisheries (MAF). Within MAF, MPAs are the responsibility of both, the General Directorate of Fisheries (G DFA) (ie. Department for Conservation and Protection Aquatic Resources) and General Directorate of Forestry, Coffee and Industry Plantation (GDFCIP) (ie. National Directorate of Protected Areas and Nature Conservation), with legislation requiring both agencies to work together for planning and implementation and monitoring¹⁵. However, the specific roles and responsibilities, and particularly, the administrative, legal and institutional arrangements for managing MPAs within MAF, remain to be clarified. Despite this, the NDFA has taken the lead in initiating several MPA and ICM pilot projects.

Legal Basis for Marine Protected Areas. MPAs can be declared under fisheries legislation under Articles 96-98 of the Decree Law No. 6/2004 - *General Basis of the Legal Regime for the Management and Regulation of Fisheries and Aquaculture* (ie. aquatic natural reserves, and restocking areas, national marine parks) and also, by Government Resolution (ie. Nino Konis Santana National Park). New legislation by the GDFCIP (NDPANC) for a National System of Protected Areas was passed in 2016¹⁶, including establishing 46 protected areas, including the 15 'protected wild places' established and protected under UNTAET Regulation 2000/19 on Protected Places (Annex 2.3). The protected area network (PAN) included existing 2 Aquatic Natural reserves (Batugade and Vila, Atauro Island) declared in 25 February 2015.¹⁷

Co-Management of Marine Protected Areas. Co-management—a formal government partnership with community to manage natural resources—has become central to the successful establishment of LMMAs and MPAs in Timor-Leste. This has been strengthened by a revival in traditional, community-based natural resource management or 'tara bandu', including customary rules around harvesting - particularly fisheries¹⁸. In 2013, with the support of Conservation International under the USAID's Coral Triangle Support Partnership (CTSP) program, Timor-Leste's first co-managed,

¹⁵ The Nino Konis Santana National Park (and Marine Park), which includes both terrestrial and marine estate, is currently managed by Department for Protected Area and Natural Conservation, Directorate General for Forestry (MAF).

¹⁶ Decree Law No.5/2016 Establishing the National System of Protected Areas (gazetted on 16 March 2016).

¹⁷ The 2 Aquatic Natural Reserves were formal MPA commitments under the Timor Leste CTI NPOA, and also identified as part of the national, Protected Areas Network (PAN) for Timor Leste (Grantham et al. 2011) and the Lesser Sunda Ecoregion MPA Network (Wilson et al. 2011).

¹⁸ The first coastal and marine 'tara bandu' mapping, assessment and formalization of Suco-level regulations was undertaken by MAF in Suco Beacou (Bobonaro Municipality), with the support of the FAO RFLP program (RFLP 2012, Needham et al. 2013). The program also undertook detailed mapping of 'tara bandu' in other parts of Timor-Leste - and provided an important foundation for subsequent fisheries development work (supported by WorldFish), particularly in establishing LMMAs as a tool for community-managed fisheries and marine ecosystem protection - including the first community-managed LMMAs on Atauro Island (at Adara) in 2016.

LMMA were established, in 3 locations, as part of the Nino Konis Santana Marine Park (Timor-Leste's only Marine Park): at Com (~100ha), Tutuala (1600ha) and Lore (270ha) (see Box 6). Drawing upon international best practice for marine management, the co-management model, which embraces community-based natural resource management (or CBNRM), initially focused on the 3 LMMA within the NKS¹⁹. However, the co-management model is also applicable to terrestrial ecosystems within the park and also, resource management across Timor-Leste. Formal guidelines to assist communities with co-management and CBNRM have been developed for Timor-Leste (with the support of USAID-funded CTSP and Conservation International).²⁰ This successful management model is now being used to establish other LMMA across Timor-Leste. However, there remains a significant lack of coordination by development partners supporting LMMA planning, establishment and management (including monitoring) – especially between fisheries partners and conservation partners.

HCV National Targets, Action Plans. Progress, priorities and activities in marine HCV management are broadly defined at the national level by targets and actions, including:

- National Biodiversity Strategy and Action Plan 2011-2020 (NBSAP 2011) (Annex 2.1) – which sets national biodiversity, environmental and conservation targets, including protected areas.
- CTI National Plan of Action 2009-2014 (2009) (Annex 2.4) – which set national priorities, actions and targets for Timor-Leste (2009-2014), for the 5 focal areas of the CTI-CFF: priority areas (seascapes/ICM), MPAs, EAFM, climate change and threatened species.

Role of the CTI-NCC TL National Coordinating Committee. Marine conservation, environment, fisheries, climate change and coastal livelihood programs in Timor-Leste are coordinated and implemented by the CTI National Coordinating Committee Timor-Leste (CTI-NCC TL). This is currently the only government forum which attempts to coordinate government activity across the EBM, IOM, ICM, EBFM and conservation-related activities. The CTI-NCC TL is currently located within the MAF (the key government partner for the CTI-CFF), with membership (11 members) MAF-focussed, and principally focussed on conservation and protection (Annex 2.5). Only one NGO is currently represented – Conservation International. EBM, IOM and HCV management would be considerably strengthened if the membership of the CTI-NCC TL was broadened to promote/facilitate greater inter-agency, cross-sectoral and also, donor/partner coordination²¹.

¹⁹ 'Co-management of Marine Resources in the Nino Konis Santana National Park: Capacity Development Strategy' (TL CTI NCC 2013).

²⁰ 'Guidelines for Establishing Co-Management of Natural Resources in Timor-Leste'. Prepared by Conservation International under the USAID's Coral Triangle Support Partnership (CTSP 2013).

²¹ Edyvane (2015) recommended the need to strengthen and review the role/governance and membership of CTI National Coordinating Committee – in light of broader, EBM and ICM initiatives in Timor Leste - particularly, consideration of representation from tourism, disaster management, finance and coastal infrastructure planning.

2.6 TIMOR-LESTE MPA PLANNING AND IMPLEMENTATION

A network of MPAs in Timor-Leste is currently being progressed, implemented (and updated) with the support of several regional partnerships and programs – particularly the Coral Triangle Initiative on Coral Reefs, Fisheries and Food Security (CTI-CFF), UNDP Program of Works on Protected Areas (PoWPA) and the UNDP-PEMSEA Arafura and Timor Seas Ecosystem Action Program.

As such, there has been considerable progress in planning and establishing Timor-Leste's Protected Area Network (or PAN) including:

- Under CTI-CFF, the identification of a marine PAN for Timor-Leste, as part of regional, Lesser Sunda Ecoregion (LSE) MPA network (Wilson et al. 2011). A proposed a network of seven shallow and five deep-water MPAs were proposed for the waters of Timor-Leste (see Annex 2.7)
- With support from UNDP Program of Works on Protected Areas, the identification of a PAN for Timor-Leste (comprising 30 Protected Areas and 22 Areas of Interest) by MAF-DPANP (McIntyre 2011) (Annex 2.2), based on a biophysical gap analysis or National Ecological Gap Analysis (NEGA) (Grantham et al. 2011) (Figure 2.2). Significantly, the marine component of the PAN for Timor-Leste was based on LSE MPA Network.
- Under UNDP-PEMSEA, a plan and establish a national network of Marine Protected Areas in Timor-Leste, as part of a Arafura-Timor Seas (ATS) Regional MPA network (Annex 4.7, Table A4.7.2). And also, to undertake an updated, biophysical gap analysis.
- More recently, CI has also been funded by GEF to plan and establish a National System of Protected Areas. Including a national strategy for the PAN, and also, undertake a biophysical gap analysis for the network. The focus of the GEF program is on terrestrial protected areas (and forest conservation, restoration).

However, despite these national and regional PAN policies/plans, no specific Marine Protected Areas Strategy for Timor-Leste has been developed. While the CTI NPOA 2009-2014 sets priorities and targets for MPAs, and guidelines for co-management have been defined²² - to-date, there is no over-arching technical or policy framework or plan to support the identification, planning and establishment of a national, ecologically representative network of Marine Protected Areas²³. With the development of the ATS MPA network (including the waters of Timor-Leste) (under ATSEA2), this is an ideal opportunity to develop a national MPA strategy and action plan.

²² 'Guidelines for Establishing Co-Management of Natural Resources in Timor-Leste'. Prepared by Conservation International under the USAID's Coral Triangle Support Partnership (CTSP 2013).

²³ Edyvane et al. (2009) identified the urgent need for a Timor-Leste Marine Protected Areas Strategy to support the development of a national system of MPAs, including defining, identifying and selecting MPAs, identifying priorities, management planning processes, key management tasks and importantly, clarifying MPA management and administrative arrangements.

There is also recognition of high levels of land-sea connectivity in Timor-Leste and the need for ‘ridge to reef Management’ in protected area planning. A recent threatened species assessment and prioritization of key biodiversity areas (KBAs) in the Wallacea biogeographical region (which includes Timor-Leste), has identified both, terrestrial and marine KBAs for Timor-Leste (Annex 3.1) (CEPF 2014). Significantly all 12 marine KBAs in Timor-Leste were identified and prioritized based on providing integrated, catchment (land-sea) management. Nine out of the twelve recognised marine KBAs for Timor-Leste occur on the northern coast (CEPF 2014). Several of these identified KBAs are now protected (under Decree Law 5/2016) or currently being progressed for establishment of LMMAs (see Annex 2.8).

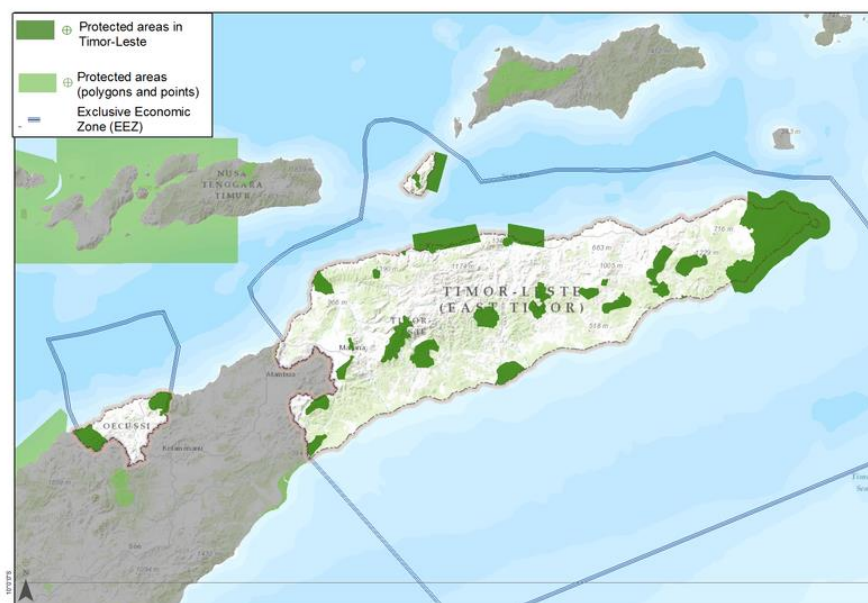


Figure 2.2 Proposed Protected Area Network (PAN) for Timor-Leste (Grantham et al. 2011).

There is critical need to revise/update the proposed marine-PAN for Timor-Leste, which is currently based on the NEGA (2011) and Lesser Sunda Ecoregion MPA planning (Wilson et al. 2011), as it was undertaken with minimal marine datasets from TL. To this end, the current PAN omits several of the identified KBAs for Timor-Leste. As such, the KBA assessment (CEPF 2014) while undertaken with minimal marine data from TL, recommends several areas for conservation which are currently unprotected.

MPA Network Planning - Key Issues, Gaps/Priorities

1. Need to ensure marine-freshwater and terrestrial integration in planning and developing the PAN and avoid duplication (where possible), particularly with strategies, management plans, gap analyses, training and capacity building plan.
2. Need to ensure that all relevant and available TL datasets are used to update the marine PAN in TL, as proposed ATS MPA Network (under ATSEA2).
3. With additional data, additional marine-KBAs may also be identified, particularly on the data-poor, southern coast.
4. With the proposed ATS MPA network (under ATSEA2), there is a critical need for a national, Marine Protected Areas Strategy and Plan, to help support the planning and establishment of an ecologically, representative network of MPAs in Timor-Leste, including identifying MPA/LMMA priorities, planning processes, monitoring and management tasks (including partnerships), and significantly, clarifying management and administrative arrangements.

2.7 STATUS OF MARINE PROTECTED AREAS, LOCALLY MARINE MANAGED AREAS

Under the new Decree Law 5/2016 on Protected Areas (enacted 16 March 2016), 46 protected areas were gazetted to establish Timor-Leste's protected area network (PAN). This included the 15 Wild Protected Areas listed and protected under UNTAET Regulation No. 19. And also 2 new Marine Protected Areas: Batugade Aquatic Nature Reserve (11,259 ha) and Vila Aquatic Nature Reserve (5,085 ha). These 2 MPAs were progressed by MAF (with support from FZ ANZDEC), with funding under the ADB CTP2 program (see Edyvane 2015). In addition, LMMAs or NTZ are also being progressed for four of the gazette coastal protected areas²⁴.

As of October 2018, Timor-Leste's Marine Protected Area estate included one Marine Park, the Nino Konis Santana Marine Park (established in 2007) and 2 Aquatic Natural Reserves (Vila, Batugade) declared in 2015. However, an additional 32 LMMAs are currently established or being progressed, contributing significantly to Timor-Leste's marine Protected Area Network. Including a network of 13 LMMAs on Atauro – together with a proposal for a 'whole-of-island' Atauro Island National Park (terrestrial-marine) (Annex 2.8). This current ambitious program of community-based, marine natural resource management and co-management in Timor-Leste will require a significant, ongoing investment in training and technical support both, for local communities and MAF.

²⁴ MAF is currently progressing LMMAs or No-take Zones in 4 coastal protected areas: Lagoa Tasitolu, Monte Guguleur, Area Mangal Citrana and Area Mangal Metinaro (TL CTI NCC).

In light of ongoing, critical food security issues, community-based LMMAs/MPAs in Timor-Leste have largely focused on sites for fisheries replenishment and fisheries recovery areas (which has been well received by local communities). Significantly, the FAO RFLP (2013) specifically recommended a cautious approach to further MPA establishment in Timor-Leste: *“The implementation of Marine Protected Areas and other common resource management methods should be reconsidered. Creative solutions which forge pragmatic partnerships between the government and fishers should be promoted instead.”*

Conservation International is currently leading and supporting MAF on many of the MPA/LMMA establishment and monitoring activities in Timor-Leste – however, other development partners are also involved, both in supporting LMMA/MPA establishment and monitoring activities (ie. The Nature Conservancy’s Coral Triangle Centre, WorldFish and Blue Ventures). FAO and WorldFish in particular have focused on LMMAs as key tools for improving seafood and nutrition security through strengthening community-based fisheries management and ecosystem protection. As a matter of priority, LMMA/MPA planning, establishment and management needs to be coordinated across Timor-Leste, particularly on Atauro Island (see Annex 2.8).

Despite the large number of development partners involved in MPA/LMMA monitoring, there is currently no formal, agreed, coordinated approach to marine baseline assessments, monitoring, data gathering or data deposition. Coordinated coral reef and fisheries assessments and monitoring is a key priority. With much of the monitoring data residing on individual computers and laptops. Together with differing data collecting protocols, methods, sampling regimes and significantly, technical capacity and degree of technical support²⁵, this poses major problems in data standardization, validation/accuracy and coordination. And importantly, also presents a major challenge for data collation, and assessing the status of Timor-Leste’s Marine Protected Area Network.

Of the total Marine Protected Area estate, the vast majority of MPAs/LMMAs are located on the north coast of Timor-Leste, in the Nino Konis Santana Marine Park and on Atauro Island – leaving large areas of coastline (particularly along the south coast) un-monitored and under-protected. That said, several new/existing MPAs/LMMAs will soon be established or significantly supported under the new GEF-funded ATSEA2 program, ie. with proposed strengthening of the NKS Marine Park and the LMMA at Com, and also, a new, approximate 90,000 ha MPA in Betano to Clacuc in Município Manufahi (extending along 40 km coastline and out to 12 nautical miles) (Annex 4.7).

²⁵ WorldFish is currently providing ‘on the ground’ technical support for communities engaged in fisheries monitoring in many of the LMMAs/MPAs in Timor-Leste – as part of a larger NORAD (and ADB CTP2)-funded program to improve food security, strengthen community-based marine resource management, and develop a national fisheries catch (and effort) system. But technical support and field assistance is currently varied and/or limited across other community-based marine monitoring activities.

With the support of Conservation International (particularly under USAID's CTSP program), Timor-Leste has made significant progress on 'co-management' of LMMAs/MPAs.²⁶, particularly in the NKS Marine Park. Including the initiation of some LMMA monitoring and also, the development of some local fisheries plans. But with an estimated 32 LMMA/MPAs in progress, there is a major need for significant (and coordinated) training and technical support to assist 'on the ground' management (including baseline surveys, monitoring and compliance). And also, significantly, for complementary, alternative livelihood development (to help offset the impacts from fishing restrictions)²⁷.

Significantly, a national Marine Protected Areas strategy and plan could assist with not only setting MPA/LMMA priorities, but also improving donor/partner coordination in MPA/LMMA planning, monitoring and management, and also, identifying and prioritizing complementary livelihood development programs.

Progress on marine HCV management has been closely tied to international donor funding, with the RDTL national investment in Protected Areas to-date, minimal (approximately US\$121K²⁸ per year). A major focus of national and international-supported marine HCV activity, including baseline surveys and assessments, has been on the sheltered, northern coast – particularly in the NKS Marine Park and on Atauro Island. Outside these focal areas, many coastal areas (particularly the south coast) remain 'data-poor' and unprotected.

No formal assessment of management effectiveness (ME) of MPAs or LMMAs has been undertaken in Timor-Leste. Timor-Leste remains the only country in the CTI-CFF not to have conducted a ME assessment of its MPA system.

2.8 NINO KONIS SANTANA MARINE PARK

The Nino Konis Santana Marine Park, gazetted on 27 July 2007 (under Government Resolution 8/2007) (see Annex 2.9), remains the largest Marine Protected Area in Timor-Leste. Established with the support of BirdLife International, NSW Parks and Wildlife (Department of Environment and Climate Change), and Charles Darwin

²⁶ Co-managed LMMAs currently being progressed by MAF (with support from Conservation International) - include zoned maps and management plans in Suco Regulations and approved in principle by Municipality and National Government. With the community co-management group, management plan and zoning maps recognised at a national level through Ministerial Diplomas (CTSP 2013).

²⁷ For instance, several local fishers are known to have re-located from Atauro to the mainland, following the establishment of NTZs in LMMAs on the island. However, other fishers and local communities on the island have reported economic benefits from LMMAs, particularly from the 'tourist tax' levied in LMMAs (particularly in Beloi).

²⁸ A limiting factor in developing Timor-Leste's Protected Area system and natural resource management in general, has been the limited flow of funding from the national government. Over the period of 2010-2016, approximately USD 121,000 per year was allocated for protected area management; including approximately USD 37,000 per year for salaries of departmental and field staff, USD 3,000 per year for maintenance, and USD 81,000 per year for various goods and services. (GEF 9434 ProDoc, pp.20)

University and UK-based Darwin Initiative, the park remains a major focal point of marine- and terrestrial-HCV management (investment and development partner) activity in Timor-Leste. From 2006-2009, MAF (with the support of Charles Darwin University) undertook detailed coastal and marine mapping, baseline surveys (coral 2009)²⁹. While completed almost a decade ago, many of the management issues, priorities and recommendations remain valid today.

The NKS Marine Park has been the major focal point for international and national marine HCV investment in Timor-Leste (ie. CTSP, MACF, FAO, GEF Dugong and Seagrass Project) (Annex 2.10). This includes several major baseline marine surveys and also, mapping of the park (Ayling et al. 2009, CI MRAP 2012, PISC 2017) reefs, mangroves, ecotourism, fisheries, marine megafauna) for the new Marine Park (see Section 3), and also, significantly, detailed protected area management planning (Edyvane et al. 2009). And also, the implementation of the country's first regulated, 'no-take zones' (NTZ) in 2013, and the planning and implementation of co-managed LMMAs declared in 2016. However, opportunities for data integration have been lost due to a significant lack of donor/partner/program coordination in NKS baseline assessments (ie. marine habitat mapping, coral reef assessments and fish surveys).

Since 2009, the Government of Timor-Leste, supported by USAID's Coral Triangle Support Partnership (CTSP), has worked to develop a co-management approach to marine resource management with the communities in NKS, primarily through development and implementation of community-based management plans for locally marine managed areas (LMMAs). Under the USAID funded Coral Triangle Support Partnership (CTSP) (2009-2013), Conservation International and local firm, Rai Consultadoria, worked with local communities in the Nino Konis Santana National Park to improve conservation and management of their marine and coastal resources. In particular, developing and applying successful co-management³⁰ approaches, drawing on international practice but tailored specifically to Timor-Leste.

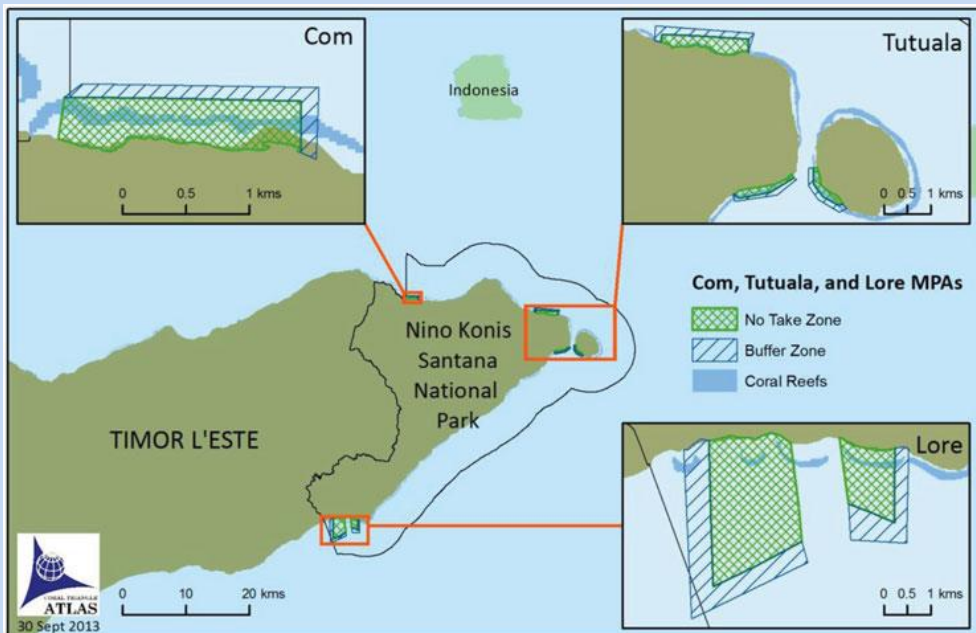
²⁹ Edyvane, K., N. de Carvalho, S. Penny, A. Fernandes, C.B. de Cunha. A. Amaral, M. Mendes and P. Pinto (2009a) *Conservation Values, Issues and Planning in the Nino Konis Santana Marine Park, Timor Leste – Final Report*. Ministry of Agriculture & Fisheries, Government of Timor Leste.

³⁰ Co-management is not the same thing as Community Based Natural Resource Management (CBNRM). CBNRM is an integral part of co-management– it is community-focused and necessary for enabling localised management efforts. Co-management always involves: (i) a conscious and official distribution of responsibility, and (ii) the formal vesting of some authority (Government to Community, etc.). The amount of responsibility and authority that the Government of Timor-Leste devolves to local institutions, regardless of how much or little, will be: site-specific, and invariably tied to an agreement. Significantly, co-management embeds CBNRM within a broader governance context, and seeks to establish partnership arrangements between government, resource users, and local communities (CTSP 2013).

Box 6: Co-Management in the Nino Konis Santana Marine Park

The Nino Konis Santana (NKS) National Park, located on the eastern-most tip of Timor-Leste (Figure 7), is the nation's first and only national park. Declared in 2007, five years after Timor-Leste's independence, the park encompasses over 1,236 km² of terrestrial estate and 556 km² of marine territorial waters (1.3% of the national EEZ), and encompasses 29.5% of the coral reefs of Timor-Leste. In 2013, under the USAID's Coral Triangle Support Partnership (CTSP) program, Timor Leste's first co-managed, LMMAs were established in 3 locations in the marine waters of the park: at Com (~100ha), Tutuala (1600ha) and Lore (270ha).

The LMMAs are zoned, with core 'no take' and buffer zones. A total of 7 'no take' zones are embedded within broader multiple-use, Marine Park, which encompasses 207 km² of coastal waters. Marine zones within the NKS include no-take zones, buffer zones, and special regulation zones, with a mix of gear restrictions, temporal closures, and species-specific take limits. The zones encompass important coral reefs which help maximize climate resilience, serve as reef fish spawning sites, enable fisheries replenishment, and protect key dive and snorkel sites for tourism purposes. A major focus of current activity is implementation of LMMA plans and building the management capacity of local communities through monitoring programs (seagrass, dugong, sea turtles, mangroves), and also, livelihood development (ecotourism).



The central feature of this co-management approach is supporting community members and Government at the National, Municipal, and *Sucu* (village) levels to develop the knowledge and key skills needed for effective marine resource and fisheries management, primarily through the development and implementation of community-based management plans for locally marine managed areas (LMMAs). These skills and knowledge include: facilitation, outreach, and awareness raising on

marine ecology and the benefits of management, project planning, zoning and rule making, designing and implementing collaborative compliance and enforcement systems, biological and socioeconomic monitoring, reporting results to stakeholders, and financial management. Many valuable lessons and insights can be learnt from the application of this LMMA co-management model in the NKS Marine Park.

A plan of management for the NKS National Park (including the Marine Park) (McIntyre 2015a)³¹ and a capacity-development plan (McIntyre 2015b)³² was completed in 2015, with the support of the UNDP PoWPA program. A separate zoning plan³³, and capacity-development plan³⁴ for the Marine Park was completed by the CTI NCC in 2013, with the support of Conservation International. However, despite the significant level of donor investment, the status of the NKS Marine Park management plan remains unclear³⁵. Under the ATSEA2 program, the management of the NKS Marine Park will be significantly strengthened³⁶: including updating/strengthening the NKS management plan, strengthening financial sustainability, supporting implementation of LMMAs - particularly LMMA monitoring³⁷ (Annex 4.7)

In addition to great clarity and coordination in finalizing management planning, 'on the ground' support for co-management of the NKS Marine Park remains a critical, ongoing issue. No LMMAs within the park have been formally gazetted (under Ministerial Diplomas), no fisheries management plans have been finalized and LMMA and marine monitoring outputs are limited³⁸. To this end, ongoing technical support,

³¹ McIntyre, M.A. (2015a). *Site Conservation Management Plan, Nino Konis Santana National Park. Annex 2: Thematic Aims, Objectives and Strategic Actions*. UNCBD Programme of Work on Protected Areas. Prepared for Department of Protected Areas, Ministry of Agriculture and Fisheries, Government of Timor-Leste, with the assistance of UNDP Timor-Leste and GEF. Planning 4 Sustainable Development Pty Ltd, Landsborough, Queensland, Australia.

³² McIntyre, M.A. (2015b). *Site Conservation Management Plan, Nino Konis Santana National Park, Timor Leste*. UNCBD Programme of Work on Protected Areas. Prepared for the National Directorate of Forestry, Ministry of Agriculture and Fisheries, Government of Timor Leste, with the assistance of UNDP Timor Leste and GEF. Planning 4 Sustainable Development, Caloundra, Queensland, Australia. 67pp.

³³ CTI-CFF National Coordinating Committee (2013). *Marine Zoning Recommendations for the Nino Konis Santana National Park Timor-Leste*. Coral Triangle Support Partnership, Coral Triangle Initiative on Coral Reefs, Fisheries and Food Security (CTI-CFF), 7pp.

³⁴ CTI-CFF National Coordinating Committee (2013). *Co-management of Marine Resources in the Nino Konis Santana National Park: Capacity Development Strategy*. Coral Triangle Support Partnership, Coral Triangle Initiative on Coral Reefs, Fisheries and Food Security (CTI-CFF), 12pp.

³⁵ Funding under the Margaret Ann Cargill Foundation (MACF) (2015–2018) has also been provided to support the establishment of a NKS Steering Committee and also, the preparation of NKS management plan (\$650,000). However, no reports were accessible/available on this activity.

³⁶ Outputs 2.3.2-25 to 2.3.2.-28 of the ATSEA2 ProDoc.

³⁷ Under Output 2.3.2-28, potential LMMA implementation activities will include building the capacity of local communities to strengthen existing LMMAs, e.g., seagrass, dugong and turtle monitoring programmes, ecotourism ventures, or mangrove watch, etc.

³⁸ While community-based MPA/LMMA surveys, training, monitoring and management activities have been undertaken for the NKS Marine Park – no datasets or reports were available on these activities.

training and critical capacity-building for community-based management in the NKS Marine Park remains a major issue.

2.9 ATAURO ISLAND LMMAS AND MARINE PARK

Atauro Island is the second major national focal point for marine HCV activity in Timor-Leste (after the NKS Marine Park). It is also the recognised ‘birthplace’ of ecotourism in Timor-Leste, particularly community-based ecotourism – with the establishment of the country’s first community-run, eco-lodge (Tua Koin).

The island was the site of the first coral reef surveys in Timor-Leste (Wong & Chou 2004, Dutra & Taboada 2006), including the first coral reef monitoring using ‘Reef Check’ (Dutra et al. 2008 – Reef Check surveys)³⁹. Including the establishment of the first LMMA in Timor-Leste – in Beloi in 2005-6.

Since this time, the island has become a major national/international focal point for marine HCV activity (see Annex 2.11) – particularly marine habitat mapping (Leiper et al. 2011), several coral reef surveys (CI MRAP 2012, 2016, PISC 2017) and more recently, the establishment of a Aquatic Natural Reserve (Vila) and a network of LMMAs (with the support of CI, CTC, WorldFish, BV, and FZ ANZDEC). With the support of Conservation International and CTC, a network of 13 LMMAs is currently being progressed on Atauro – including a proposal for a ‘whole-of-island’ Atauro Island National Park (terrestrial-marine) (Annex 2.8).

A survey of coral reefs (hard coral, fish) conducted by Conservation International in July 2016) reported that the island hosts the highest average fish diversity globally. The 10 study sites averaged 253 reef fish species per site, including one site where 315 species – the third highest globally – were recorded.⁴⁰

Like the NKS Marine Park, Atauro Island has been a major focal point for international and national marine HCV investment in Timor-Leste (NORAD, AUSAID, WorldFish, ADB CTP, GEF Dugong and Seagrass Project) (Annex 2.11). This includes several baseline coral reef and fisheries surveys (ANZDEC, CI, WorldFish, CTC), habitat mapping of the island (Lieper et al. 2009, PISC 2017) and LMMA establishment and monitoring (see Section 3). Importantly, major efficiencies and opportunities for data integration have likely been lost due to a significant lack of donor/partner and program coordination.

³⁹ In their coral reef surveys, Wong & Chou (2004) used both the Reef Check methodology and the standardized, AIMS LIT (Line-Intercept-Transsect) methodology. Full details of the Reef Check methodology are available at www.reefcheck.org and LIT as described in English et al (1997).

⁴⁰ No published report or datasets are currently available on the 2016 CI MRAP (marine rapid assessment) of Atauro Island.

2.10 CURRENT MPA-LMMA ESTATE – ISSUES, GAPS, PRIORITIES

Current MPA-LMMA Estate - Key Issues, Gaps/Priorities

1. With several major partners involved in supporting LMMAs/MPAs there is a critical need for a formal, national, coordinated approach to LMMA/MPA planning, establishment and management. Particularly data collection and monitoring activities, including standardized methods and data deposition, agreed training (level/type) and ongoing technical support (particularly for local communities). As a matter of priority, coral reef and fisheries monitoring in LMMAs, MPAs and across Timor-Leste needs to be coordinated (particularly on Atauro Island).
2. A large number of co-managed LMMAs/MPAs are currently being planned / implemented by MAF across Timor-Leste (32). However, there is an urgent need for prioritization and a cautious approach - due to the critical need for complementary, alternative livelihood development (to offset impacts from fishing restrictions), and also, a major lack of resources for training and ongoing technical support for co-management (to support communities with LMMA baseline surveys, ongoing monitoring, compliance).
3. With the large number of LMMAs and NTZ's currently being progressed/established on Atauro Island (13) (with several development partners), a stocktake and review of activities is needed to assist with coordinated LMMA planning / monitoring / management and livelihood development.
4. Similarly, with the wide range of donors and activities in the NKS Marine Park and the proposed update of the management plan – a stocktake and review of marine HCV MPA/LMMA activities in the NKS marine park – would assist with identifying key information gaps, monitoring/management needs, areas for improved donor coordination and importantly, identify lessons learnt.
5. Poor coordination and a critical lack of data-sharing (particularly between development programs) continues to be a significant challenge for marine-HCV management in Timor-Leste. This has been exacerbated by major HCV investment and development partner activity focussed on a few key locations (ie. Atauro Island and Nino Konis Santana MP). This has resulted not only in overlap, duplication of effort (ie. coral reef surveys, habitat mapping), but also significant lost opportunities for marine data integration.
6. Importantly, a national Marine Protected Areas strategy and plan could assist with not only setting MPA/LMMA priorities, but also improving donor/partner coordination in MPA/LMMA planning, monitoring and management, and also, identifying and prioritizing complementary livelihood development programs.
7. Coordinated marine HCV monitoring and management efforts (including standardized data collection) could also be strengthened if the membership of the CTI NCC TL was broadened to include relevant donors/programs involved in LMMA/MPA establishment and management.

SECTION 3

REVIEW OF MARINE HCV DATASETS

3.1 SEASCAPES, REEFSCAPES

While detailed oceanographic and geomorphological datasets are limited for Timor-Leste - at the broader scale, functional 'seascapes' and have been defined for the Lesser Sunda Ecoregion, based on a range of oceanographic, geomorphological and biogeographic patterns⁴¹, the most eastern of which included Timor-Leste (DeVantier et al. 2008).

Around the island of Timor itself, a further reef habitat stratification identified four coral 'reefscales' (DeVantier et al. 2008) - three of which occur in Timor-Leste, and incorporate fringing reefs and associated seagrass and mangrove habitats: **Atapupu**, **Fatu** and **Timor East** reefscales (see Figure 3.1, Annex 3.4).

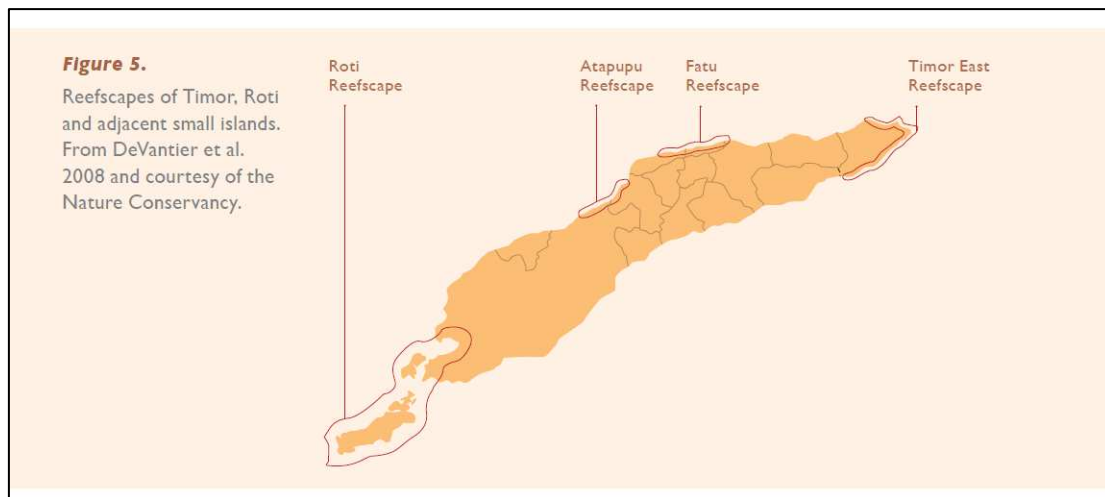


Figure 3.1. Coral 'reefscales' of the island of Timor (from DeVantier et al. 2008).

⁴¹ The nested stratification of the Lesser Sunda Ecoregion delineated 24 coral reefscales nested within seven functional seascapes, using published and unpublished information and expert opinion, specifically on oceanography, bathymetry and physico-chemical parameters, habitats and distributions of corals, fishes, stomatopods, mangrove and seagrass communities and cetaceans (DeVantier et al. 2008).

There remains a major opportunity for developing a range of ‘seascape-level’ datasets for Timor-Leste, using existing bathymetric, physical geomorphological, and physical and chemical oceanographic datasets,⁴² specifically to define biophysical environments (particularly in deeper waters) to support EBM and marine spatial planning and also, identify areas of productivity, biological significance and assist ocean conservation.

3.2 COASTAL & MARINE HABITATS

3.2.1 HABITAT MAPPING

National-scale habitat mapping (coral reefs, seagrasses, mangroves) has been completed for the shallow inshore waters of Timor-Leste (less than 10m depth, using satellite imagery (Landstat TM, WorldView2) (Boggs et al. 2009, Leiper et al. 2011, PISC 2017). However, there is a lack of ‘ground-truthing’ and data/validation, particularly for the southern coast. Additional finer-scale mapping and surveys are being undertaken in protected areas.⁴³

Bathymetry has been successfully derived from the shoreline to approximately 15-m depths for Atauro Island, Oecusse, and most of the north shore of Timor-Leste with relatively few spatial gaps (PISC 2017). However, insufficient depth soundings and prolonged periods of high turbidity (i.e., low visibility) caused by extensive rain and sediment runoff, have prevented effective ground-truthing and the calculation of reliable estimated depths for the entire south coast⁴⁴.

There has been no deeper water, benthic habitat mapping undertaken in Timor-Leste.

Key Habitat Mapping Datasets:

- Bathymetry and habitat mapping of the coasts and nearshore waters of Timor-Leste (using WorldView2) (PISC 2017) (see Figure 3.2)
- Habitat mapping of the north coast (including NKS Park, south to Lore) (using Landstat TM) (Boggs et al. 2009)
- Habitat mapping of the south coast and north-west (including Atauro Island (using Landstat TM) (Leiper et al. 2011) (see Figure 3.3, 3.4)

Timor-Leste’s coastline extends for approximately 700 km, including the islands of Atauro and Jaco and the western province of Oecussi. As a high-standing island, shallow, nearshore coastal-marine habitats (mangroves, coral reefs and seagrasses) of Timor-Leste are very limited in extent - predominantly due to the country’s narrow continental

⁴² Modelling approaches using globally available satellite remote sensing and model-assimilated data have successfully been used recently in the Sunda-Banda Seascape to define and delineate biophysical environments for spatial/seascape planning, particularly in deeper water habitats (Wang et al. 2015).

⁴³ Conservation International is currently leading the mapping of individual protected areas, including multi-country scientist partnerships surveying national protected areas. But no reports or data was available on this activity.

⁴⁴ Estimated depth calculations (for bathymetry) and also, the quality of benthic habitat classifications are highly dependent on the quality of satellite and aerial photographic - good visibility is essential.

margin and coastal physiography. Specifically, high profile coasts on the northern coast, and the lack of near-shore, protected habitat on the wave-exposed southern coast (Boggs et al. 2009).

The limited extent of coastal-marine habitats, combined with high levels of resource dependency and food insecurity (and climatic and non-climatic pressures), underscore the critical urgency for sustainable resource use, integrated coastal management and alternative coastal livelihood development.

Recent coastal habitat mapping indicates that the total estimated areal extent of nearshore coastal habitat in Timor-Leste, is just 121km² (Annex 3.6). Detailed coastal habitat mapping, by NOAA (under US CTI - USAID), using WorldView2, has mapped a total area of more than 190 km² of shallow water habitat (classified into hard and soft substrate, mangrove, seagrass, intertidal, rock and lagoon habitats) (Figure 3.2, Annex 3.5). Significantly, the NOAA mapping does not map/classify coral reefs.

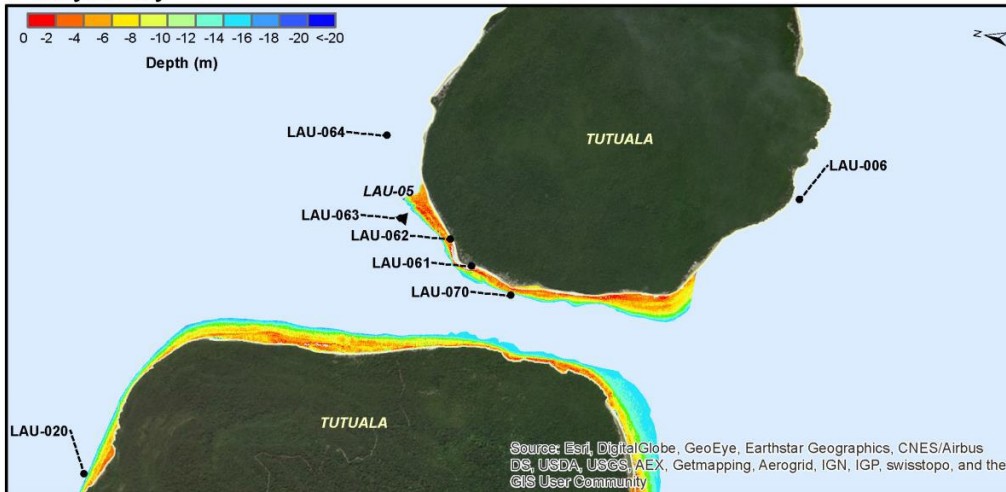
Potential much larger areas of deeper water coral reefs have been identified (Boggs et al. 2009). This has been confirmed in recent field surveys, which reveal that coral communities extend to > 60 m depth, although most coral growth occurred above 30 m depth, on slopes ranging from near horizontal to near-vertical reef walls, the latter being uncommon (Turak and Devantier 2012).

By way of example, the vast majority of the marine habitats within the Nino Konis Santana Marine Park (>90%) are deepwater habitats (>100m depth), due to the very steep offshore, coastal gradient in the region. Habitat mapping conducted to-date within the Nino Konis Santana Marine Park has been limited to the shallow, nearshore environments of the north coast (and Jaco Island), only <2% of the area (ie. 990 ha) of the Marine Park (59,308 ha) has been mapped (see Boggs et al. 2009).

Current Status of Seascape, Marine Habitat Mapping

- Bathymetry has been successfully derived from the shoreline to approximately 15-m depths for Atauro Island, Oecusse, and most of the north shore of Timor-Leste with relatively few spatial gaps (PISC 2017).
- National-scale habitat mapping (coral reefs, seagrasses, mangroves) has been completed for the shallow inshore waters of Timor-Leste (less than 10m depth, using satellite imagery (Landstat TM, WorldView2) (Boggs et al. 2009, Leiper et al. 2011, PISC 2017).
- There are major depth limitations of satellite-based mapping and also, a lack of field 'ground-truthing' and available validation data for the habitat classifications, particularly for the south and northwest coast.
- As a high-standing island, with deep coastal and offshore gradients, the vast majority of Timor-Leste's territorial waters remain unmapped. No deep water habitat mapping has been undertaken to-date.
- Globally available satellite remote sensing and model-assimilated data should be used to define and delineate biophysical environments particularly in deeper water habitats (to assist both HCV management, EBM and importantly, provide a foundation for marine spatial planning).

Bathymetry



Benthic Habitat

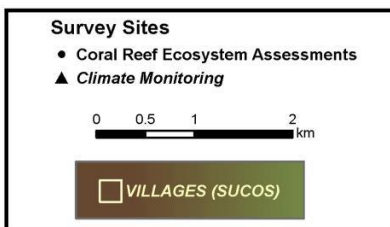
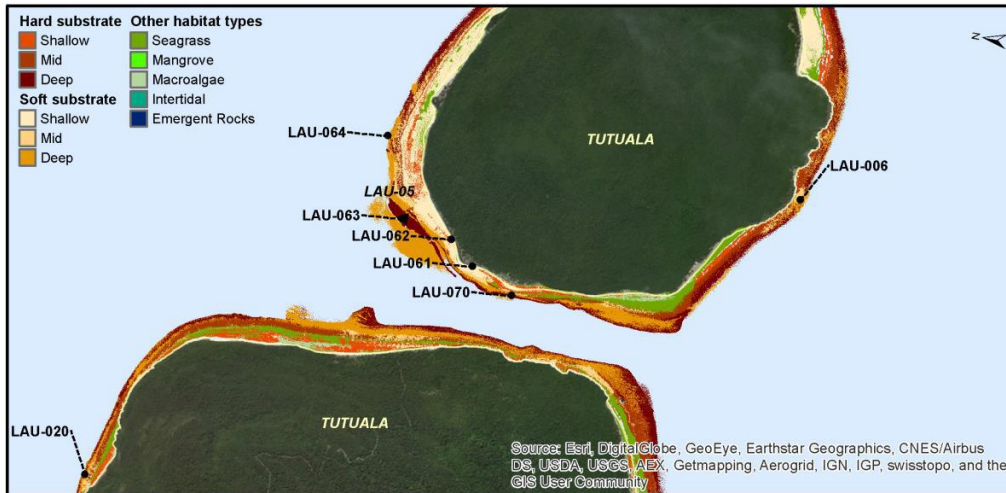


Figure 3.2. Example of outputs from national-scale bathymetry and marine habitat mapping by USAID-funded NOAA-CREP mapping using WorldView2 imagery (PISC 2017).

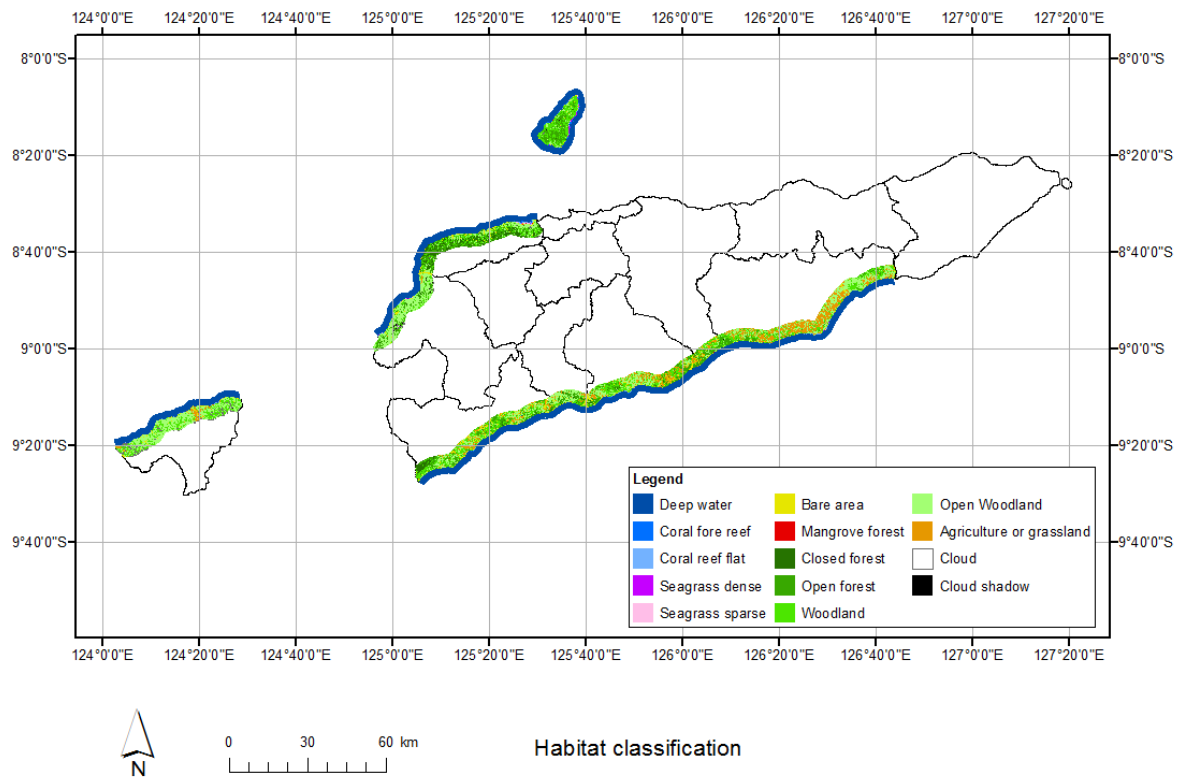
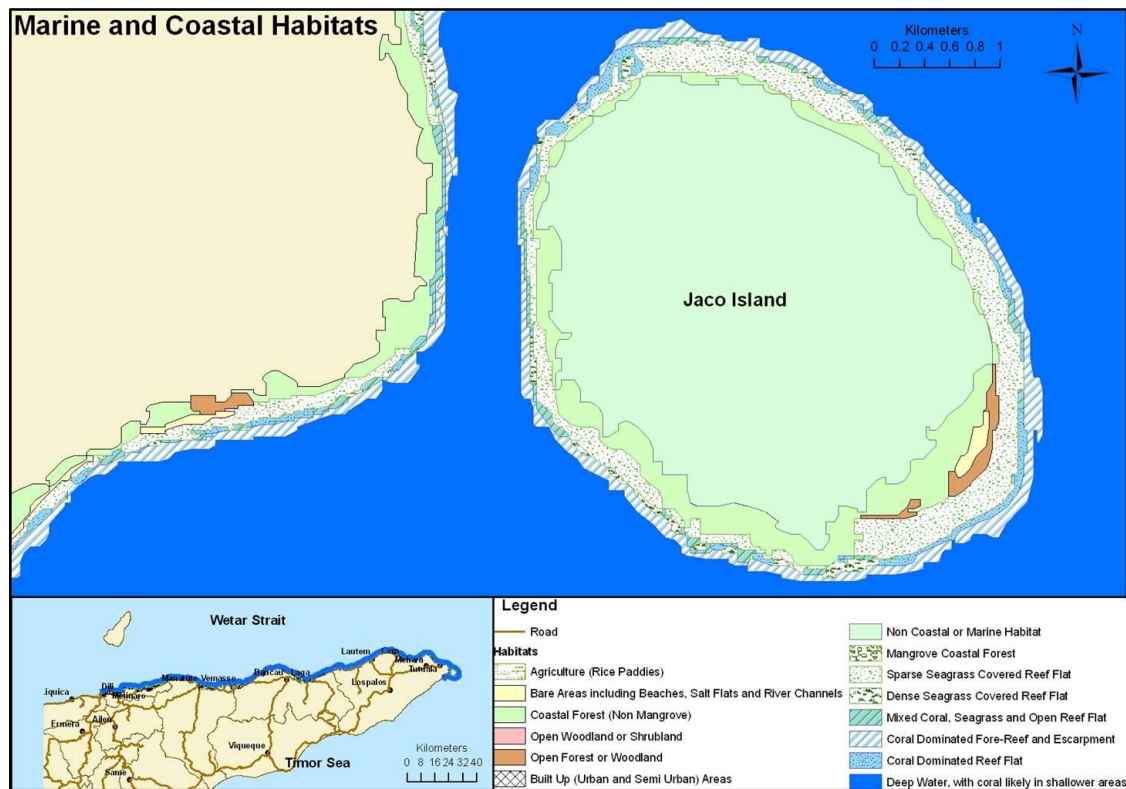


Figure 3.3. Example of outputs from national-scale coastal and marine habitat mapping by CDU mapping using Landsat TM imagery (Boggs et al. 2009, Lieper et al. 2013).

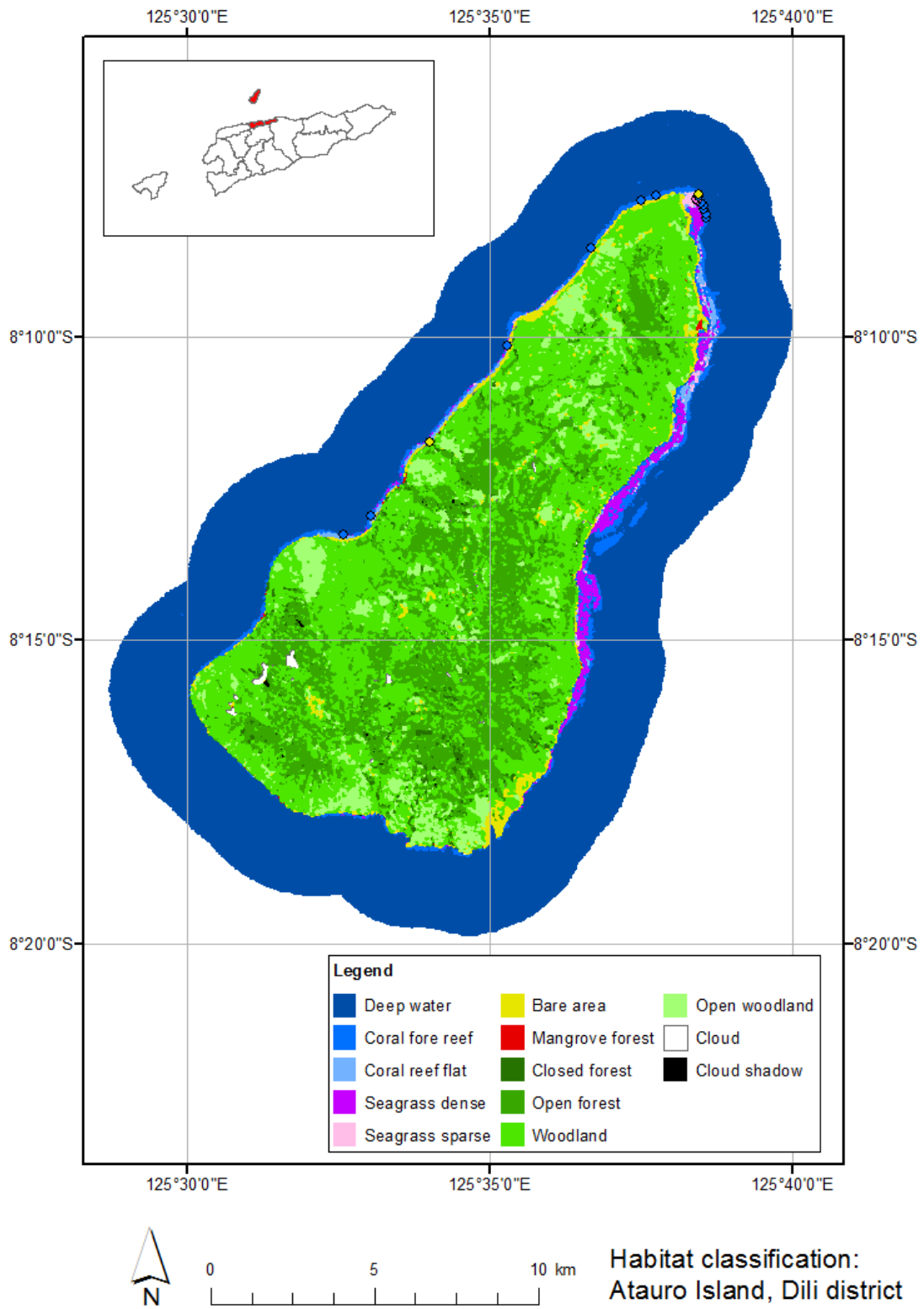


Figure 3.4. Example of output for terrestrial and marine habitat mapping by CDU mapping using Landsat TM imagery (from Lieper et al. 2013).

3.2.2 MARINE BENTHIC SURVEYS

Marine benthic surveys in Timor-Leste have primarily focused on the north coast and particularly existing/potential MPAs, LMMAs, especially the Nino Konis Santana Marine Park and Atauro Island.

Further, the major focus of systematic benthic surveys has been on coral reefs (see ‘Coral Reef Surveys’ below). However, the focus and coral reef survey methods employed have varied considerably, ie. all major epibiota, ie. corals, macroalgae, seagrasses, invertebrates, fish (Ayling et al. 2009), hard corals and fish only (CI-MRAP 2012, 2016), and benthic cover categories (PISC 2017).⁴⁵

Key Marine Benthic Survey Datasets:

- Benthic surveys of the north coast (including NKS Park, south to Lore) (November 2008) (Ayling et al. 2009, Edyvane et al. 2009) - corals, macroalgae, seagrasses, invertebrates, fish
- CI-Marine Rapid Assessment of the Nino Konis Santana Marine Park (MRAP) (August 2012) (Turak & Devantier 2013) – hard corals, fish
- CI-Marine Rapid Assessment (MRAP) of Atauro Island (June 2016) — hard corals, fish (10 sites)
- Reef surveys of the coasts and nearshore waters of north coast and Atauro Island (June 2013) (PISC 2017) - benthic cover (8 classes), reef fish

3.3 CORAL REEFS

One of the most ‘data-rich’ marine HCV habitats in Timor-Leste. Coral reefs have been mapped at the national scale in Timor-Leste using satellite imagery (Landstat TM) (Boggs et al. 2009, Leiper et al. 2011). However, there has been limited field ground-truthing and data validation for the south and northwest coast. While a total of 4 major coral reef survey programs (2008 – 2016) have been undertaken, the majority of these confined to the north coast.

Key Coral Reef Datasets:

- Mapping and classification of coral reefs (global MCRM database) (Andrefouet et al. 2006, Grantham et al. 2011)
- Coral reef surveys, using ‘Reef Check’ (2004, 2006, 2008) – north coast, Oecusse, Atauro Island (8 sites)(Wong & Chou 2004, Dutra et al. 2008)
- Benthic surveys of the north coast (including NKS Park, south to Lore) (November 2008) (Ayling et al. 2009, Edyvane et al. 2009) - corals, macroalgae, seagrasses, invertebrates, fish
- CI-Marine Rapid Assessment of the Nino Konis Santana Marine Park (MRAP) (August 2012) (Turak & Devantier 2013) – hard corals, fish
- CI-Marine Rapid Assessment (MRAP) of Atauro Island (June 2016) — hard corals, fish (10 sites) – no reports available.
- Reef surveys of the coasts and nearshore waters of north coast and Atauro Island (June 2013) (PISC 2017) - benthic cover, 8 classes including Hard coral, Soft coral, Crustose Coralline Algae (CCA)

3.3.1 TYPES OF CORAL REEFS

Coral reefs of Timor-Leste have not only been mapped, but also classified (based on coral reef geomorphology) using the MCRM classification (Andrefouet et al. 2006) (see Table 3.1).

Name	Attribute 1	Attribute 2	Attribute 3	Area (km ²)
Type 1	Continental island	Outer barrier reef complex	Subtidal reef flat	1
Type 2	Continental island	Shelf patch-reef complex	Forereef	<1
Type 3	Continental island	Shelf patch-reef complex	Reef flat	<1
Type 4	Continental island	Ocean exposed fringing	Enclosed lagoon or basin	2
Type 5	Continental island	Ocean exposed fringing	Forereef	36
Type 6	Continental island	Ocean exposed fringing	Reef flat	57
Type 7	Continental island	Ocean exposed fringing	Shallow terrace	7.5
Total Area				100

Table 3.1. Area and types of coral reefs in Timor-Leste (adapted from Grantham et al. 2011). Reefs were classified using the MCRM classification (Andrefouet et al 2006).

Coral Reef data for Timor-Leste was sourced from The Millennium Mapping Project, undertaken by the University of Miami (see <http://imars.marine.usf.edu/MC/index.html>).

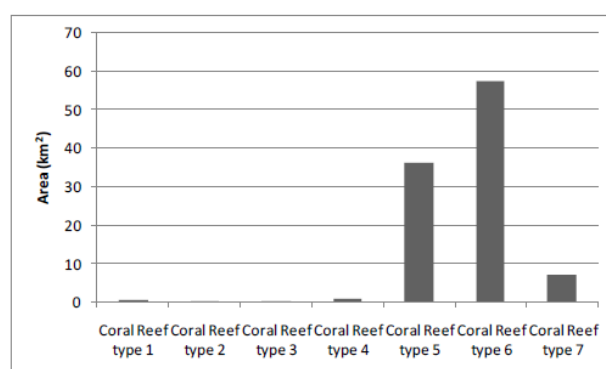


Figure 3.5. Area and types of coral reefs in Timor-Leste (adapted from Grantham et al. 2011). Reefs were classified using the MCRM classification (Andrefouet et al 2006).

3.3.2 CORAL REEF SURVEYS

There have been four major coral reef surveys of the northern coast of Timor-Leste (2008 – 2013). However, the focus and survey methods employed have varied considerably, i.e. all major epibiota, i.e. corals, macroalgae, seagrasses, invertebrates, fish (Ayling et al. 2009), hard corals and fish (CI-MRAP 2012, 2016), and benthic cover categories (PISC 2017). Further, with no coordination of activity (particularly location of sampling sites), opportunities for data integration, cross-validation, and long-term reef monitoring are limited.

- *CDU-MAF Nino Konis Santana Marine Park Project (2006-2009)* - The first marine benthic ecological survey (i.e. corals, macroalgae, seagrasses, invertebrates, fish) of selected sites in the newly declared Marine Park - took place from the 20th to the 28th of November 2008 (Ayling et al. 2009). During this time quantitative

surveys were made at a total of 27 sites spaced around 80% of the almost 100 km length of coastline within the Marine Park. Including 9 sites around Jaco Island, 9 sites on the north coast and 9 sites on the south coast of the park.

- *CI-MRAP (August 2012) - Turak & Devantier (2013)* - A total of 39 sites (adjacent deep and shallow areas) at 20 stations⁴⁶ (individual GPS locations) were surveyed along the NE coast inside and outside of Nino Konis Santana National Park and on Atauro Island (see Figure 3.6). A total of 15 sites were surveyed within the NKS Marine Park. Unfortunately the southern coastline including Lore was not surveyed due to weather conditions. Two of the sites were assessed for corals only (sites 14 and 22), and two of the sites were assessed for fishes only (sites 12 and 13). Five stations were identified as sites of high conservation priority for coral reefs (based a range of criteria) (see Annex 3.7).

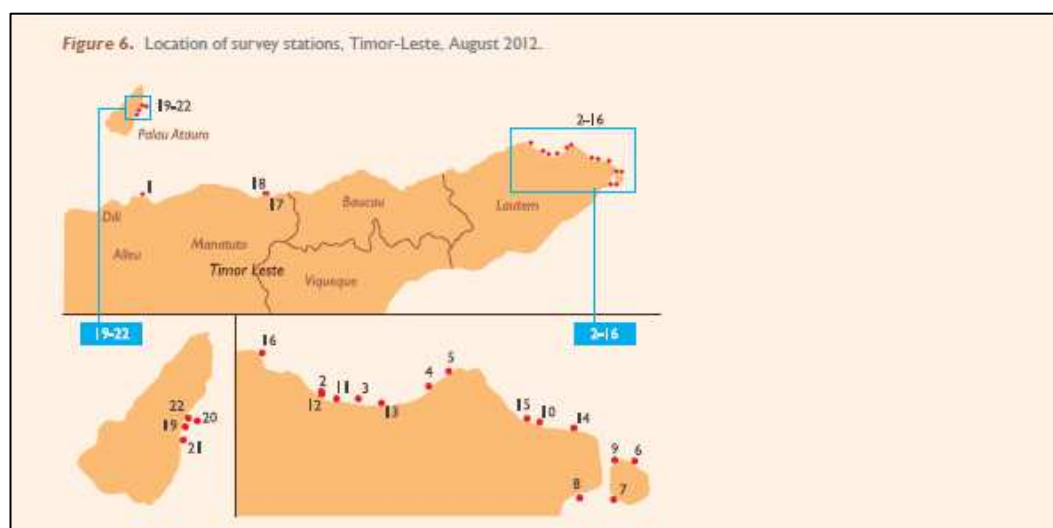


Figure 3.6. Location of MRAP survey stations, Timor-Leste, August 2012.

- *CI-Marine Rapid Assessment (MRAP) of Atauro Island (June 2016)* — hard corals, fish (10 sites) – no reports currently available.
- *USAID-funded NOAA-CREP Coral Reef Assessment (June 2013)* – 150 sites.
 - *Reef Fish Surveys* - In total, reef fish surveys were conducted at 150 sites along Timor-Leste’s north shore from June 4–27, 2013 (see Figure 3.7) . See Annex H (PISC 2017) for a list of the sites surveyed. Surveys were not conducted along the southern coastline due to weather and logistical/fiscal limitations.
 - *Benthic Cover* - Photographs of the benthos were collected and analyzed for benthic cover at 139 of the reef fish survey sites (see Figure 3.8). Benthic cover categories included 8 categories: Hard coral, Soft coral, Crustose Coralline Algae (CCA), Macroalgae, Turf Algae, Invertebrates, Sand and Unclassified.

⁴⁶ The term ‘station’ refers to the combined results of the two sites (depths). At all but one station (Station 22), deep (>10m) and shallow (<10m) areas, herein named ‘sites’ (designated as site #.1 and #.2 respectively) were surveyed concurrently.

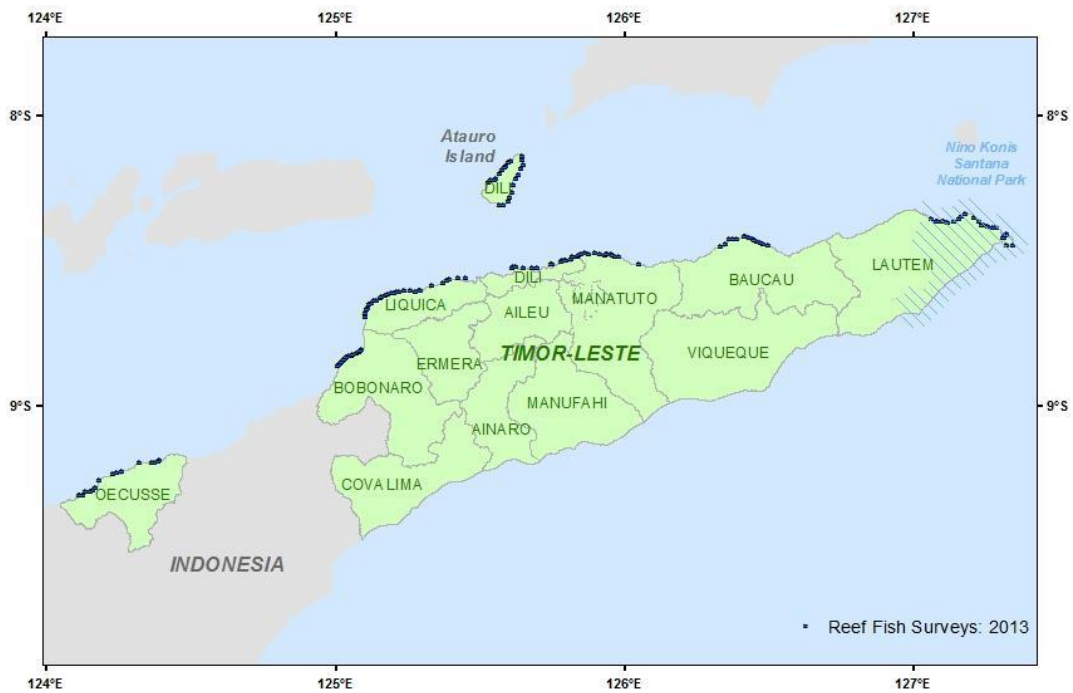


Figure 3.7. Map of locations where NOAA-CREP conducted reef fish surveys along the north coast of Timor-Leste and around Atauro Island in June 2013.

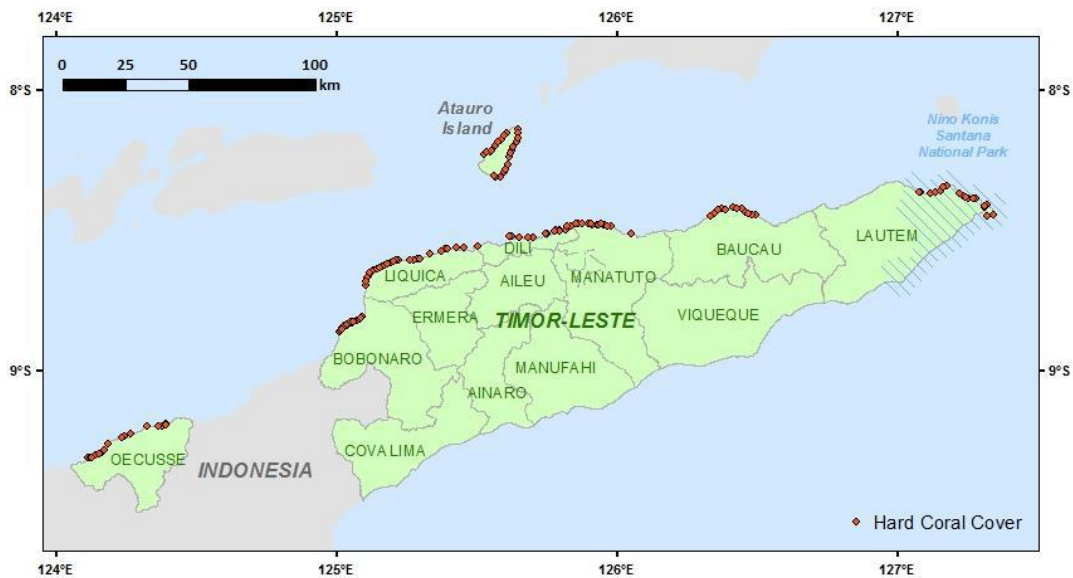


Figure 3.8. Map of 139 locations where NOAA-CREP collected benthic images along the north coast of Timor-Leste and around Atauro Island in June 2013 that were analyzed for benthic cover.

3.4 MANGROVES, COASTAL WETLANDS

3.4.1 MANGROVES

Mangroves have been mapped at the national scale in Timor-Leste using satellite imagery (Landstat TM, WorldView 2) (Boggs et al. 2009, Leiper et al. 2011, PISC 2017). However, no detailed ‘ground-truthing’ or finer-scale mangrove community mapping (1:10,000) or floristics has been undertaken for the south coast or northwest coast.

Key Mangrove Datasets:

- Coastal wetland surveys (Trainor et al. 2007, 2011)
- Mangrove mapping of the north coast (including NKS Park, south to Lore) (using Landstat TM), including detailed mangrove floristics and mapping (1:10,000) (Boggs et al. 2009)
- Mangrove mapping of the south coast and north-west (including Atauro Island (using Landstat TM) (Leiper et al. 2011)
- Mangrove mapping of the coasts and nearshore waters of Timor-Leste (using WorldView2) (PISC 2017)
- UNDP Building Shoreline Resilience Project – survey and biophysical assessment of 11 mangrove sites (Ilman 2017) (6 sites on north coast, 5 sites on south coast)

Detailed mangrove floristics mapping (1:10,000) for the north coast, identified a total of 20 mangrove communities with clear zonation patterns (Boggs et al. 2009). Field surveys identified 14 structural classes (based on the structure of the upper strata), 45 classes based on all strata and 24 floristic groups. The vegetation ranged from closed forest dominated by mangrove species (e.g. *Avicennia marina*, *Rhizophora stylosa* and *Sonneratia alba*), through palmlands and woodlands dominated by *Borassus flabellifer* and *Tamarindis indica* respectively to bare salt flats with a total of 42 dominant plant species identified (Annex 4, Boggs et al. 2009).

Additional mangrove data is also available from extensive wetland surveys conducted by BirdLife International. Of the 93 wetlands surveyed by BirdLife International (Trainor 2005, Trainor et al. 2007, 2011), 16 sites recorded mangroves (see Table 3.2). These sites should be considered as potential project sites for mangrove protection, and restoration.

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

Table 3.2. Total number of surveyed wetlands, with mangroves confirmed present (Trainor et al. 2007, 2011).

Under the US\$7M UNDP Building Shoreline Project, there is also the potential for significant additional mangrove data. In March 2017, mangrove surveys and biophysical field assessments⁴⁷ were undertaken of the 11 largest mangrove areas in Timor-Leste (6 sites on north coast, 5 sites on south coast) (see Figure 3.9). The assessment covered an area of approximately 1,500 ha of coastal wetlands. In each location, the status of mangroves was assessed, including mangrove area, mangrove species and population size; physical/environmental variables, particularly soil condition, tidal regime, inundation area; and identification of past and future threats and key drivers of mangrove loss. Significantly, mangrove conservation and restoration sites will be also monitored (using Mangrove Watch protocols).

Completion of a mangrove (and coastal wetlands) inventory is proposed under the UNDP project⁴⁸. But it is not clear whether this includes floristics mangrove mapping for the south and northwest coast, as specifically recommended for this UNDP project (Edyvane 2015).

⁴⁷ 'Assessment Report of the Biophysical, Ecological and Socio-Economic Conditions of Mangroves Ecosystem of Timor Leste' (Ilman 2017) .

⁴⁸ In consultation with MPW, use the 2014 high resolution aerial photographs for land use planning as well as LiDAR data (expected to be available in 2015), to take inventory of coastal wetlands and calculate actual mangrove coverage with follow up ground surveying - identify areas most affected by sea level rise and mangrove loss; with data to be maintained at the UNTL Climate Change and Biodiversity Centre.

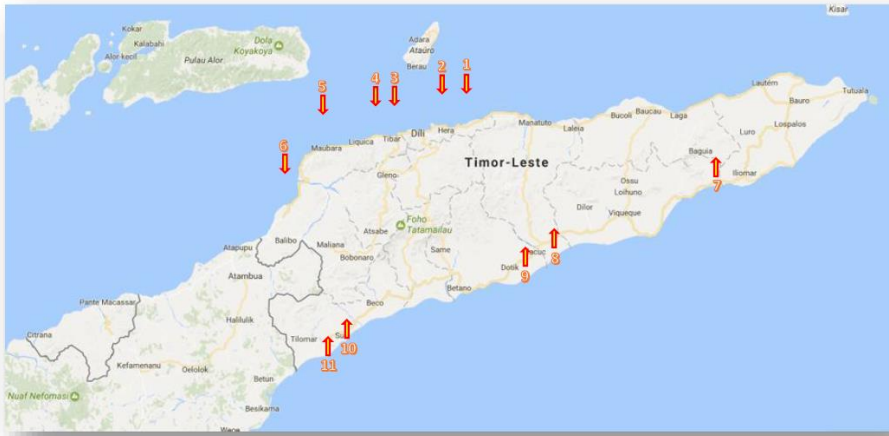


Figure 3.9. Locations of mangrove survey, conservation and re-afforestation assessments (from Ilman 2017).

3.4.2 WETLANDS OF INTERNATIONAL / NATIONAL IMPORTANCE

In Timor-Leste, coastal wetlands (and particularly the avifauna) have been relatively well-studied by BirdLife International, including bird surveys of 93 inland and coastal wetland sites (Trainor 2005, Trainor et al. 2007, 2011). Coastal wetlands (both, brackish and freshwater), like mangrove forests, are important coastal features that provide both, a range of coastal protection functions (against storm surge, coastal erosion, strong winds), as well as ecosystems services to support coastal livelihoods (ie. water, food, fisheries, timber resources, cultural/spiritual values).

During 2005-2006, 74 wetland sites were surveyed, primarily to record aquatic bird life and their key wetland habitat (Trainor 2005). Sixteen of these sites were identified, nominated and subsequently listed as internationally, Important Bird Areas (IBAs) (Annex 3.2). Most of these sites are concentrated on the northern and eastern coast of Timor-Leste (see Figure 3.10). In addition, a total of 24 key wetland sites were identified as environmentally significant at the national scale, and in need of conservation and improved management, both to support threatened and near threatened birdlife, also, to protect wetland habitat and improve the coastal protection against sea storms and inundation (Trainor et al. 2007, NBSAP 2010) (Annex 3.3).

Key Wetlands Datasets:

- Coastal wetland surveys (Trainor et al. 2007, 2011)
- Wetlands of International Importance, Important Bird Areas (IBAs), Endemic Bird Areas (EBAs) (Trainor et al. 2007) (Annex 3.2)
- Wetlands of National Significance (Trainor et al. 2007, NBSAP 2012) (Annex 3.3).

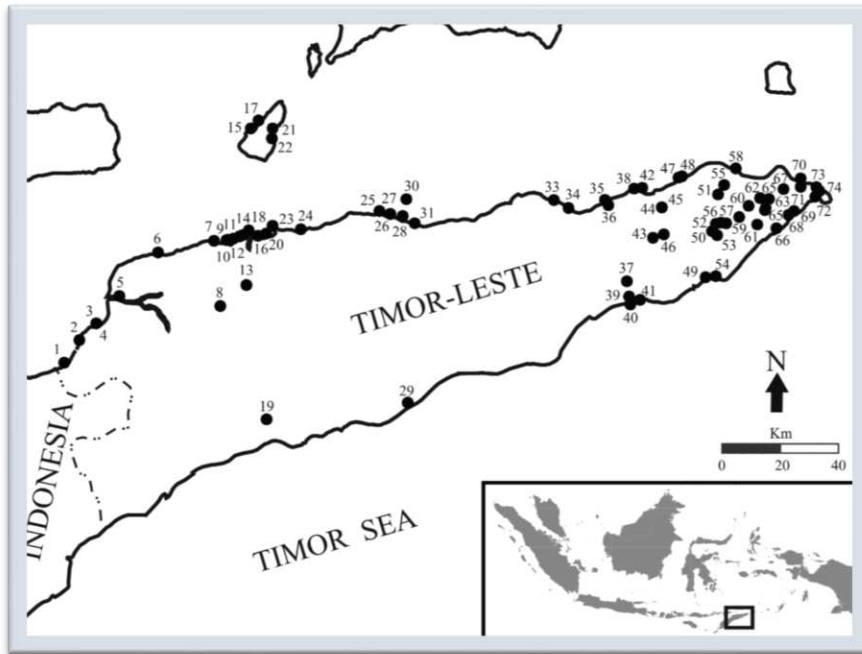


Figure 3.10. Map of wetland study sites in Timor-Leste (from Trainor 2005).

3.5 SEAGRASSES

Seagrasses have been mapped at the national scale in Timor-Leste using satellite imagery (Landstat TM, WorldView 2) (Boggs et al. 2009, Leiper et al. 2011, PISC 2017). However, like mangroves, coral reefs, there has been limited ground-truthing and field validation for seagrasses on the south and northwest coast. One-off surveys of seagrass have also been undertaken for the Tibar Bay region⁴⁹. Current seagrass monitoring efforts (using the Seagrass Watch protocol) are confined to only a few sites on the north coast (Beloi, Com).

Key Seagrass Datasets:

- Seagrass mapping of the north coast (including NKS Park, south to Lore) (using Landstat TM) (Boggs et al. 2009)
- Seagrass mapping of the south coast and north-west (including Atauro Island (using Landstat TM) (Leiper et al. 2011)
- Seagrass mapping of the coasts and nearshore waters of Timor-Leste (using WorldView2) (PISC 2017)
- GEF Dugong and Seagrass Project – monitoring of seagrasses using Seagrass Watch protocol (Beloi, Com).

Under ATSEA2 program (Activity 2.3.3-4), exchange visits are proposed (within and between ATS countries) with other projects and programs including addressing fisheries impacts on seagrass habitats and also seagrass research and monitoring (Annex 4.7).

⁴⁹ Marine megafauna and critical habitat assessment of the Tibar Bay region (13-18 July 2014), including seagrass mapping and seagrass survey (Charles Darwin University) (Eisemberg et al. 2014).

3.6 MARINE HABITATS, SURVEYS - KEY ISSUES, GAPS, PRIORITIES

Marine National Habitat Mapping, Surveys – Key Issues, Gaps/Priorities

1. Complete national-scale marine habitat mapping (coral reefs, seagrasses, mangroves) of Timor-Leste. Undertake benthic surveys of nearshore habitats of the south and northwest coasts (to validate satellite mapping) – using cost-effective, existing survey methodologies established for the north coast. For any additional finer-scale, marine surveys and mapping, existing or proposed MPAs / LMMAs should be prioritized.
2. Undertake finer-scale, mangrove community mapping (1:10,000) and floristics, on the south and northwest coast. Explore the use of recent UNDP mangrove floristics data (collected at 11 sites) and also ongoing mangrove monitoring data (including Mangrove Watch).
3. Undertake a ‘stock-take’, analysis and consolidation of existing nearshore habitat mapping and extensive benthic survey datasets – particularly nearshore coral reef surveys (ie. corals, seagrasses, invertebrates, fish) - to (a) validate and improve accuracy of existing (satellite-based) habitat mapping, and (b) generate additional valuable national-scale marine datasets.
4. Potential additional datasets include key marine species mapping and also indicators of marine ecosystem condition. For example, ‘benthic substrate ratio’, defined as the ratio of the sum of coral (hard and soft) and crustose coralline algae (CCA), divided by the sum of turf and fleshy macroalgae, is often used as a metric of ‘coral reef condition’ (Houk et al. 2010).
5. Globally available satellite remote sensing and model-assimilated data should be used to define and delineate biophysical environments particularly in deeper water habitats (to assist both HCV management, EBM and importantly, provide a foundation for marine spatial planning).

3.7 ENDANGERED & PROTECTED MARINE SPECIES

A total of 235 globally threatened species of marine reptiles, corals, fish, mammals, molluscs, and sea cucumbers - listed internationally (ie. IUCN Red List) as either, critically endangered, endangered, or vulnerable - occur in the waters of Timor-Leste (CEPF 2014) (see Table 3.3). But very little spatial data (apart from marine megafauna) is available for these species, and the population status for the majority of globally threatened marine species is largely unknown in Timor-Leste⁵⁰.

Key Endangered & Protected Species Datasets:

- List of globally threatened species in Timor-Leste – (CEPF 2014) (Annex 3.8)
- List of protected aquatic species – Joint Ministerial Order No.18 (Annex 3.9)

IUCN Red List Status Taxonomic Group	Species Distribution by Bioregion				Species Distribution by Country				
	CR	EN	VU	total	Sul	Mal	LS	IND	T-L
Amphibians	0	4	4	8	6	1	1	8	0
Birds	12	20	29	61	29	16	20	61	6
Calanoida	0	0	1	1	1	0	0	1	0
Decapoda	1	15	16	32	32	0	0	32	0
Freshwater fish	4	4	29	37	37	0	0	37	0
Freshwater Gastropods and Bivalves	1	1	1	3	3	0	0	3	0
Lepidoptera	0	5	14	19	10	4	6	19	2
Mammals	5	23	36	64	40	13	15	64	2
Odonata	2	1	4	7	4	2	1	7	0
Plants	5	7	54	66	36	23	18	66	4
Reptiles	2	3	5	10	6	2	7	10	2
Corals	0	9	167	176	171	172	168	176	168
Marine fish	2	6	46	54	51	48	45	54	46
Marine mammals	0	3	2	5	5	5	5	5	5
Marine mollusk	0	0	2	2	2	2	2	2	2
Marine reptiles	1	2	2	5	5	5	5	5	5
Sea cucumbers	0	5	5	10	10	10	9	10	9
	35	108	417	560	448	303	302	560	251

Note: Some species occur in more than one region, and all of the species found in Timor-Leste also occur in Indonesia, which is why the sum of the totals is more than 560.

Table 3.3. Numbers of Globally Threatened Species in Wallacea, and Totals per Region and Country (from CEPF 2014). T-L=Timor-Leste.

⁵⁰ Conservation International advise that they “work across all marine areas for threatened species in Timor-Leste”. However, apart from a 5-day cetacean survey conducted in 2016, no reports or data was available on these activities.

In addition, many marine species have recently been listed and protected under country's List of Aquatic Protected Species – including sharks, dugongs, whale sharks, both oceanic and reef manta rays, spotted eagle rays, nautilus, and giant clams, and all corals (Anthozoa), dolphins, whales, sea turtles and crocodiles (see Annex 3.9). Little data is currently available in Timor-Leste on many of these marine protected species, including population status and also, critical habitat (ie. feeding, breeding, nursery areas).

3.8 KEY MARINE MEGAFUNA SPECIES

3.8.1 CETACEANS

Until 2008, the status of cetaceans in Timor-Leste was relatively poorly known and largely confined to anecdotal reports (Kahn 2008, see Wilson et al. 2011). However, major national-scale marine megafauna aerial and boat-based surveys conducted in 2008 (Dethmers et al. 2009) and more recently systematic surveys and sightings under the 'Baleia no Golfinhu Timor-Leste' (Whales and Dolphins of Timor-Leste) program have substantially improved our knowledge of cetacean diversity, abundance and seasonality in Timor-Leste⁵¹. One-off marine megafauna surveys in the Tibar Bay region⁵², Dili-Atauro-Liquica region⁵³ and community-based monitoring has also been undertaken.⁵⁴ Cetacean research, data and management priorities in Timor-Leste were identified in 2009 and largely still remain relevant today (see Box 7).

Key Cetacean Datasets:

- Marine megafauna surveys of the waters of Timor-Leste (2008) (Dethmers et al. 2009) – monthly megafauna aerial surveys (altitude -1000m, 500m) and boat surveys (including cetaceans, dugongs, crocodiles, turtles, whale sharks, manta rays).
- Cetacean surveys in the waters of Timor-Leste (2013-present) 'Baleia no Golfinhu Timor-Leste' (UNTL-CDU-MTAC) – cetacean aerial surveys (altitude – 1000m) and boat surveys, incidental sightings.
- Marine megafauna species distribution in the Lesser Sunda Ecoregion (Kahn 2008, Wilson et al. 2011) – 'expert-based' mapping (polygons, no data points available).

⁵¹ Much cetacean data collection has been undertaken, but funding assistance is required for data analysis, including development of spatial datasets.

⁵² Marine megafauna and critical habitat assessment of the Tibar Bay region (13-18 July 2014); shoreline, boat and aerial megafauna survey (Charles Darwin University) (Eisemberg et al. 2014).

⁵³ Marine megafauna survey of Dili-Atauro-Liquica region (1-5 November 2016); boat-based survey of cetaceans, including hydroacoustics (Conservation International 2017).

⁵⁴ Conservation International advise that "cetacean data collection has occurred along the south coast, Nino Konis Santana Marine Park, Atauro Island, and the northern coast." However, no reports or data was available on this activity.



Figure 3.11. Sperm whale 'fluking' off the north coast of Timor-Leste (Image Credit - K Edyvane).

The nearshore coastal waters of Timor-Leste are a recognized 'global cetacean hotspot', characterized by exceptional diversity and abundance of whales and dolphins (Dethmers *et al.* 2009) (see Box 7). This is in part due to the steeply sloping coastal profile and also, the two nearshore deepwater (>3km deep) trenches in the Ombai-Wetar Strait and Timor Passage (ie. the Ombai and Timor Trough, respectively). Together they provide ideal cetacean habitat (ie. nearshore-deepwater habitats and coastal upwellings), close to the coast. Further, narrow straits, such as the Ombai-Wetar Strait, result in 'migratory bottlenecks', where species which prefer deep-sea habitats (e.g. blue whales prefer areas >2000 metres in depth) can be seen very close to shore. This cetacean diversity and abundance also, provides a significant opportunity for development of ecotourism (e.g. whale and dolphin watching), particularly along the north coast of Timor-Leste (Dethmers *et al.* 2009, Edyvane *et al.* 2009).

The Savu Sea to the northwest is one of the world's largest whale nurseries for six whale species including humpback whales, pilot whales and the highly endangered blue whales (Bock 2006). Whales frequently pass through the deep ocean trenches in the Savu and Alor Seas and come up to the reefs to feed. In contrast to some of the neighbouring islands of the Alor archipelago, Timor-Leste has no history of whaling, and whales therefore are confident to come close to the shore (Bock 2006).

The first scientific surveys of marine megafauna in the waters of Timor-Leste (conducted in 2008) identified a total of 13 different cetacean species, including the blue whale, sperm whale, Bryde's or Sei whale, short-finned pilot whale, false killer whale, pygmy killer whale, melon-headed whale, Curvier's beaked whale, Risso's dolphin, Fraser's dolphin, spotted dolphin, rough-toothed dolphin, and the spinner dolphin (Dethmers *et al.* 2009). Recent surveys under the 'Baleia no Golfinhu Timor-Leste' Program', have now updated this to a total of 24 confirmed cetacean species).

Box 7: Priorities for Cetacean Conservation & Ecotourism in Timor-Leste

Timor-Leste's waters are recognised as a global hotspot for whales and dolphins, with great potential for ecotourism (Dethmers et al. 2009). But critical information and management efforts are needed to ensure conservation and sustainable management. In 2009, cetacean researchers and the Government of Timor-Leste identified the following research and management priorities and actions, many of which are still relevant today:

- Aerial and boat-based surveys and acoustic studies to build on the current information on species diversity, abundance and distribution and to identify behavioural activities and patterns.
- Identify cetacean 'hotspots' and potential 'critical habitat' for cetaceans (ie. feeding, breeding, calving areas), including:
 - tagging studies using satellite telemetry and/or genetic fingerprinting to define migratory pathways, identify populations and connectivity, and
 - oceanographic and trophic studies in the Wetar – Ombai Strait to identify key seasonal and localized upwellings, primary and secondary productivity, and potential key prey species of cetaceans.
- Surveys of traditional ecological knowledge to complement data from aerial and boat surveys.
- Training and capacity building on cetacean survey techniques, species identification, marine megafauna biology and conservation.
- Capacity building for community-based whale- and dolphin watching ventures
- Development of cetacean watching policies, guidelines, regulations and compliance
- Identification of threats to cetaceans and marine megafauna in Timor Leste waters
- Government policies for deep-sea and shallow-water cetacean habitat protection and threatened species management.



Timor-Leste's waters were recognised as a 'global cetacean hotspot' in 2008, following the first cetacean scientific surveys conducted in the country's waters. Surveys were conducted by researchers from the Northern Territory (Australia) and the Government of Timor-Leste. (Dethmers et al. 2009).

3.8.2 DUGONGS

Until recently, the status of dugong (*Dugong dugon*) in Timor-Leste was relatively poorly known. Existing data has largely been confined to national-scale, megafauna aerial and boat-based surveys conducted in 2008 (Dethmers et al. 2009) and anecdotal reports (Kahn 2008, see Wilson et al. 2011). However, under GEF Dugong and Seagrass Project⁵⁵, there has been a major investment in improving knowledge, as well conservation efforts, in countries across the Indian and Pacific Ocean, including Timor-Leste. One-off marine megafauna surveys in the Tibar Bay region⁵⁶, Dili-Atauro-Liquica region⁵⁷ and community-based monitoring has also been undertaken.⁵⁸

Key Dugong Datasets:

- Marine megafauna surveys of the waters of Timor-Leste (2008) (Dethmers et al. 2009) – megafauna aerial surveys (altitude -1000m, 500m) and boat surveys (including cetaceans, dugongs, crocodiles, turtles, whale sharks, manta rays).
- Marine megafauna species distribution in the Lesser Sunda Ecoregion (Kahn 2008, see Wilson et al. 2011) – ‘expert-based’ mapping (polygons, no data points available).
- GEF Dugong and Seagrass Project (Conservation International) – dugong sightings, including incidental by-catches, dugong occurrence, human–wildlife conflicts (and also, seagrass species and locations]. No published reports or data available.

In Timor-Leste, under the regional GEF Dugong and Seagrass Project, a range of dugong and seagrass data-gathering, monitoring, conservation and education activities have been funded (US\$829,353) – and are currently being undertaken in NKS Marine Park (Com) and Atauro Island (Beloi).

In relation to data-gathering, Activity TLI (Identification of priority sites for conservation of dugongs and seagrasses in Timor-Leste) is relevant. This activity’s overall aims include: identify priority sites for dugong and seagrass conservation efforts

⁵⁵ GEF CMS - *Enhancing The Conservation Effectiveness of Seagrass Ecosystems Supporting Globally Significant Populations of Dugongs Across the Indian and Pacific Ocean Basins* [Short Title: [The Dugong and Seagrass Conservation Project](#)] (1 January 2014 – 31 December 2018). [Total funding - US\$105M; \$5.9M (GEF) + \$99M (Co-financing)]

⁵⁶ Marine megafauna and critical habitat assessment of the Tibar Bay region (13-18 July 2014); shoreline, boat and aerial megafauna survey (Charles Darwin University) (Eisemberg et al. 2014).

⁵⁷ Marine megafauna survey of Dili-Atauro-Liquica region (1-5 November 2016); boat-based survey of cetaceans, including hydroacoustics (Conservation International 2017).

⁵⁸ Conservation International advise that “cetacean data collection has occurred along the south coast, Nino Konis Santana Marine Park, Atauro Island, and the northern coast.” However, no reports or data was available on this activity.

in Timor-Leste; address substantial knowledge gaps regarding the distribution and abundance of dugongs and seagrass in Timor-Leste; and support the government and local communities to undertake and develop an ongoing monitoring program⁵⁹.

Activity TLI has 3 relevant outputs relevant to developing national marine datasets (ie. dugong, seagrass) in Timor-Leste:

- (i) contribute to a national database by collecting data on fisher sightings, such as incidental by-catches, dugong occurrence, human–wildlife conflicts, community–dugong relationships, and seagrass species and locations;
- (ii) build national and local capacity (of at least 10 community members) for dugong and seagrass monitoring in the local environment through surveys and drone surveillance;
- (iii) build national capacity for quality control in data collection.

Under the ATSEA 2, some dugong conservation and education activities have also been proposed (with local communities) in the Nino Konis Santana Marine Park (at Com) (Annex 4.7).

3.8.3 SEA TURTLES

National-scale datasets, specifically on sea turtles, in Timor-Leste, have until recently, been limited. Sea turtle abundance, and potential nesting sites and foraging sites were identified during national-scale aerial surveys, conducted in 2008 (Dethmers et al. 2009)⁶⁰. Some field surveys and ‘ground-truthing’ of this data was also undertaken by turtle researcher, Dr Kiki Dethmers (particularly in the NKS Marine Park and on Atauro Island) – but to-date, this data has not been published. One-off marine megafauna surveys in the Tibar Bay region⁶¹, Dili-Atauro-Liquica region⁶² and community-based monitoring of sea turtles has also been undertaken.⁶³

However, some monitoring of sea turtles and nesting sites is currently being undertaken in the NKS Marine Park (with the support of Dr Dethmers). More

⁵⁹ Activity TLI will utilise several different means of data collection, including fisher sightings (especially any incidental by-catches), general observations and reports of incidents of human–wildlife interactions. Information concerning community relationships with dugongs and the locations and species of seagrasses will also be collected. A broad range of stakeholders (volunteers, community members, NGO and government staff) will be involved in the data collection to ensure effective knowledge-sharing.

⁶⁰ Mapping of potential sea turtle nesting/foraging sites on the north coast is presented in a formal assessment of natural (and cultural) coastal-marine heritage values (Appendix 3, in Edyvane et al. 2009b).

⁶¹ Marine megafauna and critical habitat assessment of the Tibar Bay region (13-18 July 2014); shoreline, boat and aerial megafauna survey (Charles Darwin University) (Eisemberg et al. 2014).

⁶² Marine megafauna survey of Dili-Atauro-Liquica region (1-5 November 2016); boat-based survey of cetaceans, including hydroacoustics (Conservation International 2017).

⁶³ Conservation International advise that ongoing monitoring and tagging of sea turtles has been conducted. However, no reports or data was available on this activity.

recently some tagging of some individual turtles in the park and elsewhere has been undertaken.⁶⁴

There are 5 recorded species of marine turtles in Timor-Leste: *Eretmochelys imbricata* (Hawksbill turtle), *Dermochelys coriacea* (Leatherback turtle), *Chelonia mydas* (Green turtle), *Caretta caretta* (Loggerhead turtle), *Lepidochelys olivacea* (Olive Ridley turtle) (Sandland *et al.* 2001). The Hawksbill and Leatherback turtle are ‘critically endangered’, while the Green, Loggerhead and Olive Ridley turtle are ‘endangered’ (IUCN Red List).

Key Sea Turtle Datasets:

- Marine megafauna surveys of the waters of Timor-Leste (2008) (Dethmers *et al.* 2009, Edyvane *et al.* 2009b) – megafauna aerial surveys (altitude - 1000m, 500m) and boat surveys (including cetaceans, dugongs, crocodiles, sea turtles, whale sharks, manta rays).
- Marine megafauna species distribution in the Lesser Sunda Ecoregion (Kahn 2008, Wilson *et al.* 2011) – ‘expert-based’ mapping (polygons, no data points available).
- Sea turtle monitoring / tagging in Com (NKS Marine Park) (Dr Kiki Dethmers, David Zenco) – no published reports or data available.

While overall turtle numbers in Timor-Leste are considered low, the Nino Konis Santana Marine Park appears to be a major site for both, turtle nesting and also, foraging (Edyvane *et al.* 2009a). In a survey of marine megafauna in Timor-Leste (Dethmers *et al.* 2009), turtle nesting sites have been recorded along the north coast of Timor-Leste. Aerial surveys (conducted at an altitude of 1000m) indicate increased abundance of large turtles in nearshore waters during November, with the greatest density occurring around the far north-eastern tip of Timor-Leste, in the Nino Konis Santana Marine Park region (offshore from the Lautem Municipality and southeast of Jaco Island) (Dethmers *et al.* 2009, Annex 1). While large numbers of turtles were observed foraging in the shallow coastal waters, surprisingly few tracks were sighted on the adjacent beaches during the two additional beach surveys (conducted at an altitude of 500m), which were specifically aimed at identifying key nesting areas and periods for turtles and crocodiles (Dethmers *et al.* 2009, Annex 1).

In Timor-Leste, there remains major opportunities to link with regional marine turtle experts, through the [IUCN SSC Marine Turtle Specialist Group](#) and through membership of the Indian Ocean – South-East Asian Marine Turtle Memorandum of Understanding - <http://www.ioseaturtles.org/> and also to contribute to regional status reports for turtles through the State of the World’s Sea Turtles - <http://seaturtlestatus.org/>

Under the ATSEA2 program, there is a major commitment to develop a regional action plan for the conservation of marine turtles in the Arafura and Timor Seas region

⁶⁴ Conservation International advise that “turtle tagging has occurred on the south coast, Nino Konis Santana Marine Park and Atauro Island.” However, no reports or data was available on this activity.

(Activity 2.3.3-2), including the waters of Timor-Leste; and also, to establish a pilot project in the NKS Marine Park (at Com) to work with existing women's groups to improve community-based turtle conservation and ecotourism opportunities (Activity 2.3.3-8)⁶⁵.

3.8.4 CROCODILES

The saltwater crocodile (*Crocodylus porosus*) is the largest predator in Timor-Leste. Despite its predatory nature and enormous cultural significance (as an 'ancestor figure', in the 'creation myth') however, no population surveys of the saltwater crocodile (*Crocodylus porosus*) have ever been undertaken in Timor-Leste. As such, there are no population estimates for the country or, critically, information on known nesting sites. *Crocodylus porosus* is currently protected and listed as an Endangered Species under national legislation (Joint Ministerial Order No.18/MAP/MCIA/II/2017). There is currently no plan of management for crocodiles in Timor-Leste.

National-scale, marine megafauna aerial surveys conducted in 2008 have identified areas of major crocodile abundance⁶⁶. One-off marine megafauna surveys (with crocodile sightings) have been conducted in the Tibar Bay region⁶⁷, and community-based monitoring of marine threatened species is also being undertaken.⁶⁸

Further, national data is available on past/ongoing human-crocodile conflict (Sidelau et al. 2017, Brackhane et al. 2018). Ongoing research and management⁶⁹ on crocodiles is currently coordinated by MCIE-UNTL-University of Freiberg (Germany) under the 3-person, [Timor-Leste Crocodile Taskforce](#).

Key Crocodile Datasets:

- Marine megafauna surveys of the waters of Timor-Leste (2008) (Dethmers et al. 2009, Edyvane et al. 2009b) – megafauna aerial surveys (altitude - 1000m, 500m) and boat surveys (including cetaceans, dugongs, crocodiles, sea turtles, whale sharks, manta rays).
- CROC-BITE database – human-crocodile conflict (maintained by Charles Darwin University) (see Sidelau et al. 2017)
- Timor-Leste Crocodile Taskforce – data on human-crocodile conflict (maintained by MCIE/UNTL) (Brackhane et al. 2018).

⁶⁵ Activity 2.3.3-8 under the ATSEA2 Program - Establish a pilot project to improve community-based turtle conservation and ecotourism opportunities established in Com, NKS National Park, working with existing women's groups. This would include a feasibility study as an initial step and will focus on addressing reducing direct illegal harvesting of turtles and dugongs through capacity and awareness building with local communities in NKS using Com as a case study.

⁶⁶ Mapping of potential crocodile nesting sites on the north coast is presented in a formal assessment of natural (and cultural) coastal-marine heritage values (Appendix 3, in Edyvane et al. 2009b).

⁶⁷ Marine megafauna and critical habitat assessment of the Tibar Bay region (13-18 July 2014); shoreline, boat and aerial megafauna survey (Charles Darwin University) (Eisemberg et al. 2014).

⁶⁸ Conservation International advise that it works across all marine areas for "threatened species". However, no reports or data was available on this activity.

⁶⁹ Current crocodile research and management activities in Timor-Leste can be found at - <http://www.common-environment.org/index.php/en/management.html>.



Figure 3.12. Map of *Crocodylus porosus* habitat in Timor-Leste and distribution of attacks (from Sidelau, Britton & Edyvane 2016). Dark grey regions are considered core habitat where crocodiles are likely to be found; light grey represents potential or ephemeral habitat. Small dots represent single-attack reports, large dots represent multiple reports in close proximity (numbers indicate total attacks). Each dot represents attacks in that general area or subdistrict, and does not represent a precise location.

While no population surveys have been undertaken in Timor-Leste, *C. porosus* can be found in coastal rivers and swamps, as well as the open sea and island shorelines, particularly along the south coast (Kaiser *et al.* 2009). Crocodile habitat appears limited to coastal estuaries, freshwater swamps, and small rivers (Figure 3.12). Most substantial habitat is found along the coastal lowlands of the southern coast, as the northern coast is much drier due to lower annual rainfall (Barnett and Jones 2007; Seeds of Life 2015).

While no population surveys have been undertaken, [community-based monitoring of crocodiles](#) is currently being undertaken by MCIE-UNTL with the support of the University of Freiberg (Germany) and the Rufford Foundation. With the primary aim of establishing a cost-effective community-based monitoring system (CBMS) and Citizen Science - to enable nation-wide crocodile monitoring and to provide a risk information platform at local and national level.⁷⁰

As migratory animals, any population survey and monitoring program for *C. porosus* in Timor-Leste (including identification of critical habitat), should as a priority, be linked to current *C. porosus* monitoring programs in West Timor (which is supported by world-leading crocodile experts from the Northern Territory). Timor-Leste and the Northern Territory also have a formal inter-governmental cooperation in crocodile

⁷⁰ Activities under the CBMS include: (i) the development of a data infrastructure for (community-based) crocodile monitoring including community maps, a database and a website to publish data and raise public awareness; (ii) the provision of workshops to teach geographic information systems (GIS) and database management to relevant staff from MCIE and UNTL; and (iii) the implementation of a participatory mapping approach in at least four communities affected by human-crocodile conflict.

management. The Northern Territory is a recognized global leader in crocodile conservation, monitoring and management (not Germany).

The development and implementation of a crocodile management plan for Timor-Leste is also proposed under the ATSEA 2 project (Activity 2.3.3-10) and will be focused on addressing the threats to community posed by crocodiles, particularly on the south coast and raising awareness with local communities.

3.8.5 OTHER MARINE MEGAFUNA – WHALE SHARKS, SHARKS, RAYS

Very limited information is available on whale sharks and other elasmobranchs in Timor-Leste, apart from marine megafauna surveys conducted in 2008. Results from these surveys recorded limited number of recorded sightings of whale sharks and other large elasmobranch in Timor-Leste, in contrast to the abundance of recorded cetacean sightings (Dethmers *et al.* 2009).

Other Marine Megafauna Datasets:

- Marine megafauna surveys of the waters of Timor-Leste (2008) (Dethmers *et al.* 2009) – megafauna aerial surveys (altitude -1000m, 500m) and boat surveys (including cetaceans, dugongs, crocodiles, turtles, whale sharks, manta rays).
- Marine megafauna species distribution in the Lesser Sunda Ecoregion (Kahn 2008, Wilson *et al.* 2011) – ‘expert-based’ mapping (polygons, no data points available).

According to Bajo and other fisherman from Roti and Kera Islands, whale sharks occur regularly in the Timor Passage south of Roti Island and also offshore from Suai (south-western Timor-Leste), as well as in the coastal waters near Kupang, West Timor and in the Savu Sea between Timor and Flores Islands (Stacey *et al.* 2008). However, in monthly aerial surveys for marine megafauna in the nearshore waters of Timor-Leste, a total of three whale sharks (*Rhincodon typus*) were observed over three separate surveys (May, June and November) and all were small (<5 m), non-adult individuals (Dethmers *et al.* 2009).

Rays have been recorded in Timor-Leste nearshore waters, from July – November, with peak abundance occurring in November (Dethmers *et al.* 2009). Several groups of five or more individuals were photographed during this month and identified as manta rays (*Manta birostris*).

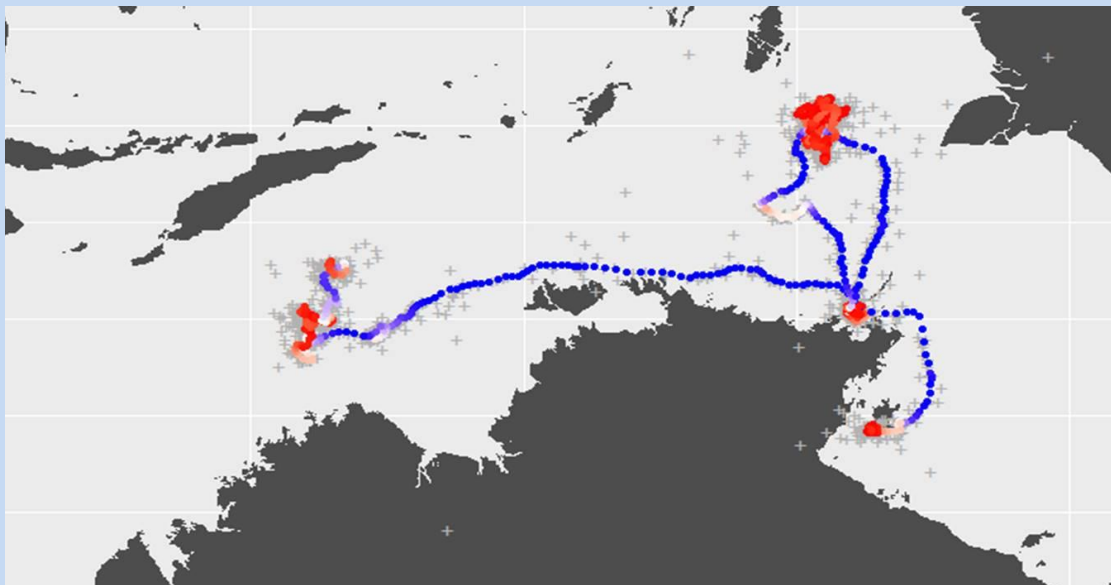
3.9 MARINE MEGAFUNA DATASETS - KEY ISSUES, GAPS, PRIORITIES

Marine Megafauna Datasets - Key Issues, Gaps/Priorities

- There is very little spatial information and national datasets on marine rare and threatened, endangered or protected species (TEPS). Where data has been collected (ie. cetaceans, turtles, dugongs, crocodiles), there is an critical need for data collation, analysis and development of spatial datasets. Lack of information on ‘critical habitat’ for TEPS, ie. key nesting, foraging breeding sites, remains a major data gap.
- Under ATSEA 2, several marine megafauna conservation activities are proposed, including a turtle RPOA and a Timor-Leste crocodile management plan. Baseline data collection (including critical habitat) and spatial datasets to support the development of these plans is a major priority.
- No population census of crocodiles in Timor-Leste has ever been undertaken. Baseline crocodile population surveys, to complement the proposed national crocodile management plan (under ATSEA2) are urgently needed – including identifying nesting sites. As a migratory species, ongoing crocodile monitoring and management is best progressed through cooperation with the current West Timor crocodile program. Technical support can also be accessed under existing Timor-Leste-Northern Territory crocodile cooperation – including technical support for National Crocodile Taskforce. The Northern Territory is a recognized global leader in crocodile conservation and management.
- With lack of data being a critical issue for marine megafauna, there is the potential to use of innovative modelling to identify ‘marine megafauna hotspots’, including identification of critical habitat (see Box 9).
- Community-based monitoring of marine megafauna and TEPS holds great potential in Timor-Leste, particularly if integrated with community-based natural resource management. However, such activities need to be nationally coordinated and supported by training and ongoing technical support to communities, if valid datasets are to be generated.

Box 8: Identifying Marine Megafauna Hotspots and Critical Habitat

Knowing where animals are, what they are doing (especially feeding, mating, calving), and at what time of year, is essential for marine megafauna conservation, management and decision-making. Charles Darwin University's [Movement and Landscape Ecology Lab](#) is currently using innovative modelling to identify marine megafauna hotspots in northern Australian marine waters. The approach combines physical oceanography and marine animal biotelemetry to better understand marine megafauna behaviour and physical environmental drivers.



Identifying Olive Ridley turtle hotspots and critical habitat. State space modelling results for 4 Olive Ridley turtles. Blue is migratory behaviour and red is foraging or nesting behaviour. Grey crosses are raw data points. (Image courtesy @ Ruth Patterson, Charles Darwin University). Original satellite tracking data from McMahon et al. (2007). "Satellite tracking reveals unusual diving characteristics for a marine reptile, the olive ridley turtle *Lepidochelys olivacea*." [Marine Ecology Progress Series](#) **329**: 239-252.

3.10 COMMUNITY-BASED MARINE MONITORING / MAPPING

With the prevalence of subsistence coastal populations - and moves towards community-based, co-management – there is considerable potential for coastal communities in Timor-Leste to assist with national-scale marine monitoring and mapping. While several community-based, and citizen science monitoring/mapping programs currently underway in Timor-Leste, there is currently no nationally coordinated, or agreed approach to monitoring (with mixed results).

Community-Based Marine Monitoring Datasets:

- ReefCheck / ReefWatch - coral reef surveys, using ‘Reef Check’ (2004, 2006, 2008) – north coast, Oecusse, Atauro Island (8 sites)(Dutra et al. 2008, Wong & Chou 2004)
- SeagrassWatch – Com, Vila
- Mangrove Watch, UNDP Mangrove Project
- LMMA/MPA monitoring – NKS Marine Park, LMMAs (Com, Lore, Tutuala, Adara, Beloi, Vila, Uaro-an, Batugade, Lamasek)
- Fisheries catch monitoring – 16 sites (supported by WorldFish)
- Dugong monitoring – Com, Vila (GEF Dugong Project)
- Human-crocodile conflict – coordinated by MCIE (national-scale)
- Cetacean sightings, monitoring – national-scale, Whale & Dolphins of Timor-Leste (Baleia no Golfinhu Timor-Leste)

Internationally-recognised community-based marine monitoring programs, ie. ‘SeagrassWatch’, ‘ReefCheck’ and ‘MangroveWatch’ are currently being undertaken at several locations in Timor-Leste (particularly in current/proposed LMMAs/MPAs). And importantly, provide standardized training, data analysis and reporting – and a regional/global dimension on marine ecosystem health. However, there is a critical need to ensure these activities are nationally coordinated (particularly with other LMMA/MPA monitoring activities) and datasets are readily accessible/available.

[Community-based monitoring of crocodiles](#) is currently being undertaken by MCIE with the support of the University of Freiberg (Germany) and the Rufford Foundation. With the primary aim of establishing a cost-effective community-based monitoring system (CBMS) and Citizen Science - to enable nation-wide crocodile monitoring and to provide a risk information platform at local and national level.⁷¹

⁷¹ Activities under the CBMS include: (i) the development of a data infrastructure for (community-based) crocodile monitoring including community maps, a database and a website to publish data and raise public awareness; (ii) the provision of workshops to teach geographic information systems (GIS) and database management to relevant staff from MCIE and UNTL; and (iii) the implementation of a participatory mapping approach in at least four communities affected by human-crocodile conflict.

Community-based marine data is currently not widely available/accessible and tends to sit on the laptops or computers of individuals. Data rarely gets collated, analysed to develop broader-scale spatial datasets. Data validation and data quality are also critical issues in community-based monitoring. Under the GEF Dugong and Seagrass project, a broad range of stakeholders (volunteers, community members, NGO and government staff) are involved in data collection, to “ensure effective knowledge-sharing”. However, with many persons or stakeholders collecting data (with varying levels of training and ongoing technical support), there is a major challenge in monitoring/ensuring data quality, accuracy.

Guidelines and standards on community-based marine resource surveys and monitoring mapping would greatly assist with HCV monitoring, particularly LMMAs monitoring. Ideally, this should also include standards and guidelines on training and technical support for communities. Under the CTI-CFF, the Solomon Islands has produced an excellent technical guide to support local communities in monitoring/managing LMMAs⁷². This could easily be customized for use in Timor-Leste. Conservation International is also in the process of developing training on ecological monitoring⁷³.

Innovative new technology also exists to support community-based monitoring (and education) and also, ‘citizen science’ programs. New technologies can now enable easy/direct data uploads from mobile phones – together with ongoing technical support/supervision (to improve data validation, accuracy). Turtle researchers from Charles Darwin University have been developing these phone-based applications to support community-based turtle monitoring in Papua New Guinea (Box 9).

Significantly, current CBM monitoring efforts in Timor-Leste largely target local fishers. With Timor-Leste’s demographic characteristics, students and youth remain a major, largely untapped, target audience for implementing community-based, ‘citizen science’ programs. The ‘Piku Warriors Program’ in Papua New Guinea provides a good case study on how environmental youth programs can complement and strengthen ongoing ‘citizen science’ data collection programs for threatened species (Box 9).

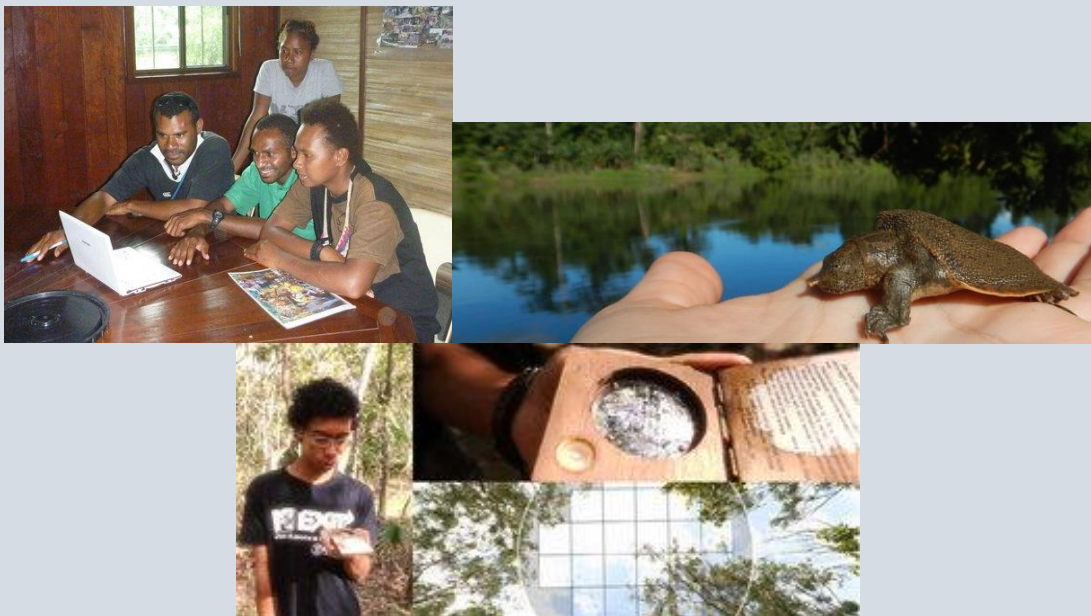
⁷² Guidelines for Community-Based Marine Monitoring in the Solomon Islands (Goby 2013).

⁷³ At the request of government, Conservation International has also been developing Certified Training (Certificate I to III) for Ecological Survey Techniques.

Box 9: Innovative Tools to Assist Community-Based Monitoring & Education

Worldwide, new technology is not only transforming lives and communication, but also becoming a powerful tool for environmental education and conservation. Charles Darwin University's [Tropical Turtle Group](#) (TTG) specialises in wildlife conservation, applied ecology, environmental education and science communication – creating, implementing and evaluate environmental education programs and products, including tools for community-based monitoring.

Working in partnership with traditional communities, schools, governments and industry partners across Northern Australia, Brazil, Papua New Guinea, Tropical Asia and Timor-Leste – the Tropical Turtle Group develops a wide range of education, training and monitoring tools to assist 'hands-on' conservation. This includes assisting and supporting environmental youth and 'citizen science' programs, such as the 'Piku Warriors Program':



The 'Piku Warriors Program' in PNG (with the support of TTG) works in partnership with schools to develop extra-curricular activities for students interested in conservation - from monitoring wildlife meat consumption in their villages, creating their own radio program, to developing phone apps for students to monitor local turtle populations, and fisheries resources in local markets.

Community-based Marine Monitoring - Key Issues, Gaps/Priorities

1. Community-based marine survey and monitoring datasets are generally not widely available/accessible. And data when collected, rarely gets collated, shared or analysed to develop broader-scale datasets. Data validation and accuracy and level of training and ongoing technical support, are also critical issues, when many persons or stakeholders are collecting data.
2. Guidelines and standards on community-based marine resource surveys, monitoring and mapping would greatly assist with marine HCV management, particularly LMMAs/MPAs. Agreed standards on training and ongoing technical support to local communities is also essential. Under CTI-CFF, Solomon Islands has produced an excellent technical guide to community-based marine monitoring, which should be considered for Timor-Leste.
3. Internationally-recognised community-based marine monitoring programs, ie. 'SeagrassWatch', 'ReefCheck' and 'MangroveWatch' provide standardized training, monitoring and technical support. But activities need to be nationally coordinated, with greater data availability/accessibility.
4. Innovative new technology exists to enable easy/direct data uploads from mobile phones – with technical support/supervision. CDU turtle researchers have been developing this for community-based turtle monitoring in PNG. Such tools could easily be customized for community-based, marine megafauna monitoring in Timor-Leste.
5. Current CBM monitoring efforts in Timor-Leste, largely target local fishers. Students and youth remain a major, largely untapped, target audience for community-based, 'citizen science' programs. Environmental youth programs can also significantly support and strengthen 'citizen science' data collection programs.
6. For community-based marine species monitoring programs, there are also opportunities to explore 'electronic inventories' (ie. e-Bird) and public sightings/reporting programs (ie. Whales & Dolphins of Timor Leste), and to support data collection, and also, promote community awareness, education and engagement.

SECTION 4

MARINE MAPPING & DATA MANAGEMENT SYSTEMS

4.1 STATUS OF A NATIONAL MARINE GIS AND MARINE DATASETS

4.1.1 NATIONAL MARINE GIS

Several marine data management information systems (and GIS's) have been developed for Timor-Leste, including USAID's funded NOAA-CREP (a data portal to support coral reef and marine ecosystem management), MCIE-NORAD (a coastal atlas and GIS to support oil spill contingency planning) and FAO RFLP funded 'Peskador' (MAF's fisheries information system).

At the regional level, the CTI-CFF has also developed a Coral Triangle Atlas, a regional GIS and data portal to support coastal and marine ecosystem management for the 6 Coral Triangle countries. While WWF-Indonesia is currently supporting the development of Sunda Banda Seascape GIS.

At the national level, MCIE's Coastal Sensitivity Atlas and GIS (for the south coast of Timor-Leste), an extensive data portal and GIS, developed with support from NORAD's Oil for Development Program – is not operational or accessible. Similarly, additional national data repositories and/or webpages, such as MCIE's National Biodiversity Clearing House Mechanism and webpage (a commitment under NBSAP and the UN CBD) and UNTL's Centre for Climate Change and Biodiversity data repository, are currently not functional or publicly accessible.

Collectively the USAID-funded, NOAA-CREP program (a 5-year partnership program), which included [Satellite Mapping of Nearshore Habitats](#), [Coral Reef Ecosystem Assessments](#) and [Establishing Ecological Baselines for Climate Change](#) provides not only a baseline assessment of Timor-Leste's nearshore habitats and coral reef ecosystems, but a very solid foundation for a future Timor-Leste marine geographical information system (see Box 10). 'Timor-Leste Project Portal' - hosted on NOAA's Coral Reef Information Service (CoRIS) website, in a 'project portal' established specifically for this project with Timor-Leste (<https://www.coris.noaa.gov/activities/projects/timor-leste/>).

4.1.2 NATIONAL MARINE DATASETS

As detailed in Section 3, a range of national-scale marine datasets are currently (and potentially) available to populate a national, marine data platform (see Annex 4.3). Significantly, several sub-national datasets have the potential to become national datasets – with additional prioritized and focused, data collection (particularly on the

south coast). In addition, a range of national-scale marine datasets are also available under previous protected area planning programs, ie. the NEGA (Grantham et al. 2011) and the Lesser Sunda Ecoregion MPA Network (Wilson et al. 2011) (Annex 4.1).

Key National Marine GIS Systems, Data Portals, Datasets

- USAID-NOAA-CREP (MAF) (Annex 4.2) – [‘Timor-Leste Project Portal’](#) - hosted on NOAA’s Coral Reef Information Service (CoRIS) website, is a data portal established specifically to enable access to the outputs of the 5-year NOAA-CREP program
- Coral Triangle Atlas (CTI-CFF) (MAF) (Annex 4.5)– regional data portal and interactive GIS, with a wide range of CTI datasets (including marine habitats, species, MPAs)
- FAO’s [‘Peskadior’](#) (Annex 4.6)- National Fisheries Statistics System of Timor-Leste (MAF) – fisheries, fishing grounds, dangerous areas and fishers’ movements, accidents at sea or in coastal areas
- Coastal Sensitivity Atlas (MCIE) – major compilation of coastal and marine spatial datasets for the south coast of Timor-Leste (funded under NORAD), to support oil spill contingency planning.
- National Biodiversity ‘Clearing House Mechanism’ (CHM) (MCIE) (Annex 4.4) – major commitment under NBSAP and also, obligation under UN CBD.
- Centre for Climate Change and Biodiversity (CCCB), National University of Timor-Leste (UNTL) - <https://www.cccb-tl.org/>
- National-scale marine datasets are currently available for a wide range of marine biodiversity, environmental and HCV-related values in Timor-Leste (Section 3). Datasets are also available under previous protected area network planning programs, ie. Lesser Sunda Ecoregion MPA network (Wilson et al. 2011) and the NEGA (Grantham et al. 2011).

Importantly, under the UNDP ATSEA2 project, significant funding has been allocated to bring together key marine spatial datasets for the Arafura-Timor Seas (ATS) region, including Timor-Leste – to assist with the identification of a regional ATS MPA network and priority conservation areas. In particular, this includes marine habitat data (mangroves, coral reefs, seagrasses), as well as biodiversity hotspots, key marine species (ie. turtles, etc.) and marine uses (see Table 4.1).

Data-rich, northern Australia has much to offer both in terms of coastal-marine datasets (oceanography, coastal-marine habitats, key marine species) for the ATS region (including Timor-Leste) – and also technical support, particularly mangroves, crocodiles, turtles, and cetaceans.

Conservation International have indicated they are also proposing (under current ADB CTP2) to collate existing marine spatial datasets for Timor-Leste, in collaboration with key data providers (including UNDP, WorldFish, CDU, NOAA) – but this is yet to be confirmed.

In collating marine spatial datasets and developing a national-scale marine data platform and inventory for Timor-Leste, several technical and data management issues and challenges will need to be addressed, including:

- Development of a national marine metadata inventory
- Scale of marine mapping and monitoring activities
- Agreed mapping protocols (or Standard Operational Procedures)
- Agreed mapping classes/classification
- Data accuracy/validation
- Data-sharing and intellectual property
- Lodging of datasets by development partners for projects/activities.

There is also a significant opportunity to strengthen and coordinate national marine data management under the CTI NCC TL.

4.2 GOVERNANCE MODEL FOR A NATIONAL MARINE GIS

A critical step in developing a national marine GIS and data management platform is deciding on a ‘data management governance model’ and also, the location (and responsible agency) for a national marine GIS and data platform.

Several possibilities are available. From regional GIS platforms and online data portals (like the Coral Triangle Atlas), to a collaborative, marine GIS and data portal, with government, university and NGO partners (such as the Sunda-Banda Seascape GIS), to a stand alone, national data platform implemented and supported by a government agency (such as MAF-ALGIS).

Within the region, Indonesia’s ‘One Map’ project (supported by WRI Indonesia) provides a good example of integrated GIS systems, to support terrestrial and marine spatial planning. While the [Sunda Banda Seascape GIS](#) and interactive data portal (supported by WWF-Indonesia) a good example of collaborative data platforms, and how data can be potentially shared between governments, universities and NGOs:

“Sunda Banda Seascape website (SBS website) provides ecological, social, cultural and fisheries information in the Sunda Banda Sea Landscape conducted by governments, universities, and NGOs. Information users must read and understand the rules for using information before downloading documents. All forms of document withdrawal in the form of access or use distributed by the SBS website are set forth in the agreement on this page. The SBS website can change the terms and conditions at any time without prior notice. The use of each document continuously is a form of agreement on the terms and conditions that apply. For further information, please contact the SBS Website.”

4.3 ONGOING GIS TRAINING AND SUPPORT

Ongoing GIS training and capacity building is critical for the development of a national marine GIS and data management platform for Timor-Leste. To-date, staff from MAF-ALGIS have been the major recipients of GIS training.

Previous GIS training and capacity-building of ALGIS staff has been undertaken by several development partners, including CDU-NTG, NOAA-CREP, including map production, creating a national consolidated, coastal-marine database – and more recently Conservation International:

- CDU-NTG (2008, 2011) – habitat mapping (Boggs et al. 2009), ArcGIS (Lieber et al. 2012)
- USAID-NOAA-CREP (2014, 2015) – satellite-based mapping, GIS training (Figure 4.1)
- CTI-CFF Coral Triangle Atlas⁷⁴
- Conservation International – GIS training, mapping⁷⁵

Northern Australia also, has relevant data management skills/expertise and GIS training services, particularly staff/researchers from the Northern Territory (CDU, AIMS, NT Government, MAGNT). Charles Darwin University has been undertaking long-term GIS training and capacity-building work in West Timor and Indonesia – with both government partners and universities. Including supporting and establishing GIS training into the university curriculum (ie. Nusa Cendana University, Kupang). Further, significant opportunities exist to progress a formal Northern Territory-Timor-Leste long-term GIS training and data cooperation under the existing ‘Trilateral Forum (Australia-East Indonesia-Timor-Leste)’ forum.

The critical importance of a long-term, GIS training and capacity-building plan and program for a national marine GIS, cannot be under-estimated⁷⁶. To this end, supporting university training (for eg. under UNTL’s Centre for Climate Change and Biodiversity) would significantly strengthen long-term GIS training and capacity-building efforts.

Any long-term, capacity-building strategy/plan for a national marine GIS – should ideally, formally link with and support relevant marine HCV and marine protected area planning and management activities in Timor-Leste, particularly LMMA/MPA monitoring and reporting, including the use of CTMPAS Management Effectiveness Toolkit.

⁷⁴ Coral Triangle Atlas trainings were undertaken at REX workshops, but unfortunately there were no representatives or a nominated focal point from Timor-Leste.

⁷⁵ CI has been training ALGIS and GIS staff in different ministries for an upcoming GEF funded project. The training will continue for another 3 years.

⁷⁶ High staff turnover within the Government of Timor-Leste, and also, short-term, one-off, training programs (with minimal ongoing technical support) present major challenges to GIS capacity-building.

Box 10: *Baseline Information for Fisheries and Ecosystem-Based Management in Timor-Leste*

The *Interdisciplinary Baseline Ecosystem Assessment Surveys to Inform Ecosystem-Based Management Planning in Timor-Leste* program provides the basis for science-based management for fisheries conservation, which in turn can improve food security and strengthen climate change resilience for the benefit of the people of Timor-Leste. NOAA’s Coral Reef Ecosystem Program (CREP) provides high-quality data and information products to inform ecosystem-based management decisions and conservation actions.

Collectively the NOAA-CREP program, which included [Satellite Mapping of Nearshore Habitats](#), [Coral Reef Ecosystem Assessments](#) and [Establishing Ecological Baselines for Climate Change](#) provides not only a baseline assessment of Timor-Leste’s nearshore habitats and coral reef ecosystems, but a very solid foundation for a future Timor-Leste marine geographical information system.

This project was undertaken by the United States National Oceanic and Atmospheric Administration (NOAA) from 2012 to 2016, through a partnership agreement with the United States Agency for International Development (USAID) Timor-Leste Mission, to support the Government of Timor-Leste—particularly the Ministry of Agriculture and Fisheries (MAF).

Under this USAID, MAF, and NOAA 5-year partnership, these activities provide essential baseline fisheries and marine resource information to inform ecosystem-based management of the nearshore waters of Timor-Leste.



OUTCOME 2.3: COASTAL AND MARINE BIODIVERSITY CONSERVED THROUGH PROTECTION OF HABITATS AND SPECIES	
Output 2.3.1 Updated information and database on coral, mangrove and seagrass beds in the ATS, supported by ecosystem valuation studies; priority conservation areas identified in Indonesia and Timor-Leste	
Regional Activities under Output 2.3.1	
2.3.1-1.	Prepare a detailed work plan for the activities under this output, through consultations with relevant regional and national ATS stakeholders, including members of the SPF and other existing expert and policy related forums.
2.3.1-2.	After objectives are agreed upon in the work plan developed under Activity 2.3.1-1, a desktop review and gap analysis will be carried out to collate existing knowledge and understanding of baseline data, for example coral reefs, mangroves, and seagrass ecosystems, as well as climate change impacts and turtle conservation in the ATS. From this a regional profile of ecosystem assets and connectivity and an evaluation of pressures will be developed.
2.3.1-3.	Carry out ecosystem valuation at the regional and national levels.
2.3.1-4.	Support regional MPA information management in the ATS region, with respect to ecological, governance, and socio-economic issues. This could include expanding the CT Atlas to incorporate ATS information as well as strengthening the Indonesian biodiversity information system (BCH) with the information collected on critical habitats.
2.3.1-5.	Support existing programs in the mapping of critical habitats for protected species, including turtles, as well as biodiversity hotspots, building on work of REBYC II to identify priority conservation areas in the ATS through cross-sectoral stakeholder consultation, including an expert workshop.
Timor-Leste:	
2.3.1-7.	Building upon the results of the regional activities listed above and on those of CTI-CFF, work with relevant governmental, NGO, and institutional level stakeholders in identifying priority marine and coastal high conservation value areas.

Table 4.1. Marine GIS, inventory and mapping activities under the ATSEA2 Program (from ProDoc).

Spatial Data Management Development & Mission Planning – June 2014

NOAA-CREP traveled to Timor-Leste to discuss spatial data management needs as part of NOAA-CREP’s activities in Timor-Leste. Meetings with representatives from MAF were held for: 1) sharing progress on the data collected by NOAA-CREP during the 2012 and 2013 missions in Timor-Leste and on the two basemaps being developed from satellite imagery, and 2) gathering requirements for organizing and managing the data to be provided by NOAA-CREP to MAF at the end of the project.



Figure 53. NOAA-CREP staff met with MAF staff and other local partners to discuss spatial data management needs.

Preparations for the third NOAA-CREP mission planned for later in 2014 were also initiated. Meetings were held with numerous in-country partners from various organizations, including service vendors, NGOs, USAID, MAF, and the U.S. Embassy to arrange logistics for the mission (Figure 53).

While in country, NOAA-CREP staff attended a celebration for “World Oceans Day” in Dili with representatives from CI and the U.S. Embassy, and gave a presentation to the Secretary of State for Fisheries and other regional partners on the NOAA-USAID projects in Timor-Leste.

GIS Workshop & U.S. Embassy Outreach Event – October 2015

NOAA-CREP conducted a three-day workshop in which MAF’s Agriculture and Land-Use Geographic Information System team was introduced to NOAA coral reef data management and linking this with the science to support fisheries management in Timor-Leste. Workshop participants explored making use of the data collected by NOAA-CREP in Timor-Leste through a series of instructional and “hands-on” GIS exercises (Figure 56).



Figure 56. Photos from the GIS workshop in 2015: NOAA-CREP workshop instructor supporting a workshop participant with a question (*top left*), a workshop participant entering field data using best data management practices (*top right*), two workshop participants working together conducting a GIS analysis using NOAA-CREP GIS data for Timor-Leste (*bottom left*), NOAA-CREP instructor demonstrating data collection in the field using a handheld GPS unit (*bottom right*).

Figure 4.I Targetted GIS training of MAF-ALGIS staff under the USAID-funded NOAA-CREP program (from PISC 2017).

4.4 MARINE HCV DATA MANAGEMENT, INVENTORY UPDATE – ISSUES, GAPS, PRIORITIES

Marine HCV Data Management, Inventory - Key Issues, Gaps/Priorities

6. No centralized, national marine information platform currently exists for Timor-Leste to support IOM (including HCV mapping and marine spatial planning). Several national and regional marine data management information systems (and/or GIS's) have been developed for Timor-Leste, under a range of development programs (ie. NOAA-CREP, MCIE-NORAD, FAO RFLP, CTI-CFF). However, several platforms are currently non-operational or non-supported.
7. Significantly, a range of national-scale marine datasets are currently available to support HCV mapping, inventory and management (and EBM, IOM). This includes marine datasets under previous protected area planning programs and also, analysis and/or integration of existing Timor-Leste, regional and global datasets.
8. In addition, the ATSEA2 program will bring together key marine spatial HCV datasets (marine habitats, key marine species, biodiversity hotspots, marine uses) for Timor-Leste, to assist with the identification of a regional ATS MPA network and priority conservation areas.
9. In developing a national marine GIS and data platform, agreement on a 'data management governance model' (including designated responsible agency, location of the data platform, role of key stakeholders and data providers) will be essential. Collaborative models, like the Sunda Banda Seascape GIS, provide a good case study on how data can be shared between governments, universities and NGOs.
10. GIS training of ALGIS and MAF/MCIA staff has been supported by several partners. However, a long-term capacity development plan is needed to support ongoing training and access to expertise and technical support. Supporting accredited training (at university level) will also significantly enhance long-term, local capacity development. CDU's spatial science training programs in West Timor are a good case study of long-term training/capacity-building with government agencies, universities.
11. Improved inter-agency coordination mechanisms (including TL CTI NCC) and the establishment of a Biodiversity CHM and national CHM website for Timor-Leste (a commitment under the NBSAP) could greatly assist with the coordination of biodiversity, environmental and HCV-related programs and activities (including data collection and management).

SECTION 5

PRIORITIES, NEXT STEPS

Marine HCV Management, Data Inventory and National Mapping

1. Develop a national, Marine Protected Areas Strategy and Plan, to help support the planning and establishment of an ecologically, representative network of MPAs in Timor-Leste, including identifying MPA/LMMA priorities, planning processes, monitoring and management tasks (including partnerships), and significantly, clarifying management and administrative arrangements.
2. Establish a Biodiversity CHM and national CHM website for Timor-Leste (a commitment under the NBSAP) to assist with the coordination of biodiversity, environmental and HCV-related programs and activities (including data collection and management).
3. Complete national-scale marine habitat mapping of Timor-Leste. Undertake benthic survey of nearshore habitats (including floristic survey of mangroves) of the southern coast (to validate satellite mapping) – using cost-effective, existing survey methodologies established for the north coast. For additional marine surveys and mapping, proposed MPAs/LMMAs should be prioritized.
4. Undertake a ‘stock-take’, analysis and consolidation of existing nearshore habitat mapping and extensive benthic survey datasets – particularly nearshore coral reef surveys (ie. corals, seagrasses, invertebrates, fish) - to (a) validate and improve accuracy of existing (satellite-based) habitat mapping, and (b) generate additional valuable national-scale marine datasets.
5. Develop Guidelines and standards on community-based marine resource surveys, monitoring and mapping to assist with marine HCV management, particularly LMMAs/MPAs. Include agreed standards on training and guidance on ongoing technical support to local communities. Under CTI-CFF, Solomon Islands has produced an excellent technical guide to community-based marine monitoring, which should be considered for Timor-Leste.
6. Support baseline information on marine threatened, endangered and protected (TEP) species in TL – particularly marine megafauna (eg. cetaceans, dugong, sea turtles, crocodiles). Particularly ‘critical habitat’ – nesting, foraging, breeding areas.
7. As a priority, support baseline crocodile surveys, to complement the proposed TL crocodile management plan (under ATSEA2) – including population census and identifying nesting sites. Support and extend existing TL-NT crocodile cooperation – including technical support for National Crocodile Taskforce. NT is a recognized global leader in crocodile conservation and management.
8. Assist community-based marine mapping, inventory and monitoring efforts through development of smart technology, including phone-based data collection applications, with opportunities for technical support, data validation and quality assurance.

9. Environmental youth programs can also significantly support and strengthen 'citizen science' data collection programs. Current CBM monitoring efforts in Timor-Leste, largely target local fishers. Students and youth remain a major, largely untapped, target audience for community-based, 'citizen science' programs. Prioritise marine megafauna and TEPs for CBM monitoring and development of smart technology and environmental youth programs.

Priorities for National Marine HCV Data Management, Inventory Update

1. Develop a long-term capacity development plan to support ongoing GIS training and access to expertise and technical support. Support the development of accredited training (at university level) to enhance long-term, local capacity development. CDU's spatial science training programs in West Timor are a good case study of long-term training/capacity-building with government agencies, universities.
2. In consultation with MAF-ALGIS and key stakeholders, develop a 'road map' for a national, centralized, marine data management system in Timor-Leste (Timor One Ocean Map) including:
 - (a) reviewing current and proposed national/regional marine GIS initiatives/commitments under related IOM, EBM and MSP programs
 - (b) identifying a proposed data management framework, governance model;
 - (c) identifying potential key steps in establishing a national marine data management framework, including (among others):
 - collate existing datasets and establish a centralised Timor-Leste national marine data inventory and create a national marine metadata database for Timor-Leste (including identifying data custodians)
 - conduct a comprehensive TL marine program/activity audit – to develop a national TL marine inventory – including identifying current and historical marine datasets.
 - marine HCV-related, environmental, fisheries and EBM datasets should be a first priority.
 - conduct stocktake and review of existing GIS platforms, data portals
 - define data-sharing obligations/responsibilities and clarify IP issues
 - define national mapping protocols (SOPs), including mapping classes/classification, accuracy/validation, metadata standards
 - promote public accessibility of data, including 'on-line' data portals
 - (d)) identifying training needs and ongoing technical support; and
 - (e) defining ongoing administrative, data coordination and update/maintenance responsibilities.

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1300 Pennsylvania Avenue, NW

Washington, D.C. 20523

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