ATSEA THEMATIC REPORTS

on the Arafura and Timor Seas Region

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on the Arafura and Timor Seas Region

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Cover picture: Coast of Lermatang, South Tanimbar, Maluku Tenggara Barat, Indonesia. (Photo by: H. L. Soselisa, 2011)

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Abbreviations and Acronyms

ADB	Asian Development Bank
AEEZ	Australian Exclusive Economic Zone
AIMF	Australia Indonesia Ministerial Forum
AIMS	Australian Institute of Marine Science
AMDAL	Analisa Mengenai Dampak Lingkungan (Environment Impact Analysis/Assessment)
APEC	Asia Pacific Economic Cooperation
ATS	Arafura – Timor Seas
ATSEA	Arafura & Timor Seas Ecosystem Action Program
ATSEF	Arafura & Timor Seas Experts Forum
AUSAID	The Australian Agency for International Development
BAPEDAL	Badan Pengendalian Dampak Lingkungan (The Agency for Controlling Environment Impact)
BAPPENAS	Badan Perencanaan Pembangunan Nasional (The National Agency for Planning and Development)
BD	Biodiversity (portfolio of GEF)
BPPT	Badan Pengkajian dan Penerapan Teknologi (The Agency for Assessment and Implementation of Technology)
BRKP	Marine & Fisheries Research Agency (of MMAF – Indonesia)
CBD	Convention on Biological Diversity
CCRF	Code of conduct for Responsible Fisheries
CCSBT	Commission for Conservation of Southern Bluefin Tuna
CDB	Computerized Data Base
CDM	Clean Department Mechanism
CI	Conservation International
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
COP	Convention of the Parties
COFISH	Coastal Fisheries
COREMAP	Coral Reef Rehabilitation and Management Program
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CTI	Coral Triangle Initiative
CZSIM	Coastal Zone Small Island Management
DAS	Daerah Aliran Sungai (watersheds)
DG	Directorate General
DJMBP	Direktorat Jenderal Mineral, Batubara dan Panas Bumi (Directorate General of Mineral, Coal and Geothermal)
DKP	Departemen Kelautan dan Perikanan (Ministry of Marine Affairs and Fisheries)
EA	Executing Agency
EEC	Exclusive Economic Zone
EFH	Essential Fish Habitat
ENT	East Nusa Tenggara or NTT – NusaTenggara Timur
FAO	Food and Agriculture Organization
FMP	Fishery Management Plan
FSP	Full Scale Project (of GEF)
GAPPINDO	Gabungan Pengusaha Perikanan Indonesia
GEF	Global Environment Facility
GEF-SEC	GEF Secretariat

GIS	Geographic Information System
GT	Gross Tonnage
GTZ	German Technical Cooperation
HDI	Human Development Index
HNSI	Himpunan Nelayan Seluruh Indonesia (Indonesian Fishers Association)
IA	Implementing Agency
ICM	Integrated Coastal Zone Management
IOC	Intergovernmental Oceanographic Commission
IMO	International Maritime Organization
IOTC	Indian Ocean Tuna Commission
IPB	Institut Pertanian Bogor (Bogor Institute of Agriculture)
IPCC	International Panel on Climate Change
ITF	Indonesian Through Flow
IUCN	International Union for the Conservation of Nature
IUU	Illegal, Unregulated and Unreported (fishing)
JICA	Japan International Cooperation Agency
KLH	Kantor Menteri Negara Kependudukan dan Lingkungan Hidup (The office of State Minister of Demography and Environment)
LME	Large Marine Ecosystem
LULUCF	Land Use, Land Use Change and Forestry
MARPOL	International Convention on preventing pollution from vessel
MCRMP	Marine and Coastal Resources Management Project
MCS	Monitoring Controlling and Surveillance
MEA	Multilateral Environmental Agreements
PMB	Program Mitra Bahari (Maritime Partnership Program)
MMAF	Ministry of Marine Affairs and Fisheries (Indonesia)
MDG	Millennium Development Goals
M&E	Monitoring and Evaluation
MOU	Memorandum of Understanding
MPA	Marine Protected Area
MSL	Mean Sea level
NAP	National Action Programme
NC	National Coordinator
NDFA	National Directorate of Fisheries and Aquaculture
NGO	Non Government Organization
NOAA	National Oceanic and Atmospheric Administration
NSC	(ATSEF) National Steering Committee
NTT	Nusa Tenggara Timur (East Nusa Tenggara)
PEMSEA	Partnerships for the Environmental Management of the Seas of East Asia
PFSEL	Provincial Fisheries Surveillance and Enforcement Line
PIC	Public Information Campaign
PIR	Project Implementation Review
PM	Project Manager
PMU	Project Management Unit
PNG	Papua New Guinea
PPLBPM	Program Pengelolaan Lingkungan Berbasis Pemberdayaan Masyarakat (Environment Management Program based on Community Empowerment)
PPG	Project Preparation Grant

P2O LIPI	Pusat Penelitian Oseanologi Lembaga Ilmu Pengetahuan Indonesia (The Research Center for Oceanology – Indonesian Institute of Sciences)
PSC	(ATSEA) Project Steering Committee
PTR	Project Terminal Report
PTR-S	Project Terminal Report Synopsis
RPOA	Regional Plan of Action
RPJM	Rencana Pembangunan Jangka Menengah (Midterm National Development Plan)
RPJPN	Rencana Pembangunan Jangka Panjang Nasional (Long-term National Development Plan)
RS	(ATSEF) Regional Secretariat
RSC	(ATSEF) Regional Steering Committee
RDTL	Democratic Republic of Timor Leste
SAP	Strategic Action Program
SCLSA	Sustainable Coastal Livelihood System Analysis
SDS-SEA	Sustainable Development Strategy for the Seas of East Asia
SEAFDEC	Southeast Asian Fisheries Development Center
SES	Social-Ecological Systems
SIDS	Small Island Developing States
SISWASMAS	Sistim Pengawasan Masyarakat (Community Based Surveillance System)
SWOT	Strength Weaknesses Opportunity Threats
TAC	Total Allowable Catch
TDA	Transboundary Diagnostic Analysis
TED	Turtle Excluder Device
TNC	The Nature Conservancy
UNCLOS	United Nations Convention on the Law of the Sea
UNFCCC	The United Nations Framework Convention on Climate Change
UNFSA	United Nations Fish Stock Agreement
UNDP	United Nations Development Programme
UNOPS	United Nations Office for Project Services
UNTAET	United Nations Transitional Administration in East Timor
UNTOC	United Nations Transnational Organized Crime Convention
VMS	Vessel Monitoring System
WPP	Wilayah Pengelolaan Perikanan (Fisheries Management Areas)
WSSD	World Summit for Sustainable Development
WWF	World Wide Fund for Nature

Foreword

The Arafura and Timor Seas Ecosystem Action is one of the United Nations Development Programme (UNDP) project funded by the Global Environmental Facility (GEF). The ATSEA project was proposed and prepared by the Arafura and Timor Seas Expert Forum (ATSEF) Regional Secretariat starting in 2006, during which the ATSEA Regional Secretariat was hosted by the Agency for Marine and Fisheries Research (AMFR), the Ministry of Marine Affairs and Fisheries (MMAF) in Jakarta, Indonesia.

Project Preparation Grant (PPG) requires that reports on biophysics, socio economics, policy framework and governance institutions of the proposed project area should be prepared and submitted to the Global Environmental Facility (GEF) International Waters prior to the submission of the project proposal. Accordingly, in order to meet the requirement, the PPG of the Arafura and Timor Seas Ecosystem Action (ATSEA) was prepared in the following topics:

1. Report On Transboundary Biodiversity, Fisheries And Oceanography Issues In The Arafura And Timor Seas (ATS) Region. This report was prepared by Dr. Sugiarta WIRASANTOSA.

   This report summarizes a wide range of reports and published information relevant to the ATS region that has been reviewed during October 2008 – February 2009. The information was summarized and analyzed to identify key characters and issues relating to the objectives of the study. Analysis of the available information identifies information gaps and deficiencies in some aspects related to the management of the marine and costal resources of the ATS region as well as its environment. In addition, the main transboundary threats in the ATS region were discussed and these issues were grouped into three main issues of transboundary problems, namely, Unsustainable exploitation of marine resources, Coastal and marine habitat destruction, Environmental change and impacts on coastal and marine ecosystems. Analysis of the main transboundary threats and their potential solution are also included in this report.

2. Report On Transboundary Biodiversity, Fisheries And Oceanography Issues In Timor Leste For The Arafura Timor Seas Ecosystem Action Program (ATSEA). This report was prepared by Mr. Duto NUGROHO.

   The aim of the report is to provide background materials for the Project Brief and Project Document. The report provides descriptions on biodiversity, fisheries and oceanography characteristics of Timor Leste waters and discusses the transboundary impacts and issues based on existing information and stakeholder consultations. Furthermore, the report identifies gaps in existing baseline knowledge of the Arafura and Timor Sea ecosystem, offers recommendations on measures to address these information gaps and recommendation on demonstration projects.

3. Socio-Economics and Development Needs Of Coastal Community In The Arafura And Timor Seas Report. This report was prepared by Dr. Luky ADRIANTO.

   This report is dedicated for completing the understandings and information on the Indonesia ATS region, especially those related to the social-economics characteristics and the development needs for community. This report discusses 5 sections that include key socio-economics and community development issues in the coastal areas, livelihood of coastal community, gaps and challenges relating to capacity development of community, recommendation on measures to address gaps and challenges for coastal communities, and recommendation on potential demonstration sites for coastal communities.

4. Policy Framework and Governance Institutions; Governing the Management of the Arafura and Timor Seas of Indonesia. This report was prepared by Prof. Dr. Subhat NURHAKIM.

   This report describes the policy framework and governance institutions governing the management of the Arafura Timor Seas region of Indonesia. The objectives of this policy framework and governance institution study are to:

   - Identify the Indonesian institutions and its law and legislation relating to the marine and fisheries development.
   - Identify gaps and challenges of the Indonesian institutional and policy frameworks relating to marine and fisheries sustainable development of the Arafura and Timor Seas region.
   - Identification of national marine and fisheries framework development and application policy framework to be integrated in the FSP (Full Size Project) framework.
   - Identification and recommendation on potential demonstration activities in order to achieve the objectives of this study and institutional set up for ATSEA.

   The report outlines environmental and sector institutions, law and legislation as well as policy that has been undertaken which cover several sectors such as: Biodiversity Conservation, Fisheries, Aquaculture, Marine science and research, Agriculture/Forestry, Catchments management, Mining, Offshore oil and gas, Port and shipping and Climate change. Several constraints and gap concerning institutions and legislation for each sector have been described in this report, and several recommendations to overcome the constraints and gaps are proposed.

5. Governance Institution Policy Frame Work And Socio-Economics Of Timor-Leste Arafura And Timor Sea Ecosystem Action (ATSEA), A regional commitment to the sustainable management of The Arafura and Timor Sea Marine Ecosystem. This report was prepared by Mr. Constancio DOS SANTOS SILVA.

   The intention of this report is to provide a Timor-Leste perspective on Transboundary governance and socio-economic issues in the ATS region. The report contains the following matters:

   - description of the region's governance, policy and socio-economic characteristics including those of global significance,
   - identification of gaps in our existing baseline knowledge of the ATS governance and socio-economic issues,

- recommendations on measures to address these information gaps and
- an outline of the main transboundary threats to and impacts on biodiversity and fisheries resources in the region.

Data and information presented in the above reports served as invaluable inputs for the ATSEA during its preparation and development of ATSEA Project Document (Prodoc). Therefore, it is ATSEA intention to share these documents with those who are working in the Arafura and Timor Seas and interested in knowing more about those aspects contained within the reports. ATSEA presents these reports in the above sequence as one collective form of books without altering their format and contents.

Jakarta, October 2011,

Dr. Tonny Wagey
ATSEA Regional Project Manager

REPORT ON TRANSBOUNDARY BIODIVERSITY, FISHERIES AND OCEANOGRAPHY ISSUES IN THE ARAFURA AND TIMOR SEAS REGION

By Sugiarta Wirasantosa

Executive summary

The tropical and semi-enclosed Arafura and Timor Seas (ATS) are shared by Australia, Indonesia, Timor Leste and Papua New Guinea (PNG). The ATS region is extremely rich in living and non-living marine resources, including major fisheries and oil and gas reserves. The ATS region is located at the intersection of two major Large Marine Ecosystems (LMEs); the Indonesian Seas to the north and northern Australian waters to the south. It is also an integral part of the recently names 'Coral Triangle Zone' considered to have the highest marine biodiversity in the world. Shallow and deep water column and seabed of the ATS provide a suitable environment for a variety of plankton, fish, crabs and shrimps, marine mammals, and turtles. The ATS region exhibits high productivity that sustains both small and large-scale fisheries that provide livelihoods for millions of people in the region.

This report summarizes a wide range of reports and published information relevan to the ATS region that have been reviewed during October 2008 – February 2009. The information was summarised and analysed to identify key characterisations and issues relating to the objectives of the study. Analysis of the available information identifies information gaps and deficiencies in some aspects related to the management of the marine and costal resources of the ATS region as well as its environment.

Bathymetry of the ATS area covers continental shelf and trough with various depths. Average depths of the Arafura Sea range from 30 m to 90 m and that of the Timor Sea range from 50 – 120 m. The depth deepens to 3000 m in the Timor trough that run parallel to the island of Timor. Bathymetry of the area, particularly the shallow Torres Strait, affects the oceanography and connectivity between the Indian and Pacific oceans.

Fresh water input to the Arafura Sea mainly comes from southwest flowing rivers in Papua and some rivers flowing to the Gulf of Carpentaria and northern Australia with continuing submerged tributaries in the shelf area. Few fresh water inputs flow from Aru, Yamdena and Kei islands. Fresh water input to the Timor Sea mainly comes from northward flowing rivers in the northern part of Australia and seasonally may come from southward flowing tributaries in Timor Island.

The ATS region is known to contain rich biodiversity that includes corals, mangroves, seagrass, sea cucumber, turtles, dugongs, whales, sharks and rays, and also plankton. Corals in the ATS area are found around the islands of Aru, Kei, Yamdena, Adi Island, Sabu, Rote and Timor islands and patches of reefs exist along the southern coast of Papua. In the coastal area of the ATS region, mangrove ecosystem has added high degree of biodiversity such as in the southern coast of Papua which is known as the most extensive mangrove ecosystem in the world. Mangrove and estuary ecosystems in the Wasur National Park, Papua, are listed in Wetlands of International Importance.

In terms of resources, sea cucumber from the ATS region is commercially well known. Presently, at least 350 species of sea cucumbers have been identified from Indonesian waters, and 54 species were collected from the Arafura and Timor Seas. 26 species of sea cucumbers collected from Indonesian waters have commercial value and at least 14 species are collected from the Arafura – Timor Seas. In the Arafura Timor Seas are also found marine turtles such as the green turtle (*Chelonia mydas),* hawksbill turtle *(Eretmochelys imbricata),* and leatherback turtle *(Dermochelys coriacea).* Beside turtles, dugongs are also observed in the Arafura - Timor Seas. Distribution of dugongs in eastern Indonesia includes the areas of Ceram, Manado and Aru. However, dugongs are in continous threat. The IUCN lists the dugong as a species vulnerable to extinction, while the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) puts dugong in Appendix I.

Concerning Cetacean, sharks and Cephalopoda in the ATS area; 30 Cetacean species are positively identified in Indonesia, out of 86 species known worldwide. At least 14 species of Cetacean have been observed in the surrounding waters of Komodo, Rinca and Flores islands. In the ATS region, sharks are found up to 15 Families with 64 species, and rays are identified up to 11 Families with 41 species, while Chimaera are known of only one Family with 2 species. Meanwhile, Cephalopoda in the ATS area, that includes among others squids, cuttlefishes and octopods, consists of at least 4 species from 3 Families as captured during a trawl survey.

The Centre for Oceanographic Research and its sub-centre in Ambon revealed that 607 species of decapod crustacea have been identified from the Arafura and Timor Seas. These crustaceans consist of Anomura, Brachyura, Dendrobranchiata, Caridea and other shrimp category. Anomura in the Arafura and Timor Seas consists of 7 families with 175 species which 15% or 26 species are endemic species. The Brachyuran crabs that live in the Arafura and Timor Seas were identified as belong to 32 families with 306 species from which 21 species are considered endemic. The Majidae Family that contains 96 species is the most diverse family, followed by the Xanthidae Family with 30 species.

The ATS region is a plankton rich region. Plankton in the Arafura Sea consists of 46 species of phytoplankton representing 4 families, and 55 species of Zooplankton representing 8 families. The dominant species is represented by 35 species of Crustacea.

Conservation of marine resources in Indonesia began in the late 1970s. In terms of sustainable management and utilization of marine resources, the government of Indonesia intends to establish at least 10 million hectares of marine conservation area in 2010 that will be extended into 20 million hectares in 2020 as has been commited by the Indonesia Government in the COP CBD meeting in Brazil, 2006. Three marine conservation areas will be developed within the ATS area: planned fish sanctuary in Savu Sea and neighbouring seas, planned Kaimana district marine conservation area and Pantar Strait Marine Park in Alor. Furthermore, at the national level, MMAF intends to establish a National Marine Conservation Area in East Nusa Tenggara around the Savu Sea and adjacent inlands. Savu Sea and adjacent waters are unique deep sea environment for whale and dolphin migration paths from the Pacific to the Indian Ocean and vice versa through narrow straits in the area.

The fisheries condition in Arafura – Timor Seas presents challenges to the fisheries management both in central and local governments in Indonesia. As is known, fisheries management in the Arafura Sea is conducted by the province of Papua, the province of Maluku and the central government. The fisheries management area of Arafura Sea is numbered WPP-RI 718, while that of the Timor Sea is included in the WPP–RI 573 of the Indian Ocean.

Arafura Sea and the Maluku Sea are important areas for shrimp and demersal fishes that have been exploited since long time ago. In general, the fish stocks in the two fisheries management areas are fully exploited. Furthermore, demersal fish and shrimp in the Arafura Sea are overfished. Shrimp trawling poses a threat to the demersal fish stock due to its inefficient catch methods. Estimated volume of the demersal fish that were considered as by catch is 80% of the total volume of the catch.

Oceanography of the ATS region is affected by the main flow of water mass from Pacific to Indian Ocean which is transported through Makassar Strait into the Flores Sea and Banda Sea where it turns toward Timor Sea and Ombai Strait. A minor component of the main flow goes through Lombok strait to the Indian Ocean. The transport volume indicates that Timor Sea represents the main route of Pacific water that flow to the Indian Ocean. During west monsoon, water transport into the Banda Sea exceeds those that outflow from the Banda Sea into Maluku, Seram and Arafura seas. Therefore, downwelling occurs in Banda Sea during west monsoon, and upwelling occurs during east monsoon resulting from excesive outflow from Banda Sea into Flores Sea and Timor Sea. The upwelling brings water mass from depths of 125 m -300 m to the surface.

Indonesian through flow is important in terms of thermohaline circulation and global climate phenomenon. Observations and model in internal Indonesian seas indicate that the main source of ITF is North Pacific Thermocline water flowing through Makassar Strait. Additional contribution of ITF comes from Lower Thermocline Water and deep water mass from the south Pacific that flow via east of Maluku and Halmahera seas, with heavier water go through Lifamatola strait.

Sea level changes in relation to global climate change in the ATS area is known only at regional and global scale. Analysis by IPCC (Intergovernmental Panel on Climate Change) and other report concluded that the rate of global average sea level rise during the 20th century is in the range of 1.0 to 2.0 mm/yr, with a central value of 1.5 mm/yr. The IPCC report concluded that on the basis of published literature, the lowest average of sea level rise is 1 mm/yr during the 20th century and a limit of 2 mm/yr is adopted as the upper bound that includes all recent global estimates with some allowance for systematic uncertainty. CSIRO (2008) reported about 200 mm increase in global mean sea level during 1870 – 2007 based on tide gauge data and satellite altimeter.

Detailed observations of sea level changes during the twentieth century show that the high variability in the rates of sea level change observed over the past 20 years were not particularly unusual. The rate of sea level change was found to be larger in the early part of last century (2.03 ± 0.35 mm/yr 1904–1953), in comparison with the latter part (1.45 ± 0.34 mm/yr 1954–2003). The highest decadal rate of rise occurred in the decade centred on 1980 (5.31 mm/yr) with the lowest rate of rise occurring in the decade centred on 1964 (−1.49 mm/yr). Over the entire century the mean rate of change was 1.74 ± 0.16 mm/yr.

Data in the previous discussion indicate that marine environment in the ATS region is in serious decline, primarily as a result of over-harvesting and other direct and indirect impact of anthropogenic stresses and global climatic changes. These factors that affect the marine environment to some extend have caused dramatic changes or shift in species composition in the Arafura –Timor Seas. The shift, which is known as phase or regime shift, is often long lasting and difficult to reverse. Recent studies on the resilience of marine ecosystems (e.g., Hughes et al., 2005) highlight the emergence of a complex system approach for sustaining and repairing marine ecosystems linking ecological resilience to governance structures, economics and society. The

approach is known as SES, social-ecological systems, that is linkages between the environment and people. The SES requires an improved understanding of the dynamic and complex processes that support or undermine resilience, the socio economic drivers to the process and the governance systems that shape the use of living marine resources.

The dynamic nature of marine biota and the marine environment requires the existing baseline information on biodiversity and ecosystems as well as resource utilization in the ATS area be monitored and updated regularly. Therefore, several gaps in existing baseline information should be addressed. The gaps include those that are related to biodiversity information, particularly on the monitoring and inventory of the specific endemic species, gaps in management and utilization of biological resources between central and local governments.

Management and development of fisheries resources in the ATS region requires that fishing activities be regulated to ensure that the quality, diversity and availability of fisheries resources is maintained in sufficient quantities for present and future generations, and that the integrity of the broader marine ecosystem and environment is sustained. Management of fisheries resources should be based on the best scientific evidence available and should apply an ecosystem-based approach. Implementation of the ecosystem-based approach requires that fisheries related information be available. Detailed oceanographic observation in the area of the eastern Banda Sea is needed to support fisheries management. Furthermore, ocean characteristics such as upwelling and down welling cycle, spawning ground characteristic and ocean dynamic related to biological resources dynamic are important characteristics of the ocean that may support the sustainable fisheries management.

This gap of information may have been part of the problems in management practices of fisheries resources, beside other management problems. Furthermore, fisheries management has to ensure that fishing and other anthropogenic effect do not undermine the productivity of stocks, and has to incorporate requirements for protection of essential fish habitat (EFH) in fishery management plans (FMPs). Some measures are recommended in this report to address the information gaps.

The main transboundary threats in the ATS region were discussed and selected through various stakeholder discussions, and these issues were grouped into three main issues of transboundary problems, namely, Unsustainable exploitation of marine resources, Coastal and marine habitat destruction, Environmental change and impacts on coastal and marine ecosystems. Analysis of the main transboundary threats and their potential solution are included in this report.

1. Introduction

The tropical and semi-enclosed Arafura and Timor Seas (ATS) are shared by Australia, Indonesia, Timor Leste and Papua New Guinea (PNG). The ATS region is extremely rich in living and non-living marine resources, including major fisheries and oil and gas reserves. The ATS region is located at the intersection of the two major Large Marine Ecosystems (LMEs); the Indonesian Seas to the north and northern Australian waters to the south. It is also an integral part of the recently names ‘Coral Triangle zone’ considered to have the highest marine biodiversity in the world. Recent review of biodiversity in the ATS region (T. Wagey and Z. Arifin (ed.), 2008) reflects that this area contains an abundance life of large and small biota within its coastal and marine ecosystems. Shallow and deep water column and seabed of the ATS provide a suitable environment for a variety of plankton, fish, crabs and shrimps, marine mammals, and turtles. The

ATS region exhibits high productivity that sustains both small and large-scale fisheries that provide livelihoods for millions of people in the region.

The gross-annual fisheries production from ATS fisheries is very difficult to estimate, given the extremely high level of illegal, unregulated and unreported (IUU) fishing in the region, involving sometimes large fleets from several countries to the north of Indonesia. In addition to unsustainable and IUU fishing, these shared seas face severe threats from a number of other human induced activities, including marine pollution, degradation of coastal habitats, aquatic invasive species and natural threats such as tsunamis and sea level rise.

The intention of this report is to provide an Indonesian perspective on transboundary biodiversity, fisheries and oceanography issues in the ATS region. The report:

- Provides a description of the region's biodiversity, fisheries and oceanographic characteristics including those of global significance,
- Identifies gaps in our existing baseline knowledge of the ATS ecosystems,
- Provides recommendations on measures to address these information gaps, and
- And provides an outline of the main transboundary threats to and impacts on biodiversity and fisheries resources in the region.

The purpose of this report is to contribute towards the ATSEA Project Preparation activities:

- To provide background materials for the Project Brief and Project Document, illustrating the environmental context for the GEF project.
- To provide a forum for consensus-building on the environmental issues of highest priority in the ATSEA region

The results will be used to identify the main transboundary threats and impacts in the ATS region, root causes and barriers as part of a more detailed Transboundary Diagnostic Analysis of the ATS region. This will contribute to the development of an ATSEA Strategic Action Programme (SAP).

1.1 Methodology

The methodological approach of this study follows a Transboundary Diagnostic Analysis (TDA) process common to GEF project preparation. The TDA process is a unique tool that enables policy and decision-makers to understand and prioritize components within a complex transboundary situation. Transboundary Diagnostic Analysis is a science-based analysis and assessment of factual conditions in a given transboundary basin involving an identification of the causes and impacts of environmental problems, a formulation of strategic action programs aiming at solving the problems and an implementation of the strategic action program.

The process of identification of major threats and their causes as well as their potential solutions in this Transboundary Diagnostic Analysis of the ATS region is done through a number of stake holders meetings involving central and local government officials, UNDP, researcher from research institutions and universities, and international and local NGOs. Prioritization process to decide on the problems to be addressed and their causes was conducted and their potential solutions

were discussed during the last stake holders meeting in Kupang, Timor, in February, 2009. As a result, a Strategic Action Program from Indonesia's perspective has been developed.

This report summarizes a wide range of reports and published information relevant to the ATS region. The review of these materials was undertaken during October 2008 – February 2009. The information was summarised and analysed to identify key characterisations and issues relating to the objectives of the study. Analysis of the available information also identifies information gaps and deficiencies in some aspects related to the management of the marine and costal resources of the ATS region as well as its environment.

2. Description of the Arafura – Timor Seas region: bathymetry, biodiversity, fisheries and oceanography, including global significance.

Figure 1. The Arafura – Timor Sea region under the ATSEA programme.

2.1 Bathymetry of the ATS region

The area under discussion is the Arafura – Timor Seas that are bounded to the south by northern Australia, to the east by the Torres Strait, to the north by the southern coast of Papua and the eastern islands of East Nusa Tenggara and Southeastern Maluku. To the west, however, the ATS area connects to the eastern part of Indian Ocean (Figure 1). The Arafura Sea area is estimated at around 600.000 km², while that of the Timor Sea is approximated as 615.000 km².

Bathymetry of the area covers continental shelf and trough with various depths. Average depths of the Arafura sea range from 30 m to 90 m. To the east, however Torres Strait depths are less than 15 m at the shallowest part while depths are slightly deepers to the west in the Timor sea - ranging from 50 – 120 m. Small areas, however, are more than 1200 m in the deepest part and the depths reaching more than 3000 m in the Timor trough that run parallel to the island of Timor. Bathymetry of the area is an important aspect of the natural condition since it affects the oceanography of the area. The shallow ridge in Torres Strait, for instance, is an impediment to a direct connectivity between the Indian and Pacific oceans, particularly for deep water connectivity. Therefore, deep ocean water from the two oceans is connected through the deeper routes such as the straits of Makassar, Lombok, Lifamatola, Ombai and through other deeper channels between islands of Nusa Tenggara.

The shelf area indicates that it was a dry land prior to 18.000 years ago, except in the trough with much greater depths. Marine transgression occurred during 11,000 – 8,000 years before present that flooded the area. According to Nontji (2002), Arafura – Sahul continental shelf consists of Arafura shelf (name was given by Krummel, 1897) that includes the shelf area from Van Diemen Cape in Australia to south of Papua, Sahul shelf to the west of Van Diemen Cape to the Cape of Leveque, and by Rowley shelf to the west of Sahul shelf. The shelf area is a vast area with a total of 1.5 million km² that comprises of 930.000 km² of Arafura shelf, 300.000 km² of Sahul shelf and about 300.000 km² of Rowley shelf. Daizell and Pauly (1990), as quoted by ATSEF Book 1 (2006), indicates that the surface area of Arafura Sea is 599.000 km², smaller than that of Nontji's figure of 930.000 km². In the geodynamics of the eastern Indonesia, Hall (1995) indicates that the shelf area is always attached to the Australia continent as well as to the southern part of Papua in the last 50 m.y., and has never been separated as blocks as is the case of the islands to the northwest.

Fresh water input to the Arafura Sea mainly comes from southwest flowing rivers in Papua and some rivers flowing to the Gulf of Carpentaria and northern Australia with continuing submerged tributaries in the shelf area. Few fresh water inputs flow from Aru, Yamdena and Kei islands. Fresh water input to the Timor Sea mainly comes from northward flowing rivers in the northern part of Australia and seasonally may come from southward flowing tributaries in Timor Island although total annual precipitations in Timor are in the range of 1600 – 2300 mm/yr. The total annual precipitation in district of Belu, the bordering district with Timor Leste, is the lowest of 1060 mm/yr.

Rivers and tributaries on the islands of Timor, Papua and northern part of Australia are discharging sediments into the study area. In Figure 2, Milliman *et al.*, 1999, shows that the largest sediment input to the area comes from Papua (427x 10^6 t/yr), while sediment input from Timor is relatively small (59x 10^6 t/yr).

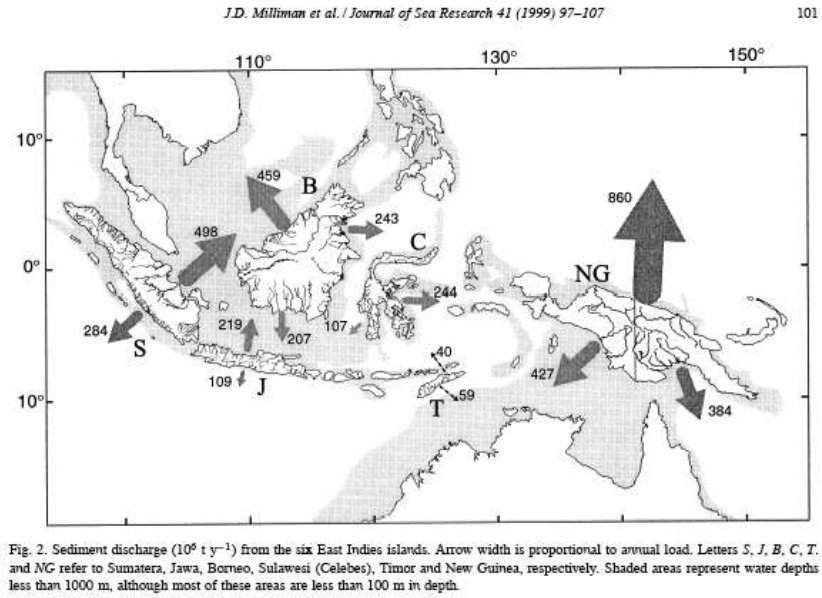

Fig. 2. Sediment discharge (10^6 t y^{-1}) from the six East Indies islands. Arrow width is proportional to annual load. Letters *S*, *J*, *B*, *C*, *T*, and *NG* refer to Sumatera, Jawa, Borneo, Sulawesi (Celebes), Timor and New Guinea, respectively. Shaded areas represent water depths less than 1000 m, although most of these areas are less than 100 m in depth.

Figure 2. Sediment discharge (10^6 t y^{-1}) from the six East Indies islands. Arrow width is proportional to annual load (Milliman et al., 1999).

A later study that was based on a Digital Elevation Model (DEM) derived from Shuttle Radar Topography Mission (SRTM) - NASA's Space Shuttle Endeavour flight of February 2000 (Figure 3) indicates an even larger contribution of sediments from Papuan rivers to the Arafura Sea (Wilson, pers. comm.).

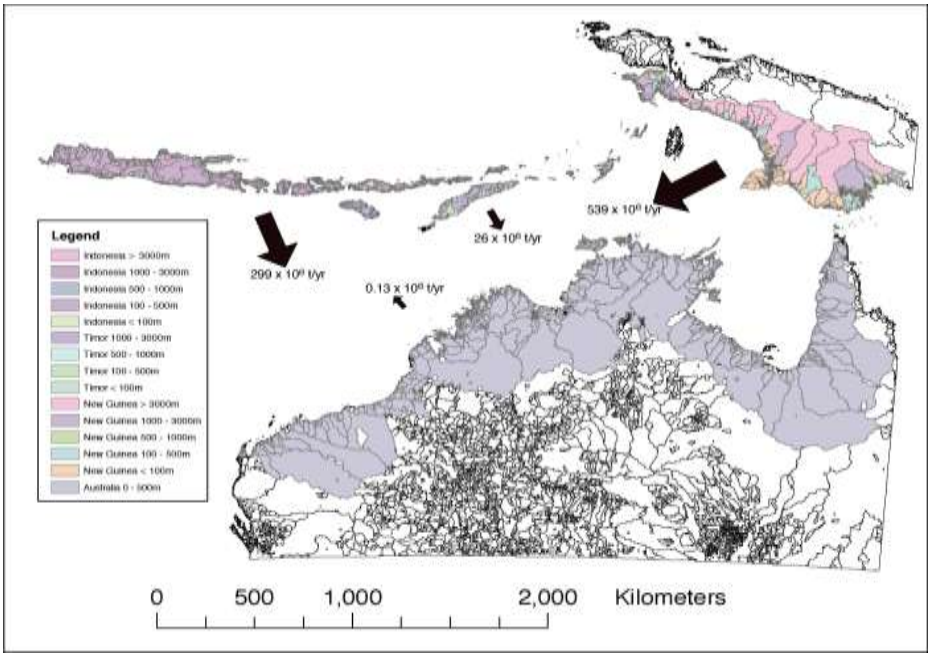

Figure 3. Sediment discharge based on Digital Elevation Model (DEM) derived from Shuttle Radar Topography Mission (SRTM) - NASA's Space Shuttle Endeavour flight of February 2000 (Wilson, pers. comm.).

Figure 3 indicates that small amount of sediment loads into the Timor Sea originates from the northern Australian rivers. The sediments coming from Timor Island, however, are most likely trapped within the deep Timor trough. Wilson (2005) reported that the sediments of the Arafura Sea are calcium carbonate rich with substansial but varying fractions of carbonate sand and subfossil shell fragments. Furthermore, Wilson recognized that sediments sampled from the AEEZ had shells from shallow-water organisms, including oysters, a diverse assemblage of other tropical molluscs, corals, bryozoans, coralline algae and Foraminifera. He concluded that these components were indicative of previous shallow water environment, such as swamps, coral reefs, shallow lagoons or sea grass beds.

2.2 Biodiversity

The Arafura – Timor Seas area are bounded to the north and northwest by the Lyddeker's line, an imaginary line that separate Wallacea on the west and Australia-Papua on the east. The line also defines the easternmost geographical limit of animals from the Oriental faunal region into the neighbouring Australian faunal region. The discussion of biodiversity in this section includes corals, mangroves, seagrass, sea cucumber, turtles, dugongs, whales, sharks and rays. Fish is discussed separately in the other section.

2.2.1 Corals

The ATS area is located in the southern perimeter of a "Coral Triangle", a recently defined area of rich biodiversity that encompasses six country territories, namely Indonesia, the Phillippines, Papua New Guinea, Timor Leste, Malaysia (Sabah), and the Solomon Islands. The Coral Triangle area consists of several ecoregions that covers reefs area of 75.000 km² with over 500 species of corals and over 3.000 species of fishes. The Coral Triangle covers the "core" of the Indo Pacific Global Center of Coral Diversity with more than 70 genera of corals.

Figure 4 shows coral reefs distribution in Southeast Asia, and corals in the ATS area are found around the islands of Aru, Kei, Yamdena, Adi island, Sabu, Rote and Timor islands and patches of reefs exist along the southern coast of Papua. Coral reefs in the islands of Kei and Yamdena are bounded by deep basins such as Weber deep and Aru basin.

Coral covers around the islands of Aru, Kei and Yamdena are the most extensive in the area (ATSEF Book 1, 2006), probably due to good environmental factors such as temperature, water visibility and nutrients that differs from those around the southern coast of Papua where river inputs affect visibility due to sediment load. However, coral reefs in Aru are not in good condition due to illegal and destructive fishing practices. Coral reefs in southern Papua are in better condition except for those near populated areas (ATSEF Book 1, 2006).

In the Timor Sea, coral reefs are found around the islands of Timor, Tikus, Burung, Kera, Semau, Kambing, Mera and Rote and commonly are of fringing type of reefs without lagoon. It was found that coral reefs in Timor Sea had 160 species of corals that formed habitat for 350 species of reef fish. In Kupang Bay of Timor island coral reefs cover is estimated to be of 72.27 km².

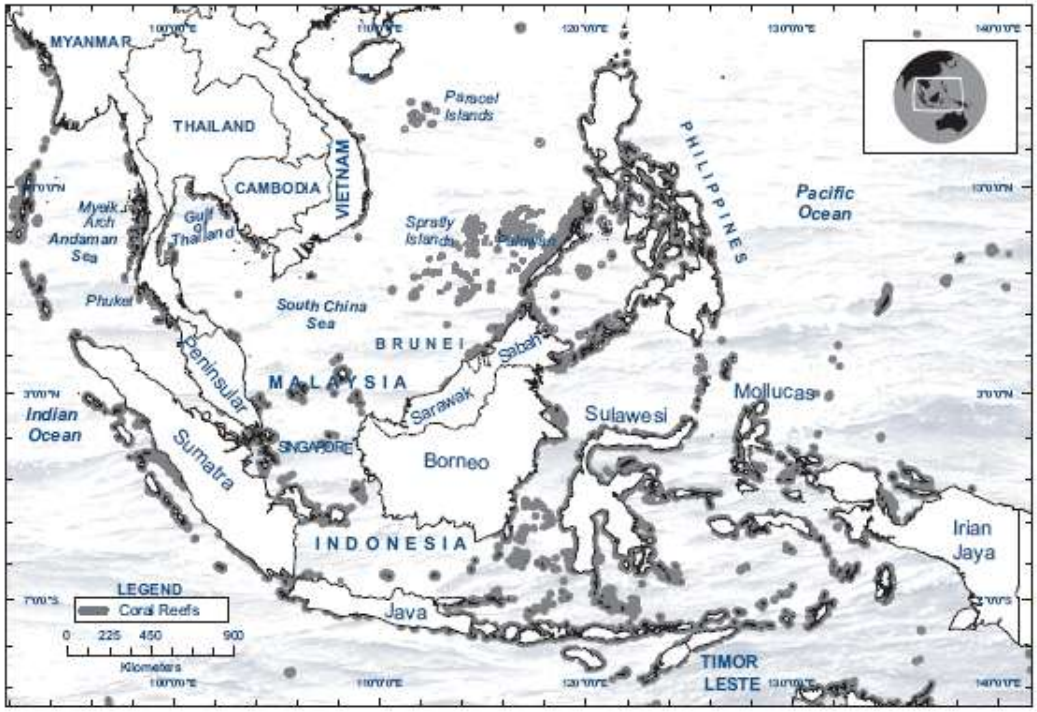

Figure 4. Coral reefs distribution in Southeast Asia (Tun *et al*., 2008).

2.2.2 Mangroves

Another important ecosystem in the Arafura – Timor Sea region is mangroves. Mangrove ecosystem covers the coastal area of Papua and other islands. In the coastal area of southern Papua, mangrove ecosystems are in good condition and mangrove forests are well developed. Satelitte images of mangrove eosystems in ten districts of the south coast of Papua indicate a total area of 638,507 hectares (ATSEF Book 1, 2006). Wagey and Arifin (2008) consider that mangrove ecosystem in the southern coast of Papua is the most extensive in the world with a high degree of biodiversity, and it consists of genera *Avicennia, Sonneratia, Rhizophora, Bruguiera, Ceriops, Nypa* and *Xylocarpus*.

Mangrove and estuary ecosystems in the Wasur National Park, Papua, are listed in Wetlands of International Importance since 16 March, 2006, as one of the three Ramsar sites in Indonesia. As is known, the Convention on Wetlands came into force for Indonesia on 8 August 1992. Indonesia presently has 3 sites designated as Wetlands of International Importance, with a total surface area of 656,510 hectares. These sites are the **Berbak National Park** in Jambi, with surface area of 162,700 ha; the **Danau Sentarum Nationak Park** in Kalimantan Barat, with surface area of 80,000 ha; and the **Wasur National Park** of 413,810 hectares in Papua.

The Wasur National Park, which is contiguous with the Tonda Wildlife Management Area Ramsar site in Papua New Guinea, is a low-lying wetland in the monsoon climate zone of southern Papua, near the town of Merauke. Coastal mangroves grow on intertidal mudflats with extensive seasonally inundated grasslands, reed swamps, savannahs, and monsoon forest. The site is the habitat for a number of rare and endemic species, including the Fly River Grassbird (*Megalurus albolimbatus*) and Grey-crowned Munia (*Lonchura nevermanni*). Tens of thousands of waterbirds visit the region during migration between eastern Siberia and northern Australia.

Report (ATSEF Book 1) indicates that mangroves in the Aru Islands are in good condition, except those in Dobo, Warmar Island. Around Benjina, Ulir Island, mangrove forest is in good condition and consists of big trees with diameter of more than 40 cm. The thickness of mangrove forest exceeds 200 m. The total area of mangrove forests in 52 islands of Aru from satellite images is estimated to be 163,964 hectares.

Based on the survey in 1995 (ATSEF Book 1), mangrove habitat in Timor and around the islands of Rote, Sabu and Semau consist of 11 species with total area of 19,600 hectares. Furthermore, this report indicates that mangrove forests in Timor District consist of several species of mangroves and they are in good condition. The thicknesses of those mangrove forests are in the range of 1 to 2 kms, except those around the Kupang Bay that the mangrove trees have been cut and the areas were altered to become tambaks (fish ponds). The mangrove species found in Timor include *Bruguiera sp, Rhizopora sp, Rhizopora apiculata, Rhizopora stylosa, Sonneratia sp, Sonneratia caseolaris, Avicennia sp,* and *Ceriops sp.*

Wagey and Arifin (2008), however, reported that the mangrove communities along the coasts of Timor Leste and Nusa Tenggara Timur cover only an area of around 7500 acres, which is quite small compares to the result of the survey in 1995. According to Wagey and Arifin, the extent of mangroves in this area is limited by inlets that can provide fresh water and the littoral strip affected by salt water. Therefore, distribution of the main mangrove species in this area depends on the physical condition of the coastal area. *Rhizophora conjugate* or *Bruguiera parvifolia* is the main species to be found in this area. Generally, more than one species are found in the area parallel to the coast line up to the high tide mark. In waters with high salinity and sandy substrate, mangroves of the *Sonneratia alba* and *Bruguiera parvifolia* may be found. On muddy substrate, mangroves of *Rhizophora conjugata* and *Bruguiera* are more common; while in stagnant water with high salinity; *Rhizophora conjugata* and *Avicennia marina* are commonly seen. The other mangrove species found in the area are *Aegiceras corniculatum, Acanthus ilicifolius, Lumnitzera racemosa, Heritiera litoralis* and *Acanthus ilicifolius*.

2.2.3 Seagrass

The seagrass ecosystem is a shallow marine ecosystem that normally found in the area between mangrove ecosystem and coral reefs. The seagrass ecosystem in Indonesian waters comprises of 12 species (Wagey and Arifin, 2008) from 50 species known in the world (Hemminga

and Duarte, 2000). Seagrass ecosystem began receive public attention only after the year 2000. For this reason, publication on seagrass is limited.

Seagrass ecosystem is known as a feeding ground for marine mammals and sea turtles. This ecosystem has high organic productivity and provides suitable living environment for many marine organisms. Furthermore, seagrass beds entrap sediments and increase the clarity of the water. Seagrass ecosystems in the Arafura Sea are found in surrounding areas of Kei and Yamdena, the Aru islands. The report from the local government office (Bappeda Kab. Maluku Tenggara, 2003) mentioned that the seagrass ecosystem in the area consists of 11 species of seagrass, such as *Halodule pinifolia, Halodule uninervis, Cymodocea rotundata, Cymodocea serrulata, Syringodium isoetifolium, Thallasodendrom ciliatum, Enhalus acoroides, Thalassia hemprichii, Halophila ovalis, Halophila ovata and Halophila spinulosa*.

In the Timor Sea seagrass are found in lagoonal areas with a sandy substrate, and also on the other types of substrate that includes muddy bottoms to rocky shores. Wagey and Arifin (2008) reported that there are 7 species of seagrass which are commonly found in the Timor Sea. These species include *Halodule uninervis, Halophila decipiens, Halophila ovalis, Enhalus acoroides, Syringodium isoetifolium, Thalassodendron ciliatum and Thalassia hemprichi*.

2.2.4 Sea cucumber

Sea cucumbers have long been traded for medicine, health related uses and delicacies. Traded sea cucumber in Indonesia is often known as teripang, which only refers to about 26 species out of more than 350 species found in Indonesian waters. Eventhough the utilization of sea cucumber has been known for more than 500 years, study on sea cucumbers identification and species naming based on collected specimens from the eastern Indonesia Archipelago only began in the late 1800's, whereas national publications only began to appear in the late 1970's (Wagey and Arifin, 2008).

Identification of sea cucumbers collected by the Siboga expedition (1899 – 1900) resulted in 184 species in which 46 of them were new species. These new species consisted of 6 Holothuriidae, 28 Cucumariidae, 6 Molpadidae and 6 Synaptidae. The Siboga expedition explored the Timor, Banda, Flores, Maluku and Halmahera Seas and the waters around Sulawesi from shallow areas down to depths of 3000 meters (Sluiter, 1900).

Other expeditions to the eastern Indonesia recorded more new species and some of them were endemic species. The Snellius II Expedition (1984 – 1985), for instance, recorded 40 species of sea cucumber from a depth of 730 meters. The collected species include 10 new species and 3 species new to Indo Malaysian waters (Jangoux et al., 1989). Presently, at least 350 species of sea cucumbers have been identified from Indonesian waters, and 54 species were collected from the Arafura and Timor Seas (Sluiter, 1901; Massin and Lane 1999). In terms of commercial value, 26 species of sea cucumbers collected from Indonesian waters have commercial value and at least 14 species are collected from the Arafura – Timor Seas.

2.2.5 Turtles

There are 250 known turtle and tortoise species in the world, including terrestrial (tortoise) and aquatic (turtle) species. However, there are only 8 species of marine turtles. Tomascik et al., (1997) noted that 6 species of marine turtle can be found in Indonesian waters; they are *Chelonia mydas, Eretmochelys imbricata, Lepidochelys olivacea, Caretta careta, Natanor depressus and Dermochelys coriacea.* The first 5 species belong to the Class Reptilia, Order Testudines, Family Cheloniidae, while the last one, *Dermochelys coriacea*, belongs to Dermochelyidae Family. The

most commonly found marine turtles in the Arafura Timor Sea are the green turtle (*Chelonia mydas)*, hawksbill turtle *(Eretmochelys imbricata)*, and leatherback turtle *(Dermochelys coriacea)*. Marine turtles of the Cheloniidae Family and Dermochelydae Family are listed in CITES Appendix I that valid from 1 July 2008. Figure 5 shows the nesting sites, feeding ground and hunting ground of marine turtles in the Arafura-Timor Seas and surrounding waters as adapted from Monk *et al*., (1997), Thebu and Hitipeuw (2005), and Lawalata *et al*. (2005).

Sea turtle populations are declining (Dutton, 2005) as observed in Mexico, Costa Rica, Malaysia and other parts of the world nesting grounds due to exploitation for centuries for their meat, eggs, shell, leather and oil. Their exploitation and habitat degradation resulting from coastal construction, commercial trade and their mortalities through incidental capture in fisheries have accelerated the decline of sea turtle populations. Genetic study (Dutton, 2005) indicates that turtle populations in the eastern Pacific, such as that in Costa Rica and Mexico, are coming from the western Pacific as confirmed later from tagging observation and satellite telemetry.

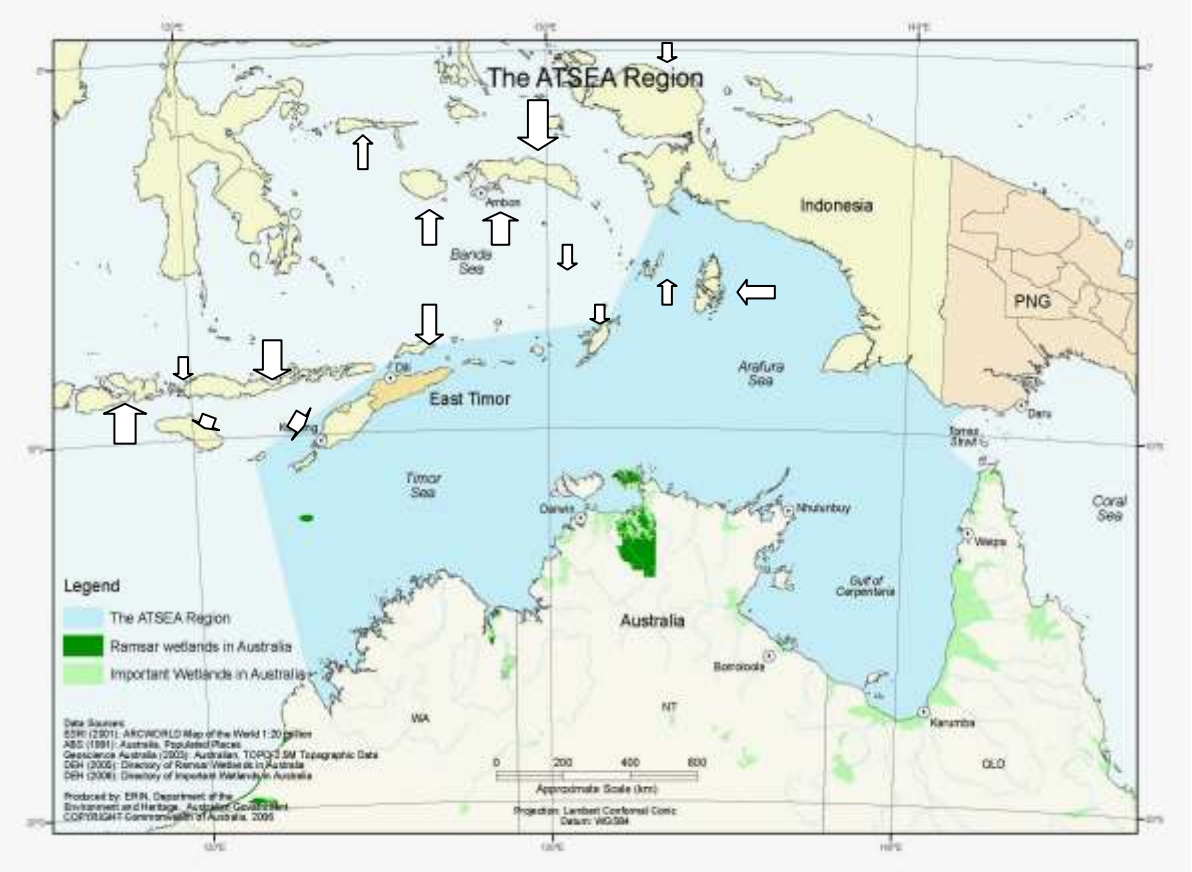

Figure 5. Distribution of marine turtles in the eastern Indonesian waters. Arrows indicate known nesting sites, feeding ground and hunting ground of marine turtles. The common marine turtles found in this area are Hawksbill turtle and Green turtle. Leatherback turtle is found in Kei Island and Warmon Beach, Birdhead area, Papua. Loggerhead turtle is found in nesting areas of Banda and Kei islands. (Monk *et al*., 1997; Thebu and Hitipeuw, 2005; and Lawalata *et al*., 2005).

2.2.6 Dugongs

The dugong (*Dugong dugon*) is a large **marine** mammal of the order **Sirenia** who is heavily dependent on seagrasses for subsistence. The dugong is also referred as "sea cows" where they are restricted to the **shallow marine habitats** to grow, with the largest dugong concentrations typically occurring in wide, shallow, protected areas such as **bays**, mangrove channels and the lee sides of large inshore island. Eventhough dugong spans the waters of the **Indo-Pacific**, the majority of dugongs live in the northern waters of **Australia** between Shark Bay and Moreton Bay.

Published information on the dugong in the Arafura-Timor Seas is limited. Dugong population was estimated at around 10.000 individuals in 1970's, but in 1994 the population of dugong was only around 1.000 individuals and was in continuous to decline (Marsh *et al*., 2002). Dugongs are associated with the abundance of seagrasses of Halodule Syringodium, Halophila, Cymodocea and Zostera species. Distribution of dugongs in eastern Indonesia includes the area of Ceram, Manado and Aru (Marsh *et al*., 2002). However, report (de Longh, 1996) stated that during 1979 as many as 80 -200 dugongs were captured by shark net, and only 20 – 40 individuals were caught in 1989.

The dugong lifespan is long, within the range of 70 years or more, but its rate of reproduction is slow. It has been hunted for thousands of years, often for its meat and oil, and many populations are close to extinction. The IUCN lists the dugong as a species vulnerable to extinction, while the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) puts dugong in Appendix I. Despite being legally protected in many countries, the main causes of dugong population decline remain anthropogenic that include hunting, habitat degradation, and fishing-related fatalities. In addition, dugongs are threatened by storms, parasites, and their natural predators, sharks and killer whales.

2.2.7 Cetacean (Dolphins and Whales)

Various species of Cetacean that includes dolphins and whales are found in Indonesian waters. Record (Wagey and Arifin, 2008; Apex Environmental; Rudolph *et al*, 1997) shows that 30 Cetacean species are positively identified in Indonesia, out of 86 species known worldwide. The 30 species are belong to 6 Families that include **Balanopteridae** with 7 species, **Delphinidae** consisting of 16 species, **Kogiidae** with 2 species, **Phoconidae** includes 1 species, **Physeteridae** with 1 species, and **Ziphiidae** consisting of 3 species (Table 1).

Table 1. List of Cetacean found in Indonesia (Wagey and Arifin, 2008; Apex Environmental; IUCN Status/Red List of Threatened Species 2008; CITES, 2008)

No.	Family	*Species*	Common Name	*IUCN Status*
1.	**Balaenopteridae**	***Balaenoptera acutorostrata***	Minke whale	LC
2.		***Balaenoptera borealis***	Sei whale	EN
3.		*Balaenoptera brydei*	Bryde's whale	DD
4.		***Balaenoptera edeni***	Pygmy Bryde's whale	DD
5.		***Balaenoptera musculus***	Blue whale	EN
6.		***Balaenoptera physalus***	Fin whale	EN
7.		***Megaptera novaeangliae***	Humback whale	LC
8.	**Delphinidae**	*Delphinus capensis*	Long-beaked common dolphin	DD
9.		*Delphinus delphis*	Short-beaked common dolphin	LC
10.		*Feresa attenuata*	Pygmy killer whale	DD
11.		*Globicephala macrorhynchus*	Short-finned pilot whale	DD
12.		*Grampus griseus*	Risso's dolphin	LC
13.		*Lagenodelphis hosei*	Fraser's dolphin	LC
14.		***Orcaella brevirostris***	Irrawaddy dolphin	VU
15.		*Orcinus orca*	Orca	DD
16.		*Peponocephala electra*	Melon-headed whale	LC

No.	Family	*Species*	Common Name	*IUCN Status*
17.		*Pseudorca crassidens*	False killer whale	DD
18.		***Sousa chinensis***	Indo-Pacific humpback dolphin	NT
19.		*Stenella attennuata*	Pantropical spotted dolphin	LC
20.		*Stenella coeruleoalba*	Striped dolphin	LC
21.		*Stenella longirostris*	Spinner dolphin	DD
22.		*Steno bredanensis*	Rough-toothed dolphin	LC
23.		*Tursiops truncatus*	Bottlenose dolphin	LC
24.	**Kogiidae**	*Kogia breviceps*	Pygmy sperm whale	DD
25.		*Kogia simus*	Dwarf sperm whale	DD
26.	**Phocoenidae**	***Neophocaena phocaenoides***	Finless porpoise	VU
27.	**Physeteridae**	*Physeter macrocephalus*	Sperm whale	VU
28.	**Ziphiidae**	*Mesoplodon sp.*	Beaked whales	DD
29.		*Ziphius cavirostris*	Cuvier's beaked whale	LC
30.		***Hyperoodon sp***.	Bottlenose whales	DD/LC

1. Status - IUCN Red List of Threatened Species, 2008; (DD - Data Deficient; EN - Endangered; LC – Least Concern; NT – Near Threatened; VU – Vulnerable)
2. CITES lists Cetacea in Appendix II, except those species listed in bold are included in Appendix I. CITES Appendices I, II and III are valid from 1 July 2008.

Kahn et al. (2000) reported the distribution of at least 14 species of Cetacean in the surrounding waters of Komodo, Rinca and Flores islands, as observed during their survey in 1999. These species include *Delphinus delphis* (Common dolphin), *Feresa attenuata* (Pygmy killer whale), *Grampus griseus* (Risso's dolphin), *Lagenodelphis hosei* (Fraser's dolphin), *Peponocephala electra* (Melon-headed whale), *Pseudorca crassidens* (False killer whale), *Stenella longirostris* (Long-nosed spinner dolphin), *S. Attenuata* (Pan-tropical spotted dolphin), *Tursiops truncatus* (Bottlenose dolphin), *Steno bredanensis* (Rough-toothed dolphin), *Ziphius cavirostris* (Cuvier's beaked whale), *Kogia sp, Balaenoptera edeni and Physeter macrocephalus* (Sperm whale).

2.2.8 Sharks and rays

Sharks and rays Families are known as elasmobranchii group. These are known as cartilaginous fish, which have skeletons formed of softer cartilage. The mouths of cartilaginous fish are on the underside of the head, and the male fish have sexual organs called claspers.

Another group of fish which is related to the **sharks** and **rays** are Chimaeras. Chimaeras are sometimes called ghost sharks, ratfish, or rabbitfishes. They belong to the order Chimaeriformes. They have elongated, soft bodies, with a bulky head and a single gill-opening, and grow up to 150 centimetres in adult body length.

Elasmobranchs are slow growing and long lived fish that mature at an old age. They produce few young in their life, and therefore make them susceptible to overfishing. Blaber *et al*., 2009, indicate that probably since 1995 Indonesia annual reported landings of elasmobranchs is more than 100,000 tons, the higest landings worldwide. Elasmobranchs in Indonesia are taken in

target fisheries, primarily by artisanal fishers using nets, long lines and droplines, and also by industrial fish trawlers. They also are taken as bycatch in the tuna fisheries. Blaber *et al*., 2009, also reported that catch rates of elasmobranchs in the Java Sea declined by at least one order of magnitude between 1976 and 1997 based on research cruise data. Furthermore, they suggested that many of the shark and ray species in Indonesia are overfished and effective fisheries management strategy need to involve capacity control, such as licensing, gear restrictions and catch limits, together with controls on the fin trade. This condition also reflects the general condition of elasmobranch fisheries in the ATS region.

In the ATS region, sharks are found up to 15 Families with 64 species, and rays are identified up to 11 Families with 41 species, while Chimaera are known of only one Family with 2 species (Wagey and Arifin, 2008). Sharks and Rays have been identified only to genus level. Observations on the result of fish trawling survey in November 2006 (Wijipriono *et al*., 2007) in the Arafura Sea have identified the sharks and rays as listed in Table 2. Table 2 also indicates key species of the elasmobranchs that were considered as bycatch in the ATS region (Blaber *et al*., 2009).

Table 2. Sharks and rays captured by fish trawling in the Arafura Sea (Wijopriono *et al*., 2007)

Group	Family	Species
Rays	Dasyatididae	*Dasyatis sp.*
	Gymnuridae	*Gymnura sp.*
	Myliobatididae	*Aetomylius nichofii*
	Narcinidae	*Narcinidae sp.*
	Rhinobatidae	*Rhinobatidae*
Sharks	Charcarinidae	*Carcharinus sp.*
		Gharcarinus sp.
		Charcarinus sp.
	Spyrnidae	*Spyrna lewini*
	Orectolobidae	*Orectolobidae sp.*

Two species of shark in the Australian northern waters are black-tip shark (Carcharhinus tilstoni and C. sorrah). Hammerhead sharks (Sphyrnidae) also form a significant part of the catch in the area (Staples D., **derek.staples@brs.gov.au**).

2.2.9 Cephalopoda

The Cephalopoda is an ancient group of the Mollusca that consists of two groups: the Nautiloidea with a few species of the pearly nautilus, and the Coleoidea, containing the squids, cuttlefishes, octopods and vampire squids. The Cephalopoda is represented by about 700 species. Cephalopoda are the most active of the molluscs and some squids rival fishes in their swimming speed. Although there are relatively few species of living cephalopoda, they occupy a great variety of habitats in all of the world's oceans. Individual species are often very abundant and provide major targets for marine fisheries (Young *et al*., 2008). Cephalopoda are of considerable economic importance to humans. Many species of squid and octopus are consumed by human.

Information on Cephalopoda in the Arafura-Timor Seas is still limited. Some information on squids, cuttlefish and octopus were obtained from the result of trawl survey in the Arafura Sea. The trawl survey has captured 4 species from 3 Families of Cephalopoda (Table 3.).

Table 3. Cephalopoda captured in the trawl survey in the Arafura Sea (Wijopriono *et al*., 2006).

Family	Species
Loliginidae	*Loligo chinensis*
	Loligo edulis
Sepiidae	*Sepia sp.*
Octopodidae	*Octopus*

2.2.10 Crustacea

The crustacea is a group of marine organisms that live as pelagic organisms in the water column or as benthic biota on the sea bed, in rivers and lakes and in estuaries, inter-tidal zones, mangrove forests, seagrass beds and coral reefs, and at various depths from shallow water to the deep waters of several thousand meters.

The crustaceans, an ancient group that arose in the early Cambrian nearly 600 million years ago, are the most diverse group in terms of form and size. The crustaceans include crabs, shrimps, and lobsters as well as barnacles, pillbugs, amphipods, copepods, krill, crayfishes, sea fleas, clam shrimps, fairy shrimps, and many others also belong to the Crustacea. In terms of size, crustaceans range from the tiny individuals not more than 0.25 millimeters in size for adult to about four-meter legspan. The Natural History Museum of Los Angeles collections preserved the largest crustacean of the the giant Japanese spider crab (*Macrocheira kaempferi*) with its four-meter legspan, the Alaskan king crab (*Paralithodes camtschatica),* which can weigh more than 10 kilograms, and the giant Tasmanian crab (*Pseudocarcinus gigas),* which has been recorded at an impressive 14 kilograms.

There are at least 60,000 crustacean species in the world (Wagey and Arifin, 2008). This figure is twice the number of all amphibians, reptiles, birds and mammals combined. The knowledge of crustacea in Indonesian waters has been derived from a number of marine expeditions since the 19th century. Research activities conducted by the Centre for Oceanographic Research and its sub-centre in Ambon and the studies based on publications and collections available in the Centre have revealed 607 species of decapod crustacea in the Arafura and Timor Seas. These crustaceans were grouped into the Anomura that consists of hermit crabs and porcelain crabs, Brachyura that comprises of many crab species, and shrimps of Dendrobranchiata, Caridea and other shrimp category (Wagey and Arifin, 2008).

Anomura in the Arafura and Timor Seas consists of 7 families with 175 species. Those that live in coastal and shallow water habitats are mostly the members of Coenobitidae, Diogenidae and Porcellanidae Families. On the other hand, Anomura in the deep waters are of the Parapaguridae and Pylochelidae. Paguridae and Galatheidae Families are most often found in deep waters. Of these Anomura species, 15% or 26 species are endemic to the Arafura and Timor Seas.

The Brachyuran crabs that live in the Arafura and Timor Seas were identified as belong to 32 families with 306 species. The Majidae Family that contains 96 species is the most diverse family, followed by the Xanthidae Family with 30 species. The species that were considered endemic consist only of 21species or 7% of the Brachyuran species.

2.2.11 Plankton

Plankton is important in terms of providing a crucial source of food to aquatic life. Plankton distribution and abundance are strongly dependent on ambient nutrients concentrations and the physical state of the water column. The ATS region is a plankton rich region. Wijopriono

et al., 2007, reported that plankton in the Arafura sea consists of 46 species of phytoplankton representing 4 families of Bacillariophyceae, Dinophyceae, Chrysophyceae and Cyanophyceae. The dominant one is the Bacillariophyceae which is represented by 36 species.

Zooplankton in the Arafura Sea is represented by at least 55 species of 8 families. The dominant species is represented by 35 species of Crustacea. The other families including Urochordata, Ciliata, Sagittidea, Sarcondina, Ophisthobranchia, Holothuroidea and Coelenterata are represented by 1 to 6 species.

2.2.12 Protected areas for marine biodiversity conservation

Conservation is an effort to protect and conserve biological resources and their diversity. The earliest concept of conservation has been known to Indonesia since the Dutch occupation until the time of the 2nd world war. The concept was applied to conserve mainly forest areas and their terrestrial biological resources. Conservation effort on terrestrial biological resources was continued by the government of Indonesia, and since the late 1970s conservation effort was extended to fresh water resources and marine resources as well in various forms. 2500 hectares Marine Protection Area (Cagar Alam Laut) in Southeast Maluku was established in 1977 by the Minister of Agriculture through Ministerial Decree No. 221/Kpts/Um/4/1977 dated 25 April 1977 to protect coral reefs, marine biota, turtle habitat, dugongs, sharks and whales. Since then various forms of marine protection areas, marine parks and national marine parks with various acreages have been established by the Minister of Agriculture and Minister of Forestry (Konservasi Sumberdaya Ikan di Indonesia, Ditjen Kelautan Pesisir dan Pulau-pulau Kecil, 2008). District Marine Conservation Areas in district level have been established by Bupatis (Head of Districts) since 2002. For example, the Marine Park of the Pantar strait and adjacent areas of the Alor Island has been established by Bupati in 2002 to protect the migrating whales and biodiversity of coral ecosystems. The distribution of Marine Conservation Area District level can be refferred to the map of Peta Sebaran KKLD dan Calon KKLD, 2007, published by the DG Kelautan, Pesisir dan Pulau-pulau Kecil.

The government of Indonesia intends to establish at least 10 million hectares of marine conservation area in 2010 that will be extended into 20 million hectares in 2020 as has been commited by the Indonesia Government in the COP CBD meeting in Brazil, 2006. Current status on the conservation program is shown in the following Table 4, Acreage of Existing and Planned Conservation Area in Marine and Coastal Waters (Luas Kawasan Konservasi Perairan dan Calon Kawasan Konservasi Perairan) (source: Ditjen KP3K, 2007).

Table 4. Acreage of Existing and Planned Conservation Area in Marine and Coastal Waters

No.	Conservation type	Total		Institution
		Number	Acreage (Ha)	
1.	Marine National Park (Taman Nasional Laut)	7	4,045,049	Min. Forestry
2.	Marine Recreation Park (Taman Wisata Alam Laut)*	18	767,610.15	Min. Forestry
3.	Marine Conservation Area (Cagar Alam Laut)*	9	274,215.45	Min. Forestry
4.	Marine Sanctuary Area (Suaka Margasatwa Laut)*	7	339,218.25	Min. Forestry
5.	Local Marine Conservation Area (Kawasan	24	3,155,572.40	MMAF & Local Gov.

No.	Conservation type	Total		Institution
		Number	Acreage (Ha)	
	Konservasi Laut Daerah)**			
6.	Planned Local Marine Conservation Area (Calon Kawasan Konservasi Laut Daerah)***	19	13,591,406.15	MMAF & Local Gov.
7.	Marine Protection Area/ Mangrove Protection Area***	2	2,085.90	MCRMP, COFISH and COREMAP MMAF
8.	Fisheries Protection Area***	3	453.23	COFISH MMAF
9.	Planned National Waters Conservation Area Anambas and Savu Sea***	2	5,705,839.00	MMAF

(Source: Ditjen KP3K, 2007)
Note: * : some of these areas will be managed by MMAF
** : reservation of the area has been done by local governments
*** : reservation not yet done awaiting for data and other information

Table 4 shows that 10 million hectares of marine conservation area will be achieved in 2010 in acreage. However, it is still questionable as whether the management of these areas can be developed in short time considering the complex problem in setting up management of a conservation area.

2.2.13 Global significance of conservation of marine biodiversity

Nevertheless, support has to be given to local government within the ATS area to develop three marine conservation areas: planned fish sanctuary in Savu Sea and neighbouring seas, planned Kaimana district marine conservation area and Pantar Strait Marine Park in Alor. Furthermore, at the national level, MMAF intends to establish a National Marine Conservation Area in East Nusa Tenggara around the Savu Sea and adjacent inlands. Savu I in west Sumba – Flores is 354,299 hectares marine sanctuary area. Savu II is located around Solor – Lembata – Alor Islands with acreage of 1,557,162 hectares, while Savu III includes the waters between Timor – Savu and Sumba with acreage of 2,763,900 hectares. Savu Sea and adjacent waters is unique deep sea environment for whale and dolphin migration paths from the Pacific to the Indian Ocean and vice versa through narrow straits in the area. Moreover, the Savu Sea also represents turtle nesting habitat and tuna migration path. Therefore, Savu Sea represents not only an area of national economic interest but also international and global interests.

2.3 Fisheries

Discussion on fisheries in the ATS area is divided into two parts: fish stock in the Arafura Sea and that of Timor Sea.

The Arafura and Timor seas are adjacent seas with different ecological conditions and fish resources utilization. Figure 6 shows the new fisheries management areas of Indonesia. These fisheries management areas have been numbered following the statistical code of FAO. According to this map, the fisheries management area of Arafura Sea is numbered WPP-RI 718. The fisheries management area of the Timor Sea, however, is included in the WPP–RI 573 of the Indian Ocean, and part of the sea that belongs to Timor Leste's jurisdiction is not included.

The status of fisheries resources in the two management areas was estimated in four fish stocks categories, namely demersal, shrimp, small pelagic and large pelagic. The status of the stock of the four categories in WPP-RI 718 and WPP-RI 573 are shown in Table 5. Fisheries resources in the Timor Sea might be represented by that in WPP-RI 573. In general, the four categories of fish stock in these two management areas are fully exploited, and demersal fish and shrimp in Arafura Sea are overfished.

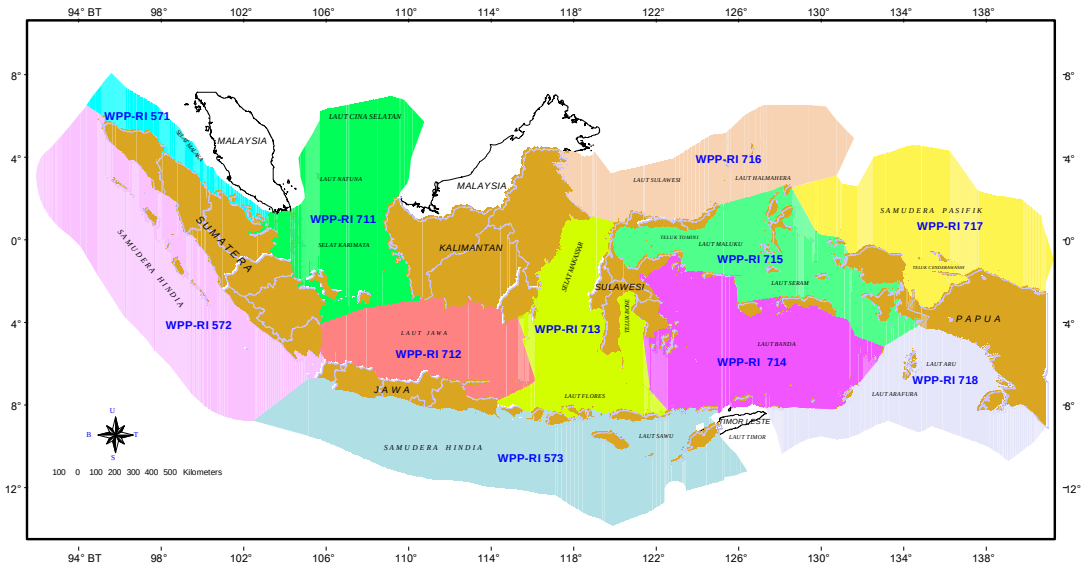

Figure 6. New fisheries management areas of Indonesia.

Table 5. Fisheries stock status in two management areas, Indian Ocean (WPP-RI 573) and Arafura Sea (WPP-RI 718)

Fisheries Management Area	Fish Type	Stock Status	Remarks
Indian Ocean WPP-RI 573	Demersal	Fully exploited	Very narrow fishing ground, deep sea untapped
	Shrimp	Fully exploited	Very narrow fishing ground, deep sea untapped
	Small Pelagic	Fully exploited	Small pelagic; other uncertain
	Large Pelagic	Fully exploited	Fishing ground in high seas out side EEZI
Arafura Sea WPP – RI 718	Demersal	Fully exploited – over exploited	Intensive utilization in EEZI; west Arafura and slope area unknown
	Shrimp	Over exploited	Size and proporsion decreases
	Small Pelagic	Moderately exploited	Utilization by fish trawler boats and as bycatch of shrimp trawlers
	Large Pelagic	Uncertain	Accidental catch

The fisheries condition in Arafura – Timor Seas area presents challenges to the fisheries management both in central and local governments in Indonesia. Management tools and measures have to be designed to improve the stock condition in the area, at least for the four categories. As is known, fisheries management in Arafura Sea is conducted by the province of Papua, the province of Maluku and the central government.

Arafura Sea as well as the Maluku Sea are important areas for shrimp and demersal fishes and have been exploited since long time ago. Shrimp trawling, however, pose a threat to the demersal fish stock in the area due to its inefficient catch methods. Demersal fish that were produced by shrimp trawling were treated as by catch product and they were disposed of. Estimated volume of the demersal fish that were considered as by catch is 80% of the total volume of the catch, and it is approximated that the figure of this by catch is about 40,000 ton – 70,000 ton per year, eventhough some of the by catch product were consumable demersal fish (ATSEF Book 2). The wasted by catch was estimated to be 500,000 ton per year before the year 2000. Excessive by-catch should become concerns to fisheries management because it is not only wasting of resources but also becomes threat to the environment of the fishing area. In 2003, by-catch product that were recapture as dead fish has been about 25-26% of the trawling catch. By-catch distribution in the estuary of Digul River is the highest.

In 2001, it was estimated that maximum sustainable yield for penaeid shrimp was 20,000 ton and for demersal fish was 30,000 ton. These figures are considered to have been exceeded considering the increasing number of trawling vessels and trawling operations in the area. Shrimp trawling is conducted in the near shore along the coast of Papua where depths are between 5 – 60 m, and along the eastern Aru waters. From 17 species of shrimps, 5 species are considered economic species for export purposes. The 5 economic species include shrimps with local name "udang jerbung" (*Penaeus Merguiensis*), "udang windu" (*P. monodon, P. semisulcatus, and P. esculentus*), "udang ratu" (*P.latisulcatus*), "udang dogol" (*Metapenaeus ensis and M. Endeavouri*) and "udang krosok" (*Parapenaeopsis stylifera, trachypenaeus asper, and Solenocera subnuda*). General species composition is dependent on the catch area, for example, *Penaeus merguiensis* is abundant in Dolak, Timika and Merauke, *P. monodon, P. semisulcatus and P. esculentus* are dominant in Aru. Annual fish production from Arafura Sea indicates declining trend, especially for shrimp and demersal fish.

The similar condition of declining trend of tiger shrimp is also found in the northern territory of Australia. The exploited shrimps include banana shrimp (*P.merguiensis*), white shrimp (*P. indicus*), brown tiger (*P. esculentus*), grooved tiger (*P.semisulcatus*), giant tiger (*P. monodon*), blue endeavour (*M. endeavour*), red endeavour (*M.ensis*), western king (*P. latisulcatus*), and red spot king (*P. longistylus*). Study indicates that tiger prawn is biologically overfished, as does also the brown and grooved tiger prawn (Caton, 2000). Another important fishery in this region is the prawn and rock lobster fishery in the Torres Strait between Australia and Papua New Guinea. The brown tiger and blue endeavour are the main target species of trawling, while the rock lobster (*Panulirus ornatus*) are the target of spear fishing or direct collection through diving.

Fish density in the Arafura Sea is observed through acoustic survey in 2003 (ATSEF Book 2). It is reported that maximum distribution of pelagic fish density through out the water column is in depths of 27 – 35 m, while demersal fish maximum density is observed in the depths of 30 – 35 m. Trawling surveys in the year of 2000 and 2002, however, presented different aspect of fish resources in the area. Comparing catch rates per hour for both demersal fish and pelagic fish in two periods of surveys indicates that catch rates are decreasing significantly. Pelagic fish catch rates were 305.3 kg per hour in 2000 and decreasing to 43.6 kg per hour in 2002. An almost similar picture is presented by demersal fish catch rates that were 885.2 kg per hour in 2000 becoming 351.0 kg per hour in 2002. Species composition in the catch during the surveys in 2000 and 2002 is presented in the following Table 6.

Table 6. Fish composition and catch rates during two surveys in Arafura Sea

No.	Family/species	Year 2000	Family/species	Year 2002
1.	*Trash fish*	463.5	*Rays*	108.8
2.	Synodontidae	284.5	*Crabs*	69.2
3.	Leiognathidae	240.3	Pomadasydae	50.5
4.	Clupeidae	239.6	Leiognathidae	42.6
5.	*Shrimps*	180.2	Carangidae	40.8
6.	*Crabs*	97.6	Mullidae	34.5
7.	*Squids*	55.6	Synodontidae	28.2
8.	Nemipteridae	54.4	*Squilla spp.*	23.8
9.	*Other food fish*	41.4	Nemipteridae	19.3
10.	Priacanthidae	37.6	Trichiuridae	13.1
11.	*Cuttles*	31.6	*Shrimps*	11.6
12.	Psettodidae	30.7	*Cuttles*	10
13.	Mullidae	29.5	Theraponidae	6.8
14.	Carangidae	27.3	Ariommatidae	6.6
15.	Ariommatidae	24.7	Gerreidae	5.7

Source: ATSEF Book 2

The catch rates of 2000 were produced by using commercial fishing vessel while the catch rates of 2002 were presented by research vessel. The differing methods produced different figures that must be considered carefully since commercial fishing vessel tend to operate in kown fishing ground while the research vessel covered the more even area, and therefore produced smaller number of catch rate. However, declining trend of resource abundance that is reflected in declining size and composition of the catch indicate degrading environment quality.

On the other hand, resource utilization in Timor Sea is not as high as that of Arafura Sea. Fisheries statistics in the province of East Nusa Tenggara show that in the periode of 1999 to 2003 fish landing in Kupang district is the highest.

2.3.1 Fish stock in the Arafura Sea

The Arafura Sea is an important ground for fisheries resources including shrimps and pelagic and demersal fishes. The most abundance species of fish in the ATS are white shrimp (*Penaeus merguiensis*), tiger shrimp (*Penaeus monodon and Penaeus semisulcatus*), and endeavour shrimp (*Metapenaeus ensis*) and demersal fish such as Nemipteridae, coral fishes, squid, shark and plain maskray (Sadhotomo *et al*., 2003).

Relative abundance

The trawl survey in the Arafura Sea in November 2006 (Wijopriono *et al*., 2007) collected 228 species from 101 Family of fish. This result indicates the fish composition and their relative abundance in the survey area (Table 7).

Table 7. Fish composition and their relative abundance in the Arafura Sea (source: Wijopriono *et al*., 2007).

Fish group	Family	Relative abundance (%)
Demersal fish	61	58.89
Pelagic fish	6	11.38
Crabs	6	9.88
Shrimps	7	7.80
Cephalopoda	3	4.57
Rays	5	3.38
Jelly Fish	1	1.21
Sea Urchin	1	0.98
Sea Cucumber	1	0.97
Sharks	3	0.64
Gastropods	6	0.27
Seastars	1	0.03

Important economic species of pelagic and demersal fish in the Arafura Sea are fringescale sardinella (*Sardinella fimbriata*), anchovy (*Setipinna tenuifilis* and *Stolephorus indicus*), thryssa (*Thryssa hamiltonii*), longnose trevally (*Carangoides chrysophrys*), common ponyfish (*leiognathus equulus*), bottlenose jewfish (*Johnius australis*), nurseryfish (*Kurtus gulliveri*), three-lined tongue sole (*Cynoglosus abbreviatus*), fourfinger threadfin (*Eleutheronema tetradactylum*), purple-headed emperor (*Lethrinus lentjan*), hard-palate catfish (*Arius silidus*), banana shrimp (*Penaeus merguensis*), yark shrimp (*Metapenaeus ebarocensis*), hardback shrimp (*Trachypenaeus fulvus*), swimming crab (*Portunus pelagicus*), and processed jelly fish. Juvenil fish such as longjaw thryssa, buffon's rivergarfish and japanese halfbeak, and juvenil shrimp are highly abundant in Arafura sea.

Studies that were conducted in 1987 and 2004 by Naamin (1987), Badrudin (2004) and Sadhotomo (2004) show that the utililization of marine living resources, primarily shrimp and demersal fish, in the Arafura Sea tends to be high as reflected in:

- A decline in abundance index for economic important shrimp from 40 -50% in 1992 to 15-20% in 2000 as well as a decline in average size of individual shrimp that tend to be smaller.
- An increase in sailing days for commercial fishing fleets from 20-30 days per trip in 1977 to 40-60 days per trip in 2000.
- A shift in species composition towards non-economical by-catch and small crabs per catch unit.

Identification of pelagic and demersal fish from juvenile samples in Benjina, Dobo, Ujung Dolak, Vanams and Agats (Arafura Sea) is shown in the Table 8 below. Crustacean and molusks have also been included in the table. The table is taken from ATSEF Book 1 that was based on Final Report on Studi Lingkungan Wilayah Laut Banda, Aru dan Arafura, PT TSB – Tim Studi IPB – Dirjen Tangkap DKP, 2004 (Environmental Studi of Banda, Aru and Arafura Seas Areas, PT TSB – DG Capture Fisheries DKP, 2004).

Table 8. Identification of juvenil pelagic and demersal fish samples from Arafura sea in the waters of Benjina, Dobo, Ujung Dolak, Vanam and Agats (source: ATSEF Book 1)

No	Indonesian name	English names	Species	Family
Pelagic species				
1.	Tembang	Fringescale sardinela	*Sardinella fimbriata* (Valenciennes, 1847)	Clupeidae
2.	Julung-julung	Buffon's rivergarfish	*Zenarchopterus buffonis* (Valenciennes, 1847)	Hemiramphidae
3.	Julung-julung	Japanese halfbeak	*Hyporhamphus sajori* (Temminck & Sshlegel, 1846)	Hemiramphidae
4.	Cendro	Crocodilian longtom	*Tylosurus crocodilus* (Peron & Lesueur, 1821)	Belonidae
5.	Bilis	Hamilton's thryssa	*Thryssa hamiltonii* (Gray, 1835)	Engraulidae
6.	Teri	Common hairfin anchovy	*Setipinna tenuifilis* (Valenciennes, 1848)	Engraulidae
7.	Bulu Ayam	Longjaw thryssa	*Thryssa setirostris* (Broussonet, 1782)	Engraulididae
8.	Teri	Indian anchovy	*Stolephorus indicus* (van Hasselt, 1823)	Engraulididae
9.	Kepala batu	Hardyhead silverside	*Atherinomorus lacunosus* (Foster, 1801)	Atherinidae
10.	Selar	Longnose trevally	*Carangoides chrysophrys* (Cuvier, 1833)	Carangidae
Demersal fish				
1.	Pepetek	Common ponyfish	*Leiognathus equulus* (Fosskål, 1775)	Leiognathidae
2.	Pepetek kecil	Toothpony	*Gazza minuta* (Bloch, 1797)	Leiognathidae
3.	Gerot-gerot	Bottlenose jewfish	*Johnius australis* (Günther, 1880)	Sciaenidae
4.		Nurseryfish	*Kurtus gulliveri* (Castelnau, 1878)	Kurtidae
5.	Ikan lidah	Three-lined tongue sole	*Cynoglossus abbreviatus* (Gray, 1834)	Cynoglossidae
6.	Pari	Plain maskray	*Dasyatis annotate* (Last, 1987)	Dasyatidae
7.		Threadfin scad	*Rhinopneres pentanemus* (Munro, 1964)	Ephippidae
8.	Sembilang	Hard-palate catfish	*Arius solidus* (Herre, 1935)	Ariidae
9.	Senangin/kurau	Fourfinger threadfin	*Eleutheronema tetradactylum* (Shaw, 1804)	Polynemidae
10.	Jerum	Northern whiting	*Sillago sihama* (Forsskål, 1775)	Sillaginidae
11.	Biji nangka	Sunrise goatfish	*Upeneus sulphureus* (Cuvier, 1829)	Mullidae
12.	Ikan jenggot hitam	Indian goatfish	*Parupeneus indicus* (Shaw, 1903)	Mullidae
13.	Ikan buntal-ekor baji	Filefishes	*Thamnaconus tessellatus* (Günther, 1880)	Monacanthidae
14.	Lencam	Purple-headed emperor	*Lethrinus lentjan* (Lacepède, 1802)	Lethrinidae
15.	Kerong-kerong kecil	Trumpeter	*Pelates quadrilineatus* (Bloch, 1790)	Terapontidae
Crustacean				
1.	Udang jerbung	Banana shrimp	*Penaeus merguensis*	Peneidae
2.	Udang dogol/api-api	Yark shrimp	*Metapenaeus ebarocensis*	Metapeneidae
3.	Udang krosok	Hardback shrimp	*Trachypenaeus fulvus*	Trachypeneidae

No	Indonesian name	English names	Species	Family
4.	Rajungan	Swimming crab	*Portunus pelagicus*	Portunidae
Mollusks				
1.	Cumi-cumi kecil	Squid	*Pterygioteuthis giardi*	
2.	Teripang	Sea cucumber		Holloturidae
3.	Ubur-ubur	Jelly fish		

Information on the abundance of pelagic and demersal fish families in the ATS area is shown in Table 9.

Table 9. Family of demersal fish in the studied area (from Anonymus, 2001, as adapted by ATSEF Book 1)

Family	Arafura sea	NW Australian Shelf	South Gulf of Carpentaria
Carangidae	38	43	21
Lutjanidae	21	17	
Carcharhinidae	19	21	
Leiognathidae	16		12
Nemipteridae	16	20	
Patycephalydae	15		
Serranidae	15	28	
Scorpaenidae	14	24	
Mullidae	14		
Bothidae	13	22	

2.3.2 Fish stock in Timor Sea

The Timor Sea is bordered to the south by nutrient rich northern Australia waters while to the north is bounded by the southern coast of Timor with relatively limited input of fresh water and limited mangrove covers. Information on fish resources in the Timor Sea is not as abundant as that of the Arafura Sea. However, some reports on fish production from local fisheries offices can be used to provide an indication of fish resources in the area. Deep sea fish resources in the northern part of Timor sea has been identified as an area worthy of further research since demersal fish in depths of 200 – 400 m are found in the area of Kei, Aru and Tanimbar islands, the area further northeast from the Timor Sea.

Fisheries resources in the northern part of the Timor Sea, particularly off the coast of the four districts along the southern part of West Timor, are shown in Table 10:

Table 10. Fisheries resources in the northern part of Timor Sea

Common fish name	Local fish name
Eastern Little Tuna	Tongkol
King Mackerel	Tenggiri
Baramundi Bream	Kakap
Indian Mackerel	Kembung
Skipjack	Cakalang
Phony fish	Paperek
Sunrise goatfish	Biji Nangka
snappers	Merah
groupers	Kerapu
yellow tail	Ekor Kuning
shark	Cucut
stingray	Pari

Common fish name	Local fish name
Silver pomfret	Bawal Putih
barracuda	Alu-alu
Mackerel scad	Layang
Jack mackerel	Selar
Jack trevallies	Kuwe
Flying fishes	Ikan Terbang
Porcupine fish	Belanak
Four finger	Kuro
Needle fishes	Julung
anchovies	Teri
fringescale	Tembang
Indonesian oil sardine	Lemuru
Dorab wolf heling	Golok-golok
mackerel	Kembung
mackerel	Tengiri
Tuna	Tuna
skipjack	Cakalang
Sea Cucumber	Teripang
Squid	Cumi-cumi
Octopus	Gurita
	Sotong
crab	Kepiting
	Udang Darah
lobster	Udang barong
	Udang windu
	Udang lain
Seaweed	Rumput Laut

The stock structure of various fish resources in the Timor Sea, including the potentially shared red snapper, shark and tuna stocks, is not available although a number of collaborative research projects have been undertaken by Australian and Indonesian marine scientists (Staples, 2004). The Timor Sea is regarded as having a fish fauna distinct from that of the Arafura Sea but the extent to which Indonesia shares the fish stocks with Australia across the Arafura Sea is not known. Detailed genetic studies of shark species that was supported by tag recaptures of Carcharhinus tilstoni and C. Sorah indicate that there is only one population of each species in the Arafura Sea. Different from the shark stock structure, Salini et al., 2006, found out that substantial evidence from allozymes and mtDNA support the presence of multiple fisheries stocks for two red snapper species (*Lutjanus malabaricus and L. erythropterus*) in northern Australian and central and eastern Indonesian waters. The allozyme data suggests seven discrete populations for *L. malabaricus*: Bali (Bali, Lombok and Sumbawa), Kupang, Ambon, Tual, Aru, Merauke and all Australian samples forming a single stock. However, mtDNA only discriminates two populations with the boundary between the islands of Sumbawa (Sape) and Timor (Kupang). In the case of *L. erythropterus*, a minimum of two fisheries stocks were suggested. The knowledge of stock structure of the red snappers in Australia and Indonesia is important for the sustainable management of fisheries relating to these species.

Surface temperatures in Indonesian seas are in between 28 - 31°C with small annual variations. Annual variations for surface temperature in equatorial region is normally less than 2°C, but it becomes 3 - 4°C, slightly larger for that in the Banda, Arafura and Timor seas. Sea surface temperature in the Arafura – Timor sea during west monsoon (December – February) is in the range of less than 29°C - more than 30°C, being the warmest by the coast of northern Australia.

During transitional period of March – May, sea surface temperature in Arafura – Timor Seas is a little bit cooler and reaches 28°C - more than 29°C. Wilson (2005) reported that temperature in the benthic boundary layer (from seafloor to 30-50 meters above the bottom) during survey period (April – May) varied from 22 - 25°C near the mixed layer above the strong thermocline (depth 70 - 90 meters) to 14 - 16°C in 230 meter depth. In June – August, during east monsoon, the sea surface temperatures are in the range of less than 25 - 27°C and they increase up to 27 - 30°C during September - December, being the warmest by the coast of northern Australia (ATSEF Book 1, 2006).

Salinity in the Arafura – Timor Seas varies with the monsoon. During southeast monsoon, small amount of water mass with high salinity of 35‰ moves from northeast Australia to the Arafura Sea via the shallow and narrow Torres Strait. Vaporization in the Arafura Sea is 780 mm and increases towards the Timor Sea to reach 1.240 mm. Therefore, during dry season salinity in Arafura – Timor Seas increases by 0.5‰ - 1.2‰. During the end of February, however, salinity in the Arafura – Timor Sea decreases due to additional water mass from the Jawa and Flores seas to this area. As a result, during the early southeast monsoon in May, salinity in this area decreases to the minimum. In the Timor Sea where the vaporization reaches 1.240 mm, annual variation of its salinity is very rarely exceeding 0.5‰. Southwesterly flow of ocean current in the Timor Sea throughout the year affects only small variation in salinity (ATSEF Book 1, 2006).

The Arafura Sea and the eastern part of the Banda Sea represent an upwelling area. During the northwest monsoon, water mass with salinity of 33.5‰ – 34.2‰ flow toward this area and fill up the upper part of sea water until 100 m depths. However, during the southeast monsoon, upwelling occurs and brings the cooler and higher salinity water mass from the deeper part to the surface. As reported by Wyrtki (1958), upwelling in Arafura and Banda Seas occurs during east monsoon, May – September, where easterly wind pushes the surface water out from the Banda Sea with larger velocity than the incoming current, and resulted in upwelling that decreases temperature 3°C lower than that during the west monsoon, and higher salinity of 1‰. Indication of an upwelling is represented by a lower surface temperature, an icrease in salinity and phosphat content, and a decrease in oxygen content during the east monsoon. More thorough understanding of regional oceanography in the studied area is obtained from several sources, such as from the three year oceanographic observation of "INSTANT" programme as well as from previous studies in the area.

Summary of Indonesian Through Flow derived from "INSTANT" Programme is shown in Figure 7.

2.4 Oceanography and climate regulation

INSTANT: International Nusantara Stratification & Transport Program
Indonesia-USA-Australia-France-Netherlands (2003-2007)

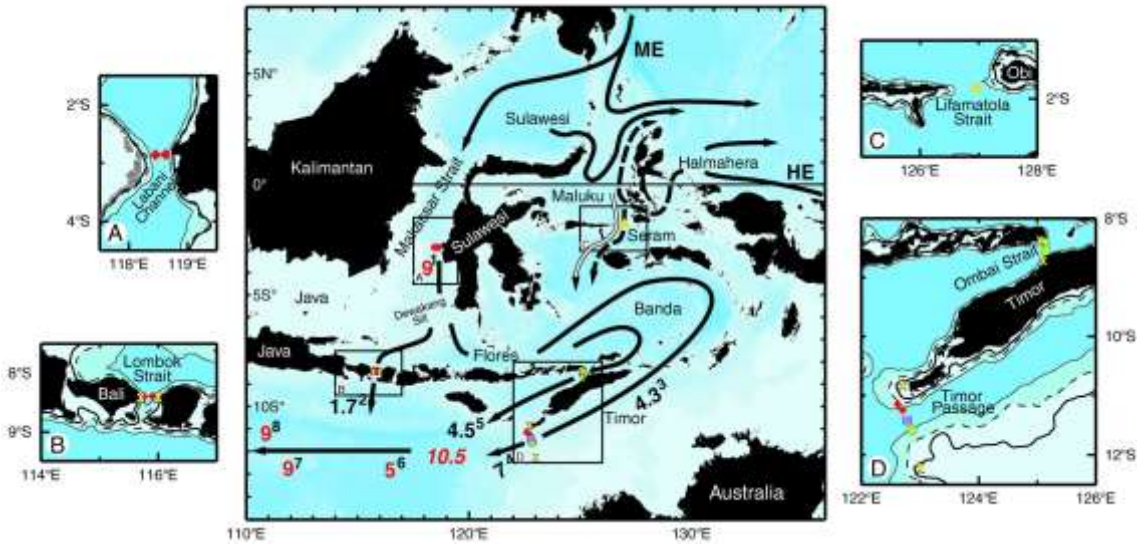

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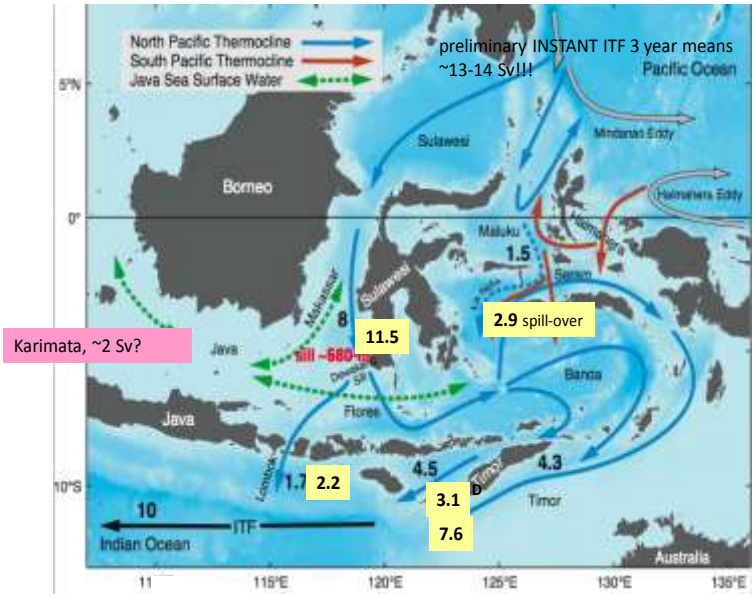
Figure 7. Summary of Indonesian Through Flow. Arrows indicate ocean current through Indonesian straits. Numbers are current in Sverdrups.

Gordon et al, ocean science, 2008



14.4 12.9

Uncertainty: due to experiment design, instrument behavior and real variability in ITF at > sampling interval

Figure 8. Updated current value of Indonesian Through Flow.(Gordon *et al*., 2008)

Figure 8 summarizes the current knowledge about the Indonesian Through Flow that represents the flow of Pacific water to the Indian Ocean through Indonesian seas. The knowledge was derived from a three year international research cooperation among five countries that includes USA, Australia, the Netherland, France and Indonesia. Thick arrows represent North Pacific Thermocline Water, while dashed arrows indicate South Pacific Lower Water. Water transport are in Sverdrup unit, (Sv = 10^6 m^3 s^{-1}), printed in red. 10.5 Sv in italics is the total flow through Sunda Arc. Superscripts are referring to the following reference sources; 1. Makassar Strait Transport (Gordon *et al*., 1999); 2. Lombok strait from January 1985 to January 1986 (Murray and Arief, 1988; Murray *et al*., 1989); 3. Timor strait (between Timor and Australia) measured from March 1992 to April 1993 (Molcard *et al*., 1996); 4. Timor strait October 1987 to March 1988 (Creewell *et al*., 1993); 5. Ombai strait (north of Timor, in between Timor and Alor island) from December 1995 to December 1996 (Molcard *et al*., 2001; 6. In between Jawa and Australia by using XBT data from 1983 to 1989 (Meyers *et al*., 1995; Meyers, 1996); 7. Above 470 m SEC east of Indian Ocean in October 1987 (Quadfasel *et al*., 1996); 8. Average ARLINDO in SEC as established by WOCE WHP (Gordon *et al*., 1987). White arrows represent the flow of water mass from Pacific to the Banda sea via Lifamatola strait with about 1 Sv. Transport (van Aken, 1988).

In summary, the main flow of water mass from Pacific to Indian Ocean is transported through Makassar Strait into the Flores Sea and Banda Sea where it turns toward Timor Sea and Ombai Strait. A minor component of the main flow goes through Lombok strait to the Indian Ocean. The transport volume indicates that Timor Sea represents the main route of Pacific water that flow to the Indian Ocean. During west monsoon, water transport into the Banda Sea exceeds those that outflow from the Banda Sea into Maluku, Seram and Arafura seas. Therefore, downwelling occurs in Banda Sea during west monsoon, and upwelling occurs during east monsoon resulting from excessive outflow from Banda Sea into Flores Sea and Timor Sea. The upwelling brings water mass from depths of 125 m -300 m to the surface.

In general, Indonesian seas are the seas that transfer warm and low salinity Pacific water to the Indian Ocean. Indonesian through flow is important in terms of thermohaline circulation and global climate phenomenon (Sprintall *et al*., 2001; Gordon, 2001). Heat and fresh water that were brought by the Indonesian Through Flow (ITF) affect the ballance between the two basin (Bryden and Imawaki, 2001; Wajsowicz and Schneider, 2001). Observations and model in internal Indonesian seas indicate that the main source of ITF is North Pacific Thermocline water flowing through Makassar Strait. Additional contribution of ITF comes from Lower Thermocline Water and deep water mass from the south Pacific that flow via east of Maluku and Halmahera seas, with heavier water go through Lifamatola strait. ITF is flowing out to the eastern Indian Ocean through the main route along the Sunda arc.

It is known since Wyrtki (1961) that water mass from the surface to 500 m depths that flow to the Indonesian seas comes from Mindanao Current. This suggestion was supported by Fine (1985), Godfrey (1993) and Gordon (1995). Further analysis of water mass in Makassar Strait shows that the water mass is coming from the North Pacific Subtropical Water above Thermocline Smax and North Pacific Intermediate Water below thermocline Smin (Ilahude and Gordon, 1996). Hautala *et al*., 1996, suggested that the main source of water mass that transported to the Indian Ocean comes from north Pacific agreeable with his observation on the impact of precipitation to salinity until 200 m depth. His study on the mass, heat and salinity budget in the area in between 10° N to 14° S suggested that the water mass flowing as ITF comes from south Pacific.

Monsoon wind affect precipitation in Arafura and Timor Seas as the south of equator has more precipitation during west monsoon, and has less precipitation during east monsoon. Data

show that precipitation in the Arafura and Timor seas is equal to or a little less than the evaporation in the area. Tropical cyclones were observed in the eastern Indian Ocean south of the equator such as in Timor Sea and Arafura Sea. Tropical cyclones occur in average of 2.6 cyclone per year since 1964 in the area between 5° S – 16.5° S and 121° E - 132° E (ATSEF Book 1, 2006).

A high-resolution (~1–2 kyr) multiproxy record from the Timor Sea in the latitude 13°04.95′S, longitude 121°47.27′E and 1783 m water depth indicate that the Timor Sea productivity fluctuations over the last 460 kyr were strongly influenced by monsoonal wind patterns offshore NW Australia (23 and 19 kyr) and were also modulated by sea level–related variations in the intensity of the Indonesian Throughflow (100 kyr) (Holbourn *et al*., 2005).

Climate change and sea level changes are closely related. Geological data indicate that global sea level has been fluctuating since hundreds of million years ago (e.g, Miller *et al*., 2005; Haq and Schutter, 2008). Geologists at the US Geological Survey observed the glaciers in the Glacier National Park, Montana, have been retreating rapidly since the early 1900's. The shrinkage of mountain glaciers is worldwide and is thought to be caused by a combination of a temperature increase from the "Little Ice Age", which ended in the latter half of the 19th century, and increased greenhouse gas emissions (USGS FS 002-00). Indeed, over the past 425,000 years the earth has gone through four cycles of ice ages. Analysis by IPCC (Intergovernmental Panel on Climate Change) concluded among others that:

- Since the Last Glacial Maximum about 20,000 years ago, sea level has risen by over 120 m at locations far from present and former ice sheets, as a result of loss of mass from these ice sheets. There was a rapid rise between 15,000 and 6,000 years ago at an average rate of 10 mm/yr.
- Based on geological data, global average sea level may have risen at an average rate of about 0.5 mm/yr over the last 6,000 years and at an average rate of 0.1 to 0.2 mm/yr over the last 3,000 years.
- During the last 6,000 years, global average sea level variations on time-scales of a few hundred years and longer are likely to have been less than 0.3 to 0.5 m.
- Based on tide gauge data, the rate of global average sea level rise during the 20th century is in the range 1.0 to 2.0 mm/yr, with a central value of 1.5 mm/yr (as with other ranges of uncertainty, it is not implied that the central value is the best estimate).
- No significant acceleration in the rate of sea level rise during the 20th century has been detected.

Spatial and temporal analysis of sea level changes over the past 100 to 200 years is generally based on the tide gauge data set of the Permanen Service for Mean Sea Level (PSMSL) of Spencer and Woodworth, 1993 (IPCC Third Assessment Report "Climate Change 2001"). The tide gauge measurement is the measurement of the level of sea surface relative to that of the land upon which the gauge is located. Tide gauge data contain information on both the displacement of the land and on changes in ocean volume (eustatic changes). Various studies cited in the report show that an average regional rise of sea level in Europe, north America, Asia (China) and Australia range between 1.0 mm/yr and 2.0 mm/yr during the 20th century after applying models and corrections for vertical land movement and effect of spatial variation in thermal expansion. Therefore, the IPCC report concluded that on the basis of published literature, the lowest average of sea level rise is 1 mm/yr during the 20th century and a limit of 2 mm/yr is adopted as the upper bound that includes all recent global estimates with some allowance for systematic uncertainty.

CSIRO (2008) reported about 200 mm increase in global mean sea level during 1870 – 2007 based on tide gauge data and satellite altimeter.

A more detailed observation of sea level changes during the twentieth century was done through nine long and nearly continuous sea level records that were chosen from around the world to explore rates of change in sea level for 1904–2003 (Holgate, 2007). These records show that the high variability in the rates of sea level change observed over the past 20 years were not particularly unusual. The rate of sea level change was found to be larger in the early part of last century (2.03 ± 0.35 mm/yr 1904–1953), in comparison with the latter part (1.45 ± 0.34 mm/yr 1954–2003). The highest decadal rate of rise occurred in the decade centred on 1980 (5.31 mm/yr) with the lowest rate of rise occurring in the decade centred on 1964 (−1.49 mm/yr). Over the entire century the mean rate of change was 1.74 ± 0.16 mm/yr.

Study on mean sea level (MSL) rise in the Western Indonesia (Hadikusumah, 1995) shows that mean sea level at Western Indonesia rise at much higher rate in the range of 3.10 to 9.27 mm per year. This figure is higher than the average global mean sea level changes, although the rate of sea level rise was not uniform. IOC Annual Report (2006) observed that from 1993 to 2006 the rate of sea level rise is approaching 20 mm/yr, or ten times global average, were detected in the western Pacific Ocean and the eastern Indian Ocean, and lower values in the eastern Pacific Ocean and western Indian Ocean. Sea level rise in negative values, or sea level fell, was also observed in some regions during this time. Variability of sea level rise is considered natural.

3. Gaps in existing baseline information on the Arafura – Timor Seas ecosystem

Data in the previous discussion indicate that marine environment in the ATS region is in serious decline, primarily as a result of over-harvesting and other direct and indirect impact of anthropogenic stresses and global climatic changes. These factors that affect the marine environment to some extend have caused dramatic changes or shift in species composition in the Arafura –Timor Seas. The shift, which is known as phase or regime shift, is often long lasting and difficult to reverse. Recent studies on the resilience of marine ecosystems (e.g. Hughes *et al*., 2005) highlight the emergence of a complex system approach for sustaining and repairing marine ecosystems linking ecological resilience to governance structures, economics and society. The approach is known as SES, social-ecological systems, that is linkages between the environment and people. The SES requires an improved understanding of the dynamic and complex processes that support or undermine resilience, the socio economic drivers to the process and the governance systems that shape the use of living marine resources. The important aspects that should be addressed to ensure the sustainable use and conservation of living marine resources are:

1. The temporal and spatial scale of ecosystem dynamics and management;
2. The importance of biodiversity in the functioning and resilience of marine ecosystems.

Existing baseline information on the ATS ecosystem only includes utilization of fisheries resources, specifically on industrial and commercial species such as fish and shrimp, but data on non-economic species, their environment and their utilization are limited**.** The dynamic nature of marine biota and the marine environment requires **the existing baseline information** on biodiversity and ecosystems as well as resource utilization in the ATS area **be monitored and**

updated regularly. Therefore, several gaps in existing baseline information should be addressed. The gaps include those that are related to biodiversity information, particularly on the monitoring and inventory of the specific endemic species, gaps in management and utilization of biological resources, including that of artisanal fisheries, between central and local governments, gaps in oceanography and climate change information, and gaps in information on human use and its impact on biodiversity, fisheries and oceanography and climate change.

3.1 Gaps in biodiversity information

Information on biodiversity, particularly on the specific endemic species, and their life cycling is important in terms of setting up an appropriate management system of the biological resources including conservation effort and sustainable utilization of the resources. Specific endemic species for on land biological resources in adjacent islands of the ATS region have been identified since the 19th century through scientific reports of the pioners (e.g. Wallace (1823-1913), Lydekker (1849 -1915), etc.). Information on the endemic species for marine biota in the ATS region is limited eventhough the region is located adjacent to the Coral Triangle that is well-known for its richness in biodiversity.

3.2 Gaps in fisheries information

Management and development of fisheries resources in the ATS region requires that fishing activities be regulated to ensure that the quality, diversity and availability of fisheries resources is maintained in sufficient quantities for present and future generations, and that the integrity of the broader marine ecosystem and environment is sustained. Management of fisheries resources should be based on the best scientific evidence available and should apply an ecosystem-based approach. Implementation of the ecosystem-based approach requires that fisheries information be available, particularly the information on:

- fish stocks and effects of fishing on species associated with or depended on target species;
- endangered species and their critical habitats;
- the risk of changes in the marine ecosystem which are not potentially reversible over two or three decades;
- critical fisheries habitats (e.g. reefs, mangroves, seagrasses) that threaten the health and viability of the fisheries resources;
- non-target and bycatch species and other biodiversity in the marine environment;

Parts of the above fisheries information are available in non-continuous time series and statistic of capture fisheries. However, the data and information on capture fisheries should be carefully evaluated since IUU fishing heavily occurs in the area that hinders unbias evaluation of fisheries data. Studies on IUU fishing that were conducted by BRKP and FAO as reported by Nikijuluw (2007) found out that every year 1.258 million tons of fish were lost due to IUU fishing in the Arafura Sea. The lost was estimated as due to discarded by-catch, unreported catch and illegal capture. Gaps in fisheries information may also occur due to incomplete and unreliable information on artisanal fisheries.

3.3 Gaps in oceanography and climate change information

Information on oceanography and the impact of climate change in the ATS region is limited eventhough research on regional oceanography of the area has been completed through the INSTANT programme. Information on the global climate change that may cause changes in ocean characteristic such as sea level rise and changes climate regularity is limited in terms of regional scale and not available in detail for the ATS region. Detailed oceanographic observation in the area

of the eastern Banda Sea is needed to support fisheries management. Furthermore, ocean characteristics such as upwelling and down welling cycle, spawning ground characteristic and ocean dynamic related to biological resources dynamic are important characteristics of the ocean that may support the sustainable fisheries management.

3.4 Gaps in information on human use and impacts on biodiversity, fisheries and oceanography and climate change

Discussion on the gaps in information on human use and impacts on biodiversity and fisheries with the current use of fisheries resources in the studied area was based on fisheries statistics for the last several years. The data reflect a decline in total annual catch in terms of weight and size. However, this information is not equally shared by all players in fisheries for a number of reasons that includes:

- The management of fisheries areas within the studied area is conducted by several districts in two provinces and central government;
- IUU fishing practices in the area may have caused further stock depletion in the already "depleting stock area";
- Data and statistics have to be updated and improved in terms of quality and accuracy;
- Large volume of non-targeted species, known as by-catch, is wasted and is not recorded.

This gap of information may have been part of the problems in management practices of fisheries resources, beside other management problems. Furthermore, most fisheries stock assessment and management policy have been focused more towards stock population and distribution. Actually, fisheries management has to ensure that fishing and other anthropogenic effect do not undermine the productivity of stocks, and has to incorporate requirements for protection of essential fish habitat (EFH) in fishery management plans (FMPs) (Caddy, 2007). EFH is defined as: "Those waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity, where "fish" are considered to include "finfish", molluscs, crustaceans and all other forms of marine animal and plant other than marine mammals and birds". Applying the concept of Social-ecological Systems in the ATSEA, the proposed ATSEA project should consider addressing the following issues:

- Identifying the type of habitat that includes physical, chemical, biological and oceanography components and species characteristics within the habitat;
- Identifying the condition of marine environment and EFH in the studied area;
- Assessing the full range of human activities affecting the coastal and marine resources and their environment;
- Identifying viable conservation measures to enhance the quality of the EFH.

4. Recommendation on measures to address information gaps

In general, the following are recommended measures to address information gaps:

- Improve policy and regulation on fisheries management;
- Improve fisheries data management and reduce or minimize IUU fishing in the ATS area;
- Conduct research and scientific monitoring on ecosystems dynamic;

- Conduct research and inventory of endemic marine species and protected species and their habitat;
- Conduct research, observation and monitoring on the oceanography and climate characteristics in the ATS area;
- Conduct regular assessment on anthropogenic factors affecting the coastal and marine resources and the quality of their environment;
- Develop public awareness and public participation in marine resource management;
- Develop model development based on partnership;
- Conduct capacity and capability building for personnel involved in management of marine and coastal resources in the central and local government offices;
- Develop cooperation and joint programme amongst domestic and regional institutions and stake holders to improve baseline data;
- Identify and develop financial support system to support the above actions.

5. Main transboundary threats to biodiversity and fisheries resources in the Arafura – Timor Seas region.

The main transboundary threats in the ATS region are broadly caused by the following factors:

- Unsustainable fishing practices;
- Alteration, degradation and destruction of coastal and marine habitats;
- Marine pollution;
- Hunting of marine mammals and turtles;
- Climate change.

These factors were analyzed through Transboundary Diagnostic Approach during various stake-holder meetings and discussions. In this approach, the main transboundary elements were considered as transboundary issues/concerns that arised from fundamental problems and their causes. The main transboundary issues were selected through various stakeholder discussions, and these issues were grouped into three main issues of transboundary problems, namely, Unsustainable exploitation of marine resources, Coastal and marine habitat destruction, Environmental change and impacts on coastal and marine ecosystems. Further analysis on the relation of the transboundary problems and their causes is shown in Table 11.

Table 11. Preliminary TDA and causal chain analysis for ATSEA region

Issues/Concern	Fundamental Problem	Primary causes	Secondary causes	Tertiary causes	Root causes
Unsustainable exploitation of marine resources	Overexploitation of living resources	Overfishing of target species Large amounts of wasted non-targeted species	Destructive fishing practices IUU fishing Commercial fishing and bycatch	Weaknesses in conducting MCS Lack of management strategy and tools	Market demand Lack of alternative source of income Changes in fishing technology Changes to ecosystem balance/dynamics Lack of information on the extent and nature of unsustainable exploitation of marine resources
Coastal and marine habitat destruction	Overexploitation of coastal and marine resources	Destructive fishing methods Pollution	Weaknesses in resource management Large amount of wasted by-catch	Lack of knowledge and training for fishermen/women Lack of alternative technologies Destructive catchment activities Traditional practices	Excesive sedimentation Lack of Community awareness and economic needs Lack of spatial planning in coastal areas
Environmental change and impacts on coastal and marine ecosystems	Climate change	Climatic change including sea level changes, cyclone patterns and ocean		Connection on marine system dynamics	Limited application of research and knowledge in oceanography and fisheries

Issues/Concern	Fundamental Problem	Primary causes	Secondary causes	Tertiary causes	Root causes
		acidification Pollution from land-based and marine-based activities			Limited knowledge of the physical/biogeochemical systems of the ATS region

5.1 Unsustainable fishing practices, including IUU fishing

Discussion in 2.2 reflects that the four categories of fish stock in the two management areas, WPP-RI 573 and WPP-RI 718, are fully exploited. Furthermore, demersal fish and shrimp in Arafura Sea have been over exploited. This study on fisheries in both fisheries management areas was based on available data on fisheries production in the area. Other important data on by-catch and IUU however, was not available. By-catch is non-targeted fish during shrimp trawling, generally consists of variety of demersal fish that were wasted and were discarded back to the sea. Observations prior to 1991 indicate that the volume of by-catch was estimated to reach a factor of 8 to 13 times volume of the targeted fish (usually shrimp) and was estimated to reach 40.000 – 170.000 ton annualy (Widodo, 1991). Naamin and Sumiono (1983) even have given a bigger picture of by-catch in Arafura Sea that produced 80% of the catch.

Impact of shrimp trawling in the Arafura Sea to the ratio of fish catch (considers as by-catch) to shrimp catch is increasing with the increase of the number of shrimp trawl vessels in the area. This ratio varies with location and also tends to vary from year to year. Wijopriono et al., 2007, reported that onboard observation during shrimp trawling in May 2007 indicates by catch was dominated by small demersal fish, such as squids, octopus and swiming crabs, and increasing trend for gulamah, halibut and swangi. Furthermore, Wijopriono *et al*. also reported that the average size of demersal fish caught in year 2000 was relatively smaller than that of the year 1997, within the same area. Sumiomo *et al*., 1998, and Sumiomo *et al*., 2001 reflected that the average size of demersal fish *Nemipterus peronii*, locally known as ”ikan kurisi”, in east of Aru was 14.75 cm TL (total length) in year 2000 while it has been 15.50 CM TL during observation in 1997. A similar observation was also reported for *Saurida micropectoralis*, locally known as “ikan beloso”, and *Leiognatus splendens* and *L. Equulus*, or known as “ikan peperek”.

Another problem that a fishery management has to face is illegal, unreported and unregulated fishing practices, widely known as IUU practices, conducted by fishing vessels.

It is indeed difficult to estimate the magnitude of economic lost due to IUU fishing. However, Nikijuluw (2007) noted that Greenpeace in 2006 estimated global IUU has caused world countries lost of 3.4 to 7.6 billion Euro annually. A different figure is extrapolated by Marine Resource Assessment Group in London from the world catch fisheries and come up with US $ 9.2 million. Furthermore, FAO estimated that fish landing from IUU is three times larger than that of legal landing. Economic lost from IUU in Indonesia is also enormous as has been approximated from several sources. Handoko (2004) as quoted by Nikijuluw estimated economic lost due to IUU in Indonesia in the range of US $ 1.9 billion, and Dahuri (2002) approximated economic lost of US $ 1.362 annualy from arround one million ton illegal fish. Actual lost due to IUU may be larger than estimated as radar surveillance in Arafura indicated that economic lost, based on numbers of fishing vessels and their total tonnage, may reach up to $ 1.0 billion within two months (Indroyono Soesilo, 2007). IUU in Arafura Sea involves fishing vessels coming from countries to the north and northwest of Indonesia. BRKP (Badan Riset Kelautan dan Perikanan) in cooperation with FAO has conducted study on IUU in the Arafura Sea (2007 -2008). The study found that every year 1.258 million tons of fish were lost due to IUU. This amount consists of 239.7 thousand ton discarded by-catch, 364.4 thousand ton unreported catch and 654.6 thousand ton illegal capture. These figures are a little smaller than that of 1996-2000 with a total of 1.553 million tons of IUU fish catch.

5.2 Alteration, degradation and destruction of coastal and marine habitats

Data and information on this subject are very limited. Pressure on the coastal and marine environment appears to come from a large volume of wasted by-catch that may be washed to the near shore area and pollute the coastal area. In addition, damage to marine environment and fish habitat also has been caused by IUU. Fishing methods involving bombing, poisoning, utilizing electricity and other illegal methods have caused damages to the marine environment and fish habitat. Destructions in coral reefs due to illegal fishing, bombing and poisoning have given an alarming magnitude. Indonesia attempts to curb the coral reef destruction through COREMAP programme (Coral Reef Rehabilitation and Management Programme). The phase I COREMAP programme began in 1998 that included 5 provinces in the western and eastern Indonesia. Unfortunately, the ATS region was not included except for Kupang bay in Timor Island.

5.3 Potential marine pollution

Data and information on marine pollution in the ATS region are very limited. Reports on the condition of marine environment in the region consider potential sources of marine pollution in the ATS may include marine debris, marine based pollution from oil and gas activities, as well as waste from fishing vessels. These activities affect water and sediment quality, habitats and marine biodiversity in the Arafura Sea, especially in the area between Aru and Papua.

5.3.1 Marine Debris

A report on marine debris (Kiessling, 2003) defines marine debris as any manufactured or processed solid waste material (typically inert) that enters the environment from any source. It is estimated that around seven billion tonnes of debris are estimated to enter our oceans, and such debris is now classified as one of the world's five major marine pollutants. Furthermore, UNEP/IOC Technical Working Group Workshop (2008), defines marine litter as any persistent, manufactured or processed solid material discarded, disposed of or abandoned in the marine and coastal environment. Marine litter consists of items that have been made or used by people and deliberately discarded into the sea or rivers or on beaches; brought indirectly to the sea with rivers, sewage, storm water or winds; or accidentally lost, including material lost at sea in bad weather. Marine litter originates from many sources and causes a wide spectrum of environmental, economic, safety, health and cultural impacts. The very slow rate of degradation of most marine litter items, mainly plastics, together with the continuously growing quantity of the litter and debris disposed, is leading to a gradual increase in marine litter found at sea and on the shores.

Marine debris affects water quality and can cause physical damage to sensitive ecosystems. Coral reefs, seagrass beds and their bottom-dwelling species are very susceptible to the impacts of marine debris. Marine debris can also be lethal for marine wildlife. At least 267 different species are known to have suffered from entanglement or ingestion of marine debris including seabirds, turtles, seals, sea lions, whales and fish. Many species accidentally ingest trash, mistaking it for food. Abandoned fishing nets and gear, discarded fishing line and other forms of debris can entangle marine wildlife – including sea turtles, manatees, sea birds and fish – maiming or even killing them (UNEP, 2008). Plastic and synthetic materials are the most common types of marine debris found on beaches in northern Australia and in sediments (Kessling, 2003). Since plastic degrades slowly in the ocean, it is likely that the quantity of plastics reaching the marine environment is increasing with time.

UNEP/IOC technical workshop (2008) estimated that around 80% of marine debris is from land-based sources and the remaining 20% is from ocean based sources. The sources can be

categorized into four major groups that include tourism related litter at the coast, sewage-related debris, fishing related debris such as fishing lines and nets, fishing pots and strapping bands, wastes from ships and boats (garbage). High quantities of marine debris may be found on the shoreline close to urban areas.

Marine debris from ocean-based sources includes the debris from accidental loss, indiscriminate littering or illegal disposal, and the result of waste disposal practices in the past. The potential sources of marine debris are commercial fishing, recreational boaters, research vessels, offshore oil and gas platforms and exploration. Coastal surveys at Cape Arnhem in the Northern Territory, Australia, revealed that the greatest proportion of identified items (including fishing nets) washing ashore as being of South-east Asia manufactured, with most originating from Indonesia, Taiwan and China (Kiessling, 2003). Derelict fishing nets of South-east Asia manufactured that were found in the Cape Arnhem were also recorded as the greatest proportion. Derelict fishing nets are causing some harm to marine animals, especially turtles.

5.3.2 Offshore oil and gas

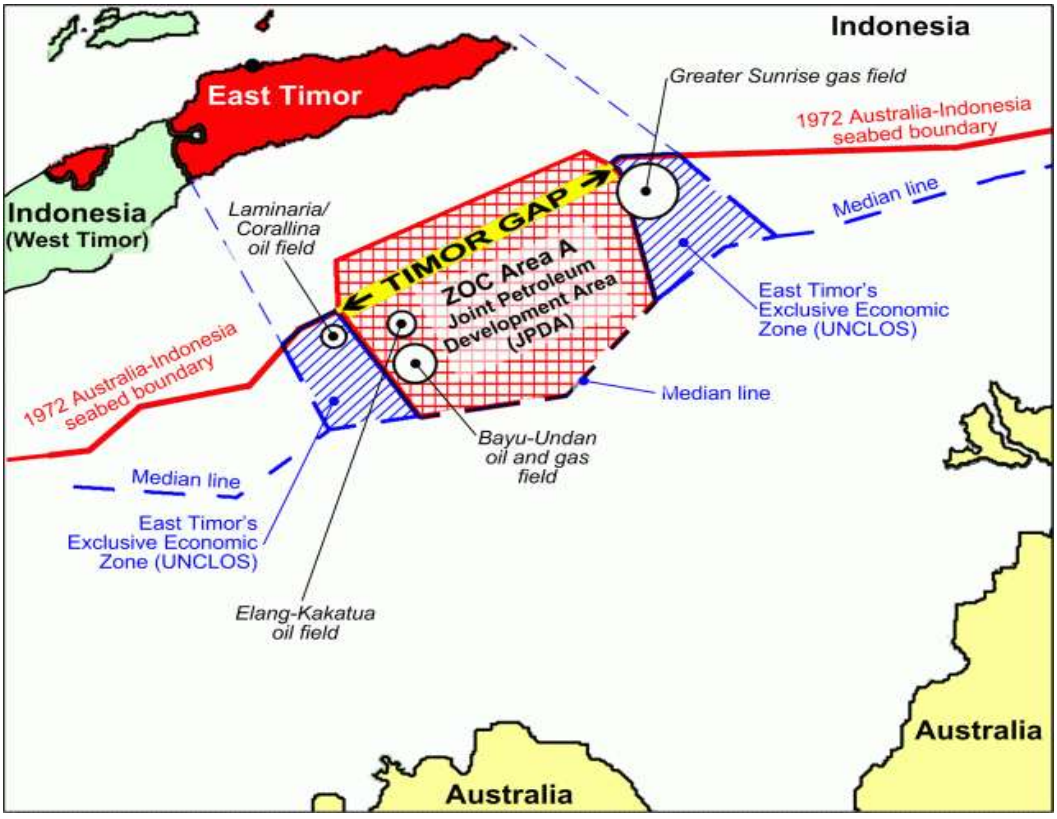


Figure 9. Oil and gas exploration in Timor Gap, the marine area between Timor Leste and Australia. (Source: The La'o Hamutuk Bull. V.4, no. 3-4, August 2003)

Oil and gas exploration in Timor Sea is not limited to Timor Gap area only but also includes the area of Timor Sea in general (Figure 9). Marine exploration activities for oil and gas in Timor Sea are still in progress as indicated by the following information:

- The Oliver oilfield, that is located 700 kilometres west of Darwin and 30 kilometres north of the Jabiru production licences, will be developed by Stuart Petroleum Limited, as announced in August 2008, and is targeting maiden production from Oliver by the end of

2011. The drilling of an appraisal well on the Oliver oilfield is estimated to cost $ 85 million.

- The oil field that was discovered in 1988 contains a 170-metre column of oil, gas and condensate from 2,927 metres depth. Recent review of newly acquired 3D seismic over the Oliver acreage has resulted in estimated recoverable liquids in the range of 9.9 million barrels to 33 million barrels of oil and condensate, with a mean volume of 19.3 million barrels. (OilVoice, Wednesday, August 20, 2008).
- A 3-D seismic survey over two Timor Sea permits AC/P37 and WA-341-P off Australia is expected to be completed by mid-December 2008. The survey which began on early November will see the acquisition of 1,195 square kilometres (461 sq miles) of new seismic data in water depths ranging from 20 metres to 220 metres (66 ft to 722 ft). (Offshore Oil & Gas News 12 Oct. 2008).

Considering the large amount of estimated oil reserves (Table 12), the occurence of oil spill might be potential due to exploration and exploitation works in the area.

Table 12. Oil and Gas Fields in the Timor Sea between East Timor and Australia (source: The La'o Hamutuk Bull. V.4, no. 3-4, August 2003)

Field(s)	Location	Estimated reserves (millions of BOE)
Evans Shoal Petrel-Tern Blacktip	Australia's side of the median line	1540
Elang-Kakatua Bayu-Undan Chudditch Kuda Tasi Jahal	JPDA (East Timor's side of the median line), excluding the IUA	1110 (including 30 already extracted)
Greater Sunrise	IUA, East Timor's side of the median line, 20.1% in the JPDA	1920
Laminaria-Corallina Buffalo	East Timor's side of the median line, outside the IUA and west of the JPDA	270 (including 220 already extracted)
Total		**4840**

5.3.3 Marine Transportation

In accordance with the United Nations Convention on the Law of The Sea (UNCLOS) 1982, Indonesia has established archipelagic sea lanes (Figure 10) as follows:

I Sunda Strait - Java Sea - Karimata Strait - Natuna Sea - South China Sea

II Lombok Strait - Makassar Strait - Sulawesi Sea

IIIa Sawu Sea - Ombai Strait - Banda Sea - (West of Buru Island) - Ceram Sea - (East of Mangoli Island) - Maluku Sea - Pacific Ocean

IIIb Timor Sea - Leti Strait - Banda Sea - (West of Buru Island) - Ceram Sea - (East of Mangoli Island) - Maluku Sea - Pacific Ocean

IIIc Arafura Sea - Banda Sea - (West of Buru Island) - Ceram Sea - (East of Mangoli Island) - Maluku Sea - Pacific Ocean

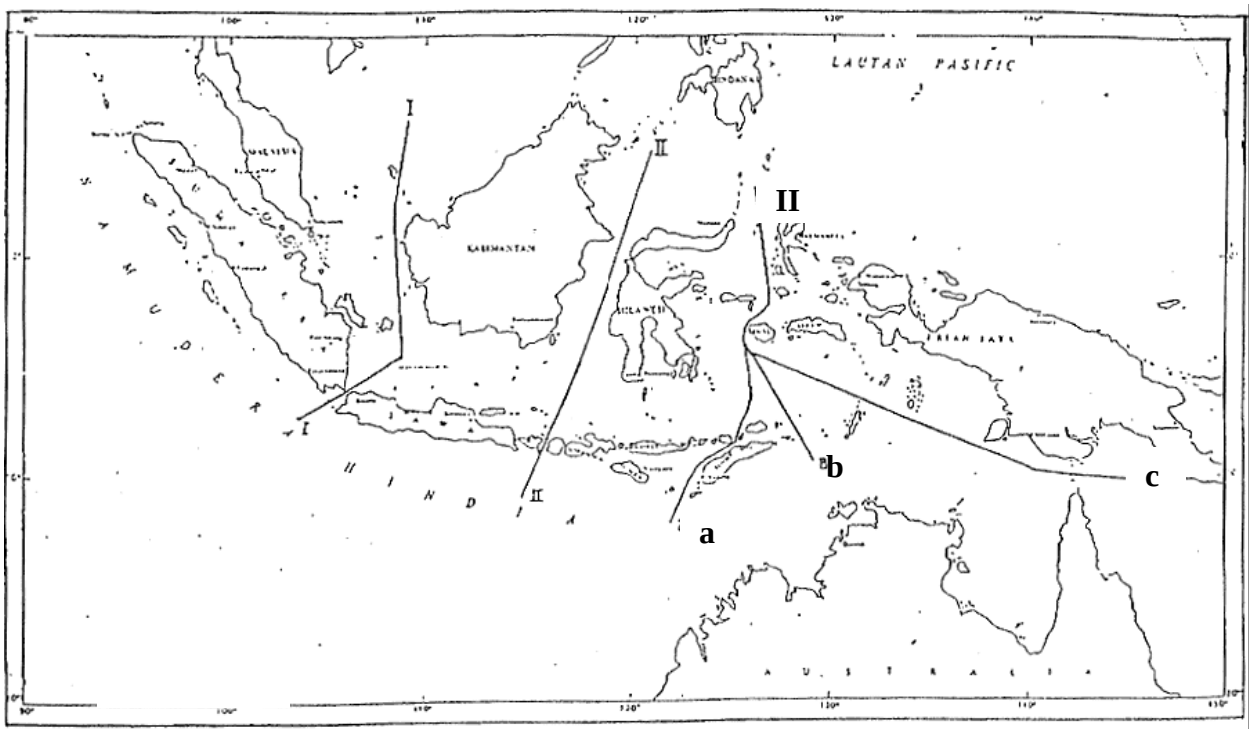


Figure 10. Archipelagic sea lanes of Indonesia.

The sea lanes IIIa, IIIb and IIIc are the archipelagic sea lanes in the ATS region for international ships passing by the eastern Indonesian seas. Potential pollution of oil from ships and fishing vessels has to be considered to occur along these sea lanes.

5.4 Threats to transboundary marine mammals and turtles

Marine mammals and turtles lifespan is long, within the range of 70 years or more. However, reports indicate that the population of transboundary marine mammals and turtles in the ATS region are declining. Their habitat for grazing and nesting in numerous beaches have been disturbed, and they were captured at sea incidentally by fish trawl or were hunted for economic or culture reasons. Turtle's eggs are collected and marketed. Furthermore, marine mammals and turtles are threatened naturally by storms, parasites and their natural predators. Marine mammals in the ATS region include Sirenians and Cetaceans. Despite being legally protected in many countries, the main causes of dugong population decline remain anthropogenic that include hunting, habitat degradation, and fishing-related fatalities.

5.5 Climate change

Climate change impact on biodiversity and fisheries resources in the ATS region is one of the natural long term impacts. Mitigation of the impact of climate change has been broadly discussed in terms of sea level changes and specifically in terms of sea level rise. Analyses of sea level changes by The Intergovernmental Panel on Climate Change (IPCC) indicate that eustatic sea level has risen at approximately 2 mm per year for at least the last century and probably at a much smaller rate for the previous several millennia. In contrast, for the next century various authors expect that global sea level will rise at a much faster rate than at present because of global warming. IPCC report gives for the ``business-as-usual" scenario of global warming an additional

sea level change of 18 cm by 2030 and 35 cm by 2050 which may reach 44 cm increase of sea level by 2070.

Estimated impact of sea level rise are inundation of low-lying areas, erosion of beaches and bluffs, salt intrusion into surface waters and aquifers, higher water tables in coastal areas, and increased flooding. The impact of sea level rise to biodiversity and fisheries resources will occur mostly in fish habitat in the coastal area. However, the impact depends on the characteristic of the coastal area. Flat coastal plain will be impacted more than the steep slope coasts. Therefore, observation of sea level changes in the ATS area has to be conducted and inventory of coastal and marine habitat should be done.

6. Recommendations on measures to address each identified transboundary threat and impact

Table 11 in section 5 shows a preliminary TDA and causal chain analysis for the ATSEA region. Three issues that include Unsustainable exploitation of marine resources, Coastal and marine habitat destruction and Environmental change and impacts on coastal and marine ecosystems were analyzed and their causes were listed. This section attempts to resolve the issues and suggests actions directed towards achieving environmental quality objectives. The first step in this attempt is to define environmental quality objectives that relate to the problems. Table 13 indicates the relation of issues and environmental quality objectives. Furthermore, potential solutions to the problems were discussed with the stake-holders in the central and local levels. The result of discussions that include possible strategic actions, activities and interventions are summarized in Table 14.

Table 13. Summary of issues and their environmental quality objectives

Issues/Concern	Environmental Quality Objective
Unsustainable exploitation of marine resources	Sustainable use of marine living resources
Coastal and marine habitat destruction	Sustainable use of marine and coastal resources
Environmental change and impacts on coastal and marine ecosystems	Managed impacts on environmental change

Table 14. Environmental Quality Objectives, Strategic Action Programs and Activities

Environmental Quality Objectives	Strategic Action Program	Activities	Interventions/Actions	Type of Intervention
Sustainable use of marine living resources	Improvement of marine resources quality and ecosystems	Establish improved system of marine resources management	Strengthening regional and international cooperation in fisheries market	Policy
			Improve quality of fish to market standard	Capabilty building and policy
			Limit fishing permit	Policy
			Improve regulation on fishing zone of 6 mil and 12 mil	Policy
			Establish regulation to reduce by-catch thru regulation on fishing gears	Policy and regulation
			Conduct research on oceanographic characteristic such as upwelling	Research
			Conduct research on stock and habitat characteristics	Research and monitoring
			Conduct study to prepare establishment of regulated fishing area	Research and policy
			Develop conservation network	Model development
			Conduct ecological assessment or rapid ecological assessment	Research
			National and regional cooperation in MCS	Capacity building and regulatory
		Enhancement of MCS capability	Enhancement of local MCS	Capacity and capability building
			Improve MCS capability in the local fisheries offices	Capacity building
			Establish regularity in conducting MCS	Capacity building and policy
			Institutional capacity building, including training and infrastructure	Capacity building
			Enhance and develop system and management tool related to new Fisheries Management Areas	Capacity building and regulatory
		Enhancement of fisheries management based on	Enhance and improve statistic and data management capacity and capability	Capacity building, regulatory and data management
			To establish sustainable quota and limit in the	Policy and research

Environmental Quality Objectives	Strategic Action Program	Activities	Interventions/Actions	Type of Intervention
		newly adopted Fisheries Management areas	fishing permit	
			Conduct study and research on deep sea fisheries/fish resources	Research
			Establish conservation area and fish refugia	Regulatory and research
			Establish marine boundary Timor – Timor Leste	Regulatory
			Strengthening local capability to conduct MCS	Capacity building and equipment
Sustainable use of marine and coastal resources	Reduced stress on marine and coastal environment	Enhancement of MCS	Conduct public awareness campaign on sustainable use of marine resources (including for children)	Public awareness
		Enhancement of local fisheries management	Strengthening human resources capability	Capacity building
			Develop protection area and fish refugia	Policy and regulation
			Explore alternative livelihood and development of potential marine and coastal resources to reduce stress to environment	Research and capacity building
			Improve local MCS and follow up actions	Capacity building
			Establish circle hook to reduce turtle by-catch	Regulation
			Inventory of endemic biota	Research
			Social marketing on conservation area	Public awareness
			Improve knowledge and technology capability of local fishers	Capacity building
			Establish government, private sector and community partnership to demonstrate sustainable use of marine resources	Model development
			Conduct regular monitoring in potential polluted areas	Scientific monitoring
			Conduct regular monitoring of rate of sedimentation in river-mouth areas	Scientific monitoring
	Reduce pollution and excessive sedimentation	Improve knowledge on pollution sources	Establish regulation on gear selectivity	Policy and regulation
		Improve coastal planning and coastal development capability	Conduct regular monitoring and local assessment of pollution indicators	Scientific monitoring
		Improvement of regulation	Conduct study on sea level changes and its	Research

Environmental Quality Objectives	Strategic Action Program	Activities	Interventions/Actions	Type of Intervention
		and technology to reduce by-catch	impact in the area	
		Improve knowledge on oceanographic characteristic of the area	Establish regulation and guideline for spatial planning in coastal areas	Policy and regulation
Managed impacts on environmental change	Develop capacity, capability and strategy to mitigate natural environmental changes and their impact	Establish mitigation strategy	Conduct study and research on geodynamic and oceanographic system (physical and biogeochemical) in the ATS	Research
			Conduct monitoring on physical and biogeochemical changes	Research and monitoring
			Adapting ecoregional plan	Research

7. Recommendation on potential demonstration sites based on their global significance

Environmental Quality Objectives, Strategic Action Programs and Activities in Table 14 are generic actions related to improving environmental quality in the ATS region. The proposed environmental quality objectives for the ATS region include sustainable use of marine living resources, sustainable use of marine and coastal resources and managed impacts on environmental change. Considering the five ATSEF foci and the above environmental quality objectives, the following model activities are recommended;

Activity 1:

- To conduct joint cooperative research focusing on oceanography, biodiversity and ecosystem, and marine resources of the Arafura and Timor Seas.

Objective:

- To provide data on marine resources and marine condition in the ATS region to support ecologically sustainable use of the living coastal and marine resources, including fisheries and biodiversity, of the ATS region.

- To support the selection of marine area in the ATS region intended to be used as a model of managed area.

Activity 2:

- To select potential sites and establish a marine manage area in the ATS region focusing on endemic species of economic importance e.g. fish, shrimp and sea cucumber.

Objective:

- To strengthen management capability of local dinases thru cooperation in conducting MCS, data management and improvement of fisheries management.

Activity 3:

- To conduct assessment on the impact of various fisheries policies implementation within the last decade to the condition of fisheries resources in the ATS region.

Objective:

- To obtain knowledge on the current condition of the marine living resources and their environment in the ATS region as impacted by various policies and other external factors in fisheries management.

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Appendix 1. The specific involvement and list of stakeholders involved in biodiversity, fisheries and oceanography in the ATS region

Stakeholders	Involvement
National Governments	Consultation, implementation, steering committees, international conventions, policy, legislation, investment, capacity building, public-private sector partnership, institutional reform
Local governments	Consultation, implementation, coastal management, capacity building, investment, public-private sector partnership, national steering committees
Non-government organizations	Consultation, implementation, public awareness, management advisory committee membership, training, participation in TDA/SAP processes
Scientific community	Consultation, research, information technology, risk assessment, monitoring, training
Private sector; including fishermen, fishing companies, oil and gas sector	Consultation, technology and financial investment, public-private partnerships, steering committee and management advisory committee membership, participation in TDA/SAP processes, post-SAP implementation phase
Community-based organizations	Consultation, monitoring, training, community mobilization, habitat protection
Environmental advocacy groups	Workshop, training, seminars, public awareness

Appendix 2. List of stake-holders involved:

- Ministry of Marine Affairs and Fisheries
- Environment Unit, UNDP Indonesia
- The Agency for Marine and Fisheries Research (AMFR)
- D.G. Capture Fisheries (Ditjen Perikanan Tangkap) - DKP
- D.G. Control and Surveillance of Marine Resources (P2SDKP) - DKP
- D.G. Marine, Coastal and Small Island (KP3K) - DKP
- P2O LIPI
- Arafura Timor Sea Expert Forum (ATSEF) Regional
- ATSEF Indonesia
- Regional Technical Advisor, Land Degradation & International Waters, UNDP Regional Bangkok
- ATSEF Timor Leste
- ATSEF Australia
- National Committee on Fisheries Stock Assessment (Komnas KAJISKAN)
- Dinas Perikanan Kelautan Kabupaten Maluku Tenggara
- Dinas Perikanan Kelautan Provinsi Nusa Tenggara
- Dinas Perikanan Kelautan Kabupaten Belu, Provinsi Nusa Tenggara Timur
- Dinas Kelautan Perikanan Kabupaten Merauke, Papua
- Sustainable Fisheries Partnership, NGO
- IPB – Bogor Agriculture Institute
- WWF – World Wide Fund for Nature
- CI – Conservation International
- TNC – The Nature Conservancy
- Private sector
- CTI – Coral Triangle Initiative
- PEMSEA/SDS-SEA - Partnerships for the Environmental Management of the Seas of East Asia
- SDS/SEA - Sustainable Development Strategy for the Seas of East Asia

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REPORT ON TRANSBOUNDARY BIODIVERSITY, FISHERIES AND OCEANOGRAPHY ISSUES IN TIMOR LESTE FOR THE ARAFURA TIMOR SEAS ECOSYSTEM ACTION PROGRAM (ATSEA)

By: Duto Nugroho

Executive Summary

Timor Leste has a coast line of 706 km, a total land area of 16,000 sq km and with marine economical jurisdictions area of approximately 75,000 km^2. Forty-two percent of villages have a coastal border. The country has unique terrestrial, lake and marine ecosystems, including the deep Timor trough rich with oil and gas reserves. Timor Leste has extreme global significance in terms of conservation of marine biodiversity and endangered marine species, such as whales, whale sharks, turtles, dugong, and dolphins. However, these ecosystems and resources are poorly understood due to very limited baseline information. In addition, the country is prone to increasing threats from domestic pollution sources and poor catchment management practices resulting in floods, landslides and erosion. Inadequate land management practices and increasing deforestation may affect the inshore and coastal marine living resources. Unsustainable artisanal and subsistence fishing and IUU fishing coupled with rapid population increases potentially put more pressure on coastal resources. Some observations suggest that coral reefs are damaged, and that some pelagic and demersal marine species are being overfished and are frequently subjected to destructive fishing practices.

The fisheries sector was almost completely destroyed in 1999 and took some years to recover. Major constraints still exist such as lack of storage facilities, poor infrastructure and high fuel costs, gear limitations including limited capacity on fisheries.

The extent of East Timor's fishery resources and total volume and value of catch from coastal and offshore areas is unknown. In 1997, fisheries contributed approximately US$ 481,000 - less than 1% of the total revenue. Recent household surveys estimated that coastal communities contributed around 80% of the total catch. About 5,000 tons of fish were landed including an estimated 1,000 tons by illegal, unregulated and unreported fishing vessels operated in the EEZ water. The approximate value of landing is around US$ 5.7 million.

The main threats facing Timor Leste related to transboundary waters are degradation of coastal and marine habitat, unsustainable fishing practices, land-sea based sources of marine pollution and socio-technical adaptability on the impacts of climate change. Recommendations to address these threats through the ATSEA program include sustainable fisheries management plans and impact assessments on environmental degradation. Some potential activities on the implementation program in the area should be related to specific places with dense populations such as Dili, Atauro Island, Lautem district and Jaco island in the north and east coasts and selected sites in the south coast.

Timor Leste, although a small country by international standards, has the potential of marine biodiversity (managed under a sustainable development plan through ATSEA and related programs)

to provide high grade protein to the Timor Leste population, provide employment and significant income earning opportunities and foreign exchange from many beneficiary aspects related to sustainable marine resource management.

1. Introduction

Australia, Indonesia, Timor-Leste and Papua New Guinea share the tropical and semi-enclosed waters of Arafura and Timor Seas (ATS). The ATS region is extremely rich in living and non-living marine resources, including fisheries and oil and gas reserves. The ATS region is located at the intersection of the Large Marine Ecosystem (LME), the Indonesian Seas to the north, and Northern Australian waters to the south, and is also an integral part of the Coral Triangle zone considered to have the highest marine biodiversity in the world. Geographically, Arafura Sea is a shallow shelf with water depths less than 200 m and the main bottom substrate is mud and sand, whilst Timor Sea, close to Timor Island, consists of deep-water-drop-off and the Australian shelf consists of a sand and mud bottom with patchy coral reefs spread about the area. The coastal zone of Timor Leste remains remarkably locally utilized with coastal habitat varying from region to region and characterized by lagoons, fringing coral reefs, sea grass beds and steep cliffs accompanied by adjacent deep-water-drop-offs, mangroves, beaches, and shallow bays (MAFF, 2004).

The region exhibits high productivity that sustains both small and large-scale fisheries that provide livelihoods for millions of people in the region. Countries of the Arafura and Timor Seas do not exist in isolation nor are they able to retain the impacts of their activities within their national boundaries. Countries bordering the Arafura and Timor Seas have exploited their aquatic coastal resources far beyond their capacities and without immediate intervention the marine biodiversity, nursery areas for fisheries and mangroves as buffer zones will be lost.

1.1 Report Objectives

The aim of the report is to provide descriptions of Biodiversity, Fisheries and Oceanography characteristics of Timor Leste waters in the Arafura and Timor Seas region regarding the transboundary impacts and issues based on existing information, and stakeholder consultations. The intention of this report is to provide a Timor Leste perspective on transboundary biodiversity, fisheries and oceanography issues in the Arafura and Timor Seas region and to contribute towards the Arafura Timor Sea Ecosystem Action Program (ATSEA) Project Preparation activities with an emphasis on:

- Providing background materials for the Project Brief and Project Document, illustrating the environmental context for the GEF project and;
- Providing a forum for consensus-building on the environmental issues of highest priority in the ATSEA region.

The General geographical coverage, and countries involved in the Project is shown in Figure 1.

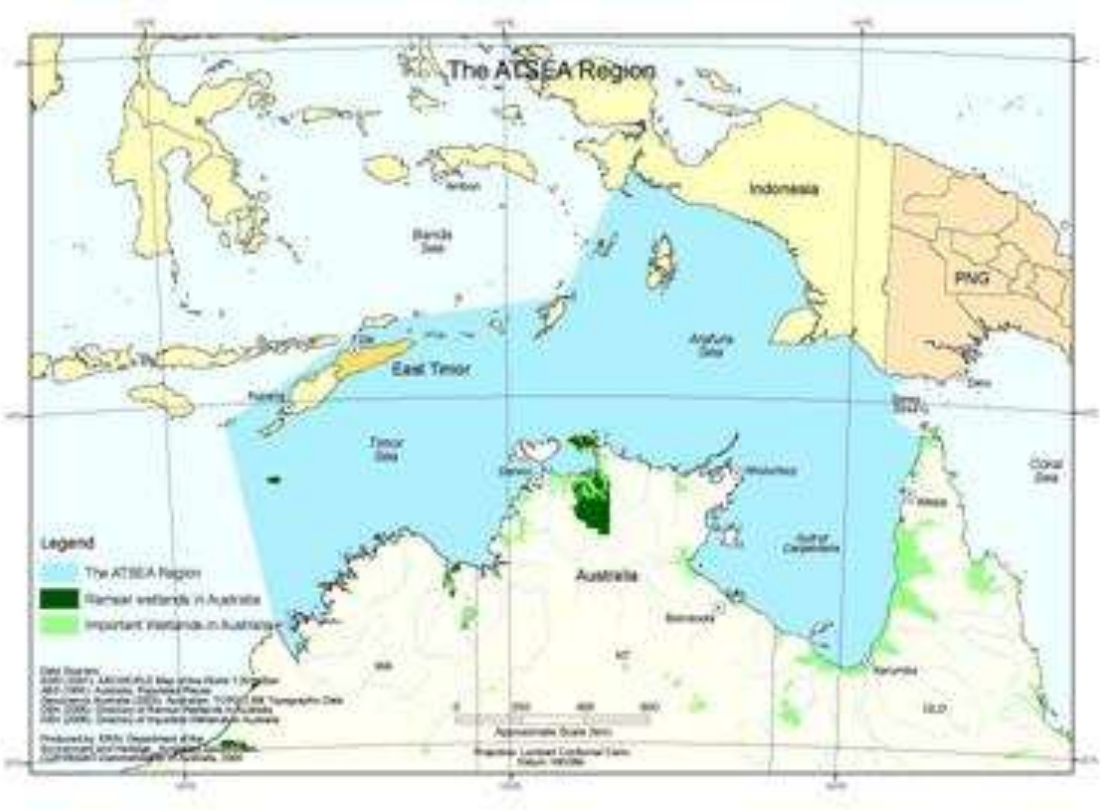

Figure 1. Arafura and Timor Seas as the area of study of ATSEA. Source: Wagey (2008)

The report provides:

- A description of the regional biodiversity, fisheries and oceanography characteristics including those of global significance.
- The identification of gaps in existing baseline knowledge of the Arafura and Timor Sea ecosystem.
- Recommendations on measures to address these information gaps.
- An outline of the main transboundary threats and impacts on biodiversity and fisheries resources in the region.
- Recommendations on demonstration projects.

It is anticipated that this report will provide a baseline from which to develop a full Transboundary Diagnostic Analysis for Timor Leste and the ATS region during the ATSEA Full Scale Project.

2. Methodology

The methods for this review included a review of relevant documents, both published and unpublished literature, government and non-government documents, stakeholder discussions and interviews including mini stakeholder consultation workshops. On the basis of existing knowledge about the Timor Sea, a summary environmental and aquatic resources profile has been prepared. This covered the most significant aspects of the semi-enclosed sea environment, marine biodiversity, fisheries and oceanography aspects.

We were able to access some reports from numerous activities related to past and ongoing capacity assessments and development programs undertaken by governmental institutions and local NGOs in the country with financial support from international agencies. Moreover, stakeholder consultations held in Dili in February 2009 also identified relevant documents related to the country's initiatives and activities regarding climate change adaptation programs, and public awareness raising activities such as conducting national dialog. We also collected existing legal regulatory documents related to natural resources and environment such as national legislation, policies, regulations, plans, programs and projects.

Several gaps and challenges emerged during the transboundary identification elements of this project. This categorization identified and delimits homogeneous areas, which are hierarchically related, as a tool for analyzing the principal processes and their associated environmental restrictions and conflicts. The information provided by the various work elements makes it possible to scale and locate geographically the problems and symptoms that were identified during the regional workshops, stakeholders meetings and consultations. A list of stakeholders consulted is provided in Appendix 2.

2.1 Outline of the Report

The first section, introduces the ATS region, geographical features, general marine productivity, human development index and distribution of GDP, marine jurisdiction and population estimates.

The second section, explains the methodological approach and procedures of report preparation within the time available.

The third section explores the description of general marine ecological characteristics which look at marine biodiversity (including coral reefs, mangroves and mammals), Fisheries and Oceanography as a type of marine ecosystem including the marine life of the Timor Sea.

The fourth section notes the gaps in existing baseline information for the Timor Sea ecosystems and gaps on general aspects in biodiversity, fisheries and oceanography information including the human use and impacts on those related aspects for Timor Leste.

The fifth section describes recommendations on measures to address information gaps.

The sixth section discuss the main transboundary threats and impacts on biodiversity and fishery resources in the region which consist of climate change, unsustainable fishing practices (including IUU fishing, alteration, degradation and destruction of coastal and marine habitat), land-sea based marine pollution, land-use practices, catchment-management, mining, other industry and urbanization/coastal development, including a brief description of offshore oil, gas and shipping.

Finally, the seventh and eighth sections build on the recommendations to address each identified transboundary threat and impact with recommendations on potential demonstration sites based on their global significance.

2.2 Timor Leste Background and Context

Timor-Leste, as the new emerging nation in the world, occupies an estimated total area of 16,000 km^2, with a coast line around 706 km length and marine economical jurisdictions area of approximately 75,000 km^2. The Government has established control of a fishing zone five times larger than the national land area of the country. It consists of the eastern half of the Timor Island, 265 km in length and 92 km of maximum width. It also includes the enclave of Oecussi (also known as Ambeno) on the north coast, 70 km to the west and is surrounded by Indonesian West Timor. Also part of East Timor is Atauro Island which is 144 km^2, located just 23 km north of the capital Díli and the tiny islet of Jaco with 8 km^2, located on the eastern most tip of East Timor (UNESCAP, 2003 *in* Wong and Chou, 2004). The geographical location and district administration of Timor Leste are shown in Figure 2.

Figure 2a. Regional location of Timor Leste.

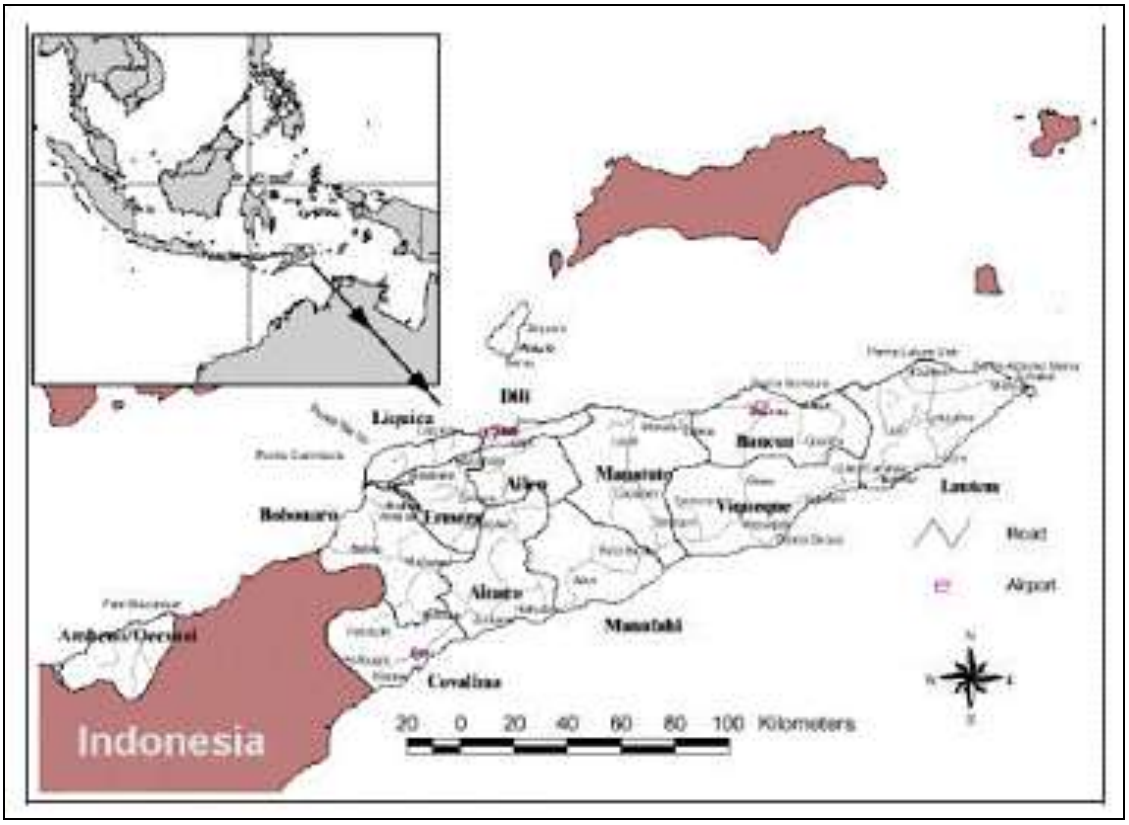

Figure 2b. District administration of Timor Leste. Source: (Sandlund *et al*., 2001 *in* Wever, 2008)

Timor-Leste is the world's youngest nation; it is also one of the less develop nations in South-East Asia. The population is estimated to be around 1 million based on the 2004 census (MAF-RDTL, 2007). Seventy-five percent of Timor-Leste's population lives in rural areas, where poverty is most prevalent, which depend on natural resources to meet their basic needs. Eighty percent of employment is natural resource related, and 98 percent of households use wood as their primary fuel (USAID-RDTL, 2004a).

The country's economy is typically characterized by significant informal activity, in part due to small domestic markets but also due to the lack of institutional capacity to effectively regulate the various economic sectors. According to the National Human Development Report (2002), the national Human Development Index (HDI) of Timor Leste was estimated at 0.395 for 1999. In 2001 the situation is slightly improved to 0.421. The country also has the highest rate of human poverty of all the Asian countries with 20% of the population living on less than US$ 1 a day. The population below the national poverty line is 41% and the GDP per capita estimate in 2001 was US$ 478 (RDTL-UN country team, 2004).

The latest information on the Human Development Index for Timor-Leste was rated at 0.483, which gives the country a rank of 158th out of 179 countries (UNDP, 2008). CIA world fact book (2009) describes briefly the distribution of GDP by sectors in 2005: agriculture (including Fishery and Forestry): 32.2%, industry: 12.8% and services, which consist of public administration and defense, civil construction, trades, transport, finance and manufacturing: 55%. The high contribution from Agriculture, Fishery and Forestry means economies are typically characterized by significant informal activity, in part, due to small domestic markets but also due to lack of institutional capacity to effectively regulate the various economic sectors.

As an independent country, the Government established control of a fishing zone five times larger than national land area. The maritime jurisdiction of Timor Leste in Timor Sea remains complex due to its past association as a province of Indonesia. There were relevant bilateral and international arrangements made during Indonesian occupation from 1972 until post independence in 2004. These include the 1972 Australia/Indonesia Seabed Agreement; 1981 ***Provisional Fisheries*** Surveillance and Enforcement Line (***Australia*** and Indonesia ***agreement***) (PFSEL); 1997 Perth Treaty; 1999 UNTAET administration; 2000 Negotiations on new boundary arrangements in Timor Sea; 2002 conclusion of Timor Sea Treaty (negotiated by UN in conjunction with ET officials) (**http://law.anu.edu.au/UnitUploads/LAWS8253-1826-Topic 20G-09 Maritime Boundaries 202.ppt**). The estimated boundary line of the EEZ shown in Figure 3 clearly shows the current maritime boundaries between the three countries, with the shaded area designating the Joint Petroleum Development Area defined by the Timor Sea Treaty between Australia and Timor Leste.

Several Timor Sea offshore oil drilling operations indicate that there are rich petroleum resources and most of the current explorations in oil and gas fields lie approximately 200 km offshore from which the revenues are shared between Timor-Leste and Australia. The exploration is operated by a consortium of oil companies and the petroleum is exported to Australian onshore facilities for further processing and storage (RDTL, 2006 *in* Wever, 2008). There has been a major change in Timor-Leste's macroeconomic situation. Petroleum royalties and tax windfall to the Government from the Bayu Undan field in Timor Sea are much larger and started earlier than expected. Revenues increased from $ 41 million in FY2004 to $ 243 million in FY2005, as compared with a budget of $ 79 million for FY2005. The Government's sound fiscal position is now secured. At the end of March 2005, net foreign assets reached $ 284 million, more than 15 months of projected imports for 2005. The Petroleum Law, unanimously passed by Parliament, commits the Government to save most of its petroleum revenues in a Norwegian-style petroleum fund designed to yield a sustainable income in perpetuity. Thus, the GDP receives little short- and medium-term commensurate boost from these revenues. (UNDP-RDTL, 2005)

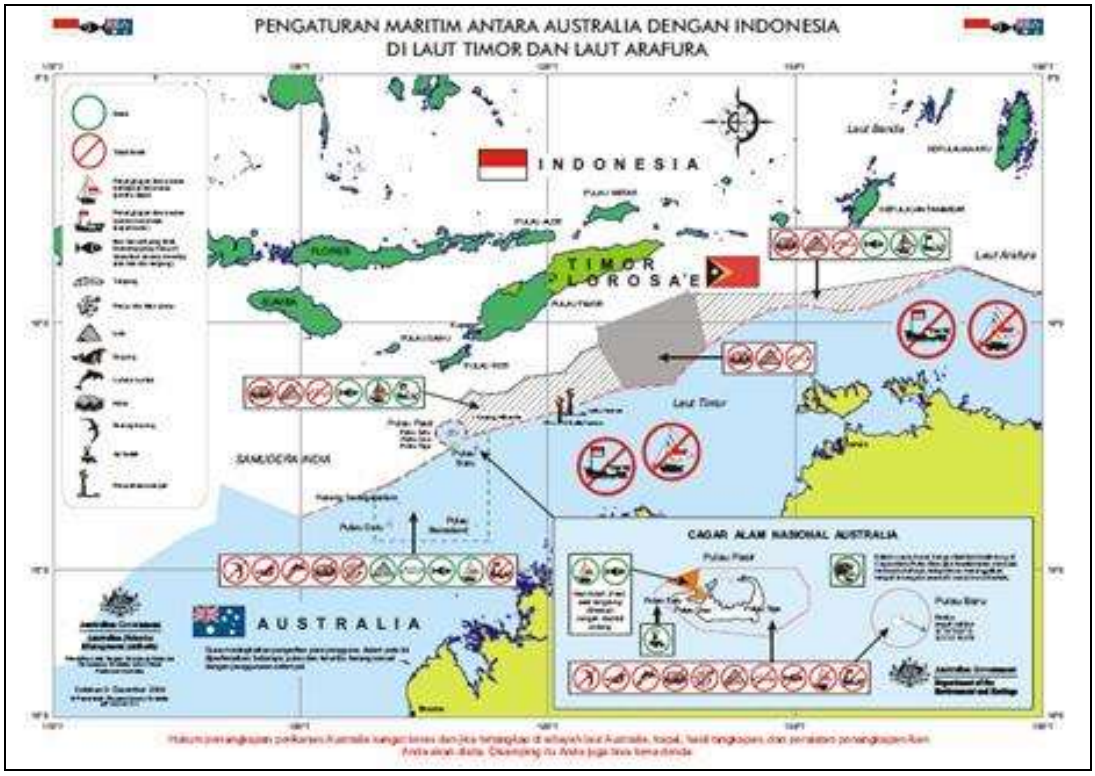

Figure: 3. International maritime boundaries in the Timor and Arafura seas. Source: AFMA (2004)

Marine habitat degradation, caused by destructive fishing practices and pollutants is increasing and could have serious implications for certain species in the near future. Impacts are currently at a relatively small scale and confined mostly to urban areas. The most pressing current urban problems include untreated sewage and solid waste disposal and unregulated coastal development and land occupation. In rural areas, current problems in coastal communities relate to their high dependence on natural resources and their vulnerability to food shortages. Many of the rural communities along the coast are impoverished and isolated. They are poorly connected to urban centers and thus have very limited access to markets, so that they depend on subsistence farming and fishing. Unsustainable agricultural practices not only result in low agricultural productivity but also cause soil degradation, deforestation, and downstream sedimentation. While many rural households rely on external food supplies, the bountiful fishery resources are far from being harvested to their potential level, mainly due to limited equipment and know-how for commercial-scale deep sea fishing. The human impacts can be expected to grow significantly with population growth and an increase in economic activities. Industrial development, tourism, and urbanization can exacerbate the pollution of coastal waters from untreated domestic and industrial waste. The need to increase agricultural productivity in order to improve food security and feed a growing nation will require additional land conversion and an increase in fertilizer use. An expansion of port operations and the construction of a new international port would necessitate land reclamation and cause pollution of the sea from increased shipping. Destruction of habitat by unregulated coastal development can cause loss of valuable coastal ecosystems that have important ecological functions such as protecting the shoreline from erosion and serving as nurseries for fishes and as habitat for the country's rich biodiversity. Increasing demand for natural resources from a growing population could also stimulate overexploitation of fisheries and accelerate soil degradation and deforestation. Another set of potential threats arise from climate change. Timor-Leste has been classified as extremely vulnerable to climate change impacts such as increased climate variability and increased frequency of climate-related natural hazards such as flooding and droughts (Wever, 2008).

According to the UN Transitional Administration in East Timor, 15 areas shall be designated as protected areas as listed on Section 2 of Regulation No. 2000/19. Most of the protected areas relate to the present regulation "protected wild areas" which applies to areas of land constituting islands, beaches, mountains, sanctuaries, reserves and any other areas. Coral reefs and Mangrove areas were the major habitats considered for protection. Among them the surrounding reefs at Jaco Island, Tutuala beach and Cristo Rei beach belong to Marine Protected Areas (UNTAET 2000). There are community managed areas in Arturo Island and Jaco Island within the Nino Konis Santana National Park at the far eastern part of Timor.

3. Description of Timor Sea Biodiversity, Fisheries and Oceanography Issues Including Their Global Significance

3.1 Marine Biodiversity

Biodiversity or biological diversity is defined by the United Nations Convention on Biological Diversity as: "The variability among living organisms from all sources, including, inter-alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part: this includes diversity within species, between species and of ecosystems." (Secretariat of the Convention on Biological Diversity, 2005).

The waters of Timor Leste contain rich marine biodiversity as part of the Indo-Malayan-Australia biogeographical region. The country's natural habitat ranges from lowland forest catchment area to mangroves, coral-reefs, offshore and deep sea ecosystems. It has a combination of Australian and Asian flora and fauna with an outstanding number of globally significant wildlife. Located within the Coral-Triangle (WWF-Coral Triangle, 2007), it belongs to a region containing the most diverse marine life and is home to most known coral species, more than 3000 species of reef fish, turtle species, whale sharks, manta rays, a diversity of marine mammals and threatened endangered species such dugong (WWF-Coral Triangle, 2007).

Geographically, the country has a coastline of 706 km (CIA 2007 *in* Wever 2008). To its north lies the Banda Sea and to its south the Timor Sea. The distance to Australia is roughly 500 km (Sandlund *et al*., 2001 *in* Wever, 2008). Most of the country consists of relatively steep terrain. The landscape is dominated by the central Ramelau mountain range that has several peaks over 2000 m. Around 44% of the country has a slope of 40% or greater (UNDP and RDTL 2006 *in* Wever, 2008). Productive soil cover is thin and is often washed away in flash floods that are characteristic for the monsoonal climate of the country. Geologically, Timor-Leste is not part of the Australian continental plate. In contrast to most Indonesian islands it is not of volcanic origin. The country is rich in mineral deposits, mainly mineral oil on land and in the Timor Sea. The climate is hot and humid and varies greatly within the country. Hard torrential rains frequently cause flash floods that increase the risk of soil erosion and landslides (Sandlund *et al*., 2001 *in* Wever, 2008). The northern coast is rocky and steep along most of the shoreline. Arid woodlands are the dominant vegetation type along most of the coast, except east of Lautem where there is dense forest cover. Some areas such as around Dili are characterized by denuded hills with only grass and bushes. There are only very narrow or no coastal plains, except in some regions such as around Manatuto and Dili. Numerous white sandy beaches with interspersed rocky outcrops are scattered along the coast. The waters off the northern coast are deeper, calmer, and more transparent than those off the south coast. Sitting on the edge of a marine trench that runs 3 km deep through the Wetar Strait, the nearshore littoral zone is very narrow, and the sea floor sharply drops off to the deep sea (RDTL and CDU, 2006 *in* Wever, 2008). The southern coast is shallower and has relatively wide coastal plains that are extensively cultivated or covered by plantations. River deltas, lagoons, floodplains and swamps are characteristic for this part of the coast (RDTL and CDU, 2006 *in* Wever, 2008). There are long stretches of sandy beach with heavy waves and surf. The continental shelf along the south coast is wide and gently sloping. Nearshore waters are more turbid (Sandlund *et al*., 2001 *in* Wever, 2008).

Ecosystem functions, mangroves and coastal vegetation protect the coastline from erosion, and the coral reefs from sedimentation. Productivity in mangroves and coral reefs is extremely high; these areas are the primary breeding grounds for many fish and shellfish species. The marine and coastal areas of Timor Leste have maintained their environmental quality for the most part. However, recent trend towards the use of destructive fishing techniques (bombing coral reefs, and cyanide fishing) (Ximenes, 2009 pers.com) could have significant negative impacts on biodiversity and endangered species if it continues. Corals are also harvested as a building material.

According to Sandlund *et al*. (2001) *in* Wever (2008), the following biotopes can be found in the coastal zone of Timor-Leste:

- Oceanic and sub-tidal marine environment: includes pelagic water columns, deep-sea bottoms, shallower rocky bottoms, sandy-muddy bottoms, seagrass beds and coral reefs.
- Intertidal zone: includes rocky intertidal shelves, sandy-muddy tidal flats and mangrove forests.

- Shorelines: include sandy beaches, dunes, rocky outcrops, limestone cliffs, river estuaries, and brackish lagoons.
- Near-shore zone: includes coastal dry lands, natural forests and wetlands.

Mangroves, seagrass beds, and corals reefs are mainly found along the north coast. Total mangrove cover is relatively small and is confined mainly to the region between Tibar and Manatuto (Stockwell, 2002 *in* Wever, 2008). The north and south coast also differ greatly with respect to climate. According to a classification of land types based on agroclimatic zones, the coastal zone includes coastal land and valley floors up to an elevation of 100m above sea level. The north coast is characterized by monomodal rainfall patterns (i.e. only one wet season of 4-5 months per year) and an average annual rainfall of below 1000 mm. This zone represents 7.16% of total land area. The southern coast, on the contrary, is exposed to two wet seasons (Nov-Apr, May-Jul) and around 1500 mm of rain annually. This zone stretches over roughly 400.000 ha which make up 10.51% of the country.

There are over 100 rivers that discharge into the coastal zone. All rivers originate in the central mountain range and are relatively short and fast-flowing. Out of the 29 main river systems, 12 are in the north and 17 in the southern part of the country. Very few of them flow throughout the year (Australian Water Research Facility, 2006). The largest catchment is the Loes River followed by Laclo River (Arafura and Timor Seas Experts Forum, 2006).

Coastal ecosystems including coral reefs, mangrove forests, seagrass meadows, and salt marshes are being lost at alarming rates, and increased scientific understanding of causes has failed to stem these losses. Increased human population and associated pressures on the environment are leading to worldwide decline of key ecosystems, eroding biological diversity and ecosystem functions (Balmford and Bond, 2005 *in* Duarte *et al*., 2008). This proportion is growing as a result of population growth and migration to these regions. These increasing anthropogenic pressures have led to a sustained global loss of coral reefs, mangrove forests, salt marshes, and seagrass meadows over the past several decades. The mechanisms of these losses are multiple, including land reclamation, coastal development, excess sediment, nutrient and organic inputs, overfishing, mechanical damage by boats and fishing gear, logging, and impacts from invasive species and intensive aquaculture and susceptibility to climate change (Duarte *et al*., 2008).

3.1.1 Coral reefs

Coral reefs are the most biologically diverse of shallow water marine ecosystems but are being degraded worldwide by human activities and climate warming. Analyses of the geographic ranges of 3,235 species of reef fish, corals, snails, and lobsters revealed that between 7.2% and 53.6% of each taxon have highly restricted ranges, rendering them vulnerable to extinction. Restricted-range species are clustered into centers of endemism, like those described for terrestrial taxa. The 10 richest centers of endemism cover 15.8% of the world's coral reefs (0.012% of the oceans) but include between 44.8 and 54.2% of the restricted-range species. Many occur in regions where reefs are being severely affected by people, potentially leading to numerous extinctions. Threatened centers of endemism are major biodiversity hotspots, and conservation efforts targeted toward them could help avert the loss of tropical reef biodiversity (Roberts *et al*., 2002). According to Hantoro *et al*. (1997), coral-rich modern reefs fringe the north coast of East Timor and flank the relatively steep slope of Wetar strait. This strait is strongly influenced by the Asian-Australian monsoon system that controls seasonal rainfall and sea surface currents. Solar insulation and fresh

water recharge to the sea influence the reef environment by modulating variations in sea surface temperature and other physical and chemical conditions. Porites growth in the intertidal zone records sea surface conditions in its carbonate skeleton. Small, longitudinal slabs of Porites were collected from the north coast of East Timor. The growth pattern is clearly seen as alternating heavy and light banding of marine-terrestrial vulvic acid. Bleached, dead surface or disturbed growth is observed, but has been covered by younger carbonate banding. This pattern can be correlated to the historical climate record.

Timor-Leste is near the centre of a global region with the highest coral species diversity. There may be in excess of 500 species of coral occurring in Timor-Leste waters (Veron and Stafford-Smith, 2000 *in* Eni, 2007). Burke *et al*. (2002) identified a number of coral reefs along the Timor-Leste coast, including five distinct communities along the south coast of Timor- Leste, that were considered to be at medium to high risk of impact from the combined effects of coastal development, marine-based pollution, sedimentation, over fishing and destructive fishing. The area of coral risk assessment is showed in Figure 4.

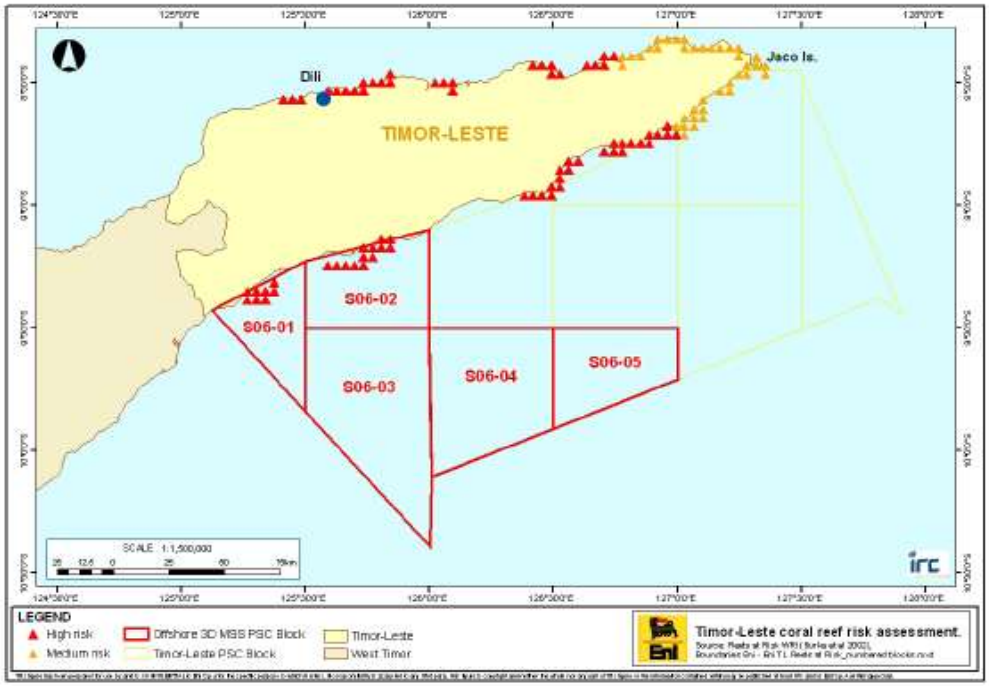

Figure 4. Timor-Leste coral reefs risk assessment map (Burke *et al*., 2002). Source: Eni (2007)

The Status of Timor Leste Coral Reefs is highlighted in the 2008 Status of World Coral Reefs published by ICRI (Chin *et al*., 2008) which showed Timor-Leste as a country with widespread poverty and malnourishment. Coastal villages rely heavily on seafood from the nearby coral reefs; thus, there is a strong risk that reef degradation or over-harvesting could result in ecological collapse, with on-going problems for the local people. Coral reefs around Ataúro Island (30 km north of the capital Díli) and at Behau (41 km east of Díli) were assessed in 2004, 2005 and 2008. At Ataúro, there were relatively large areas of recently dead corals, probably due to destructive fishing. The larger commercial reef fish (groupers, Serranidae, and snappers, Lutjanidae; larger than 40 cm) were rarely observed, and it appeared that smaller species, such as butterflyfish (Chaetodontidae), were being targeted by fishers. The situation of the corals at Behau is quite different. The reef is widely used by recreational SCUBA divers and although live coral cover and total live cover were lower than at Ataúro Island, no coral bleaching or recently killed

corals were recorded. Commercial fishes were also seldom observed at Behau (K41 station), although the condition was slightly better than Ataúro. Reef degradation and over-harvesting of reef species occurs throughout the country. Probably, the first large-scale damage to the East-Timorese reefs occurred during Indonesian occupation (1975–1999), when thousands of people were forcibly displaced from the mountains to the coast in an attempt to control the independence movement. This resulted in increased fishing pressure over the reefs. Other human impacts include: blast fishing introduced by migrant fishermen (although this is illegal under new legislation, it occurs along the northern coast); spear fishers destroying corals in attempts to increase fish catches; damage during the construction of fish traps; mining of coral for lime for chewing betel nut (mama-malus) which reduces hunger pains; marine and terrestrial debris, mainly domestic, that entangles the reef framework; cyanide fishing; and fishing with Acanthua tree branches which contain a toxin to stun fish. The East-Timorese National Directorate of Fisheries and Aquaculture is establishing coral reef monitoring to evaluate reef areas and measure the extent of human impacts in order to improve coastal management.

Since 2007, a collaborative project between the Timor Leste government and other national and international partners has been investigating various aspects of the marine environment including habitat mapping, coral reefs, fisheries, marine mammals and catchment management. The status of coral in the area was mapped through aerial surveys and ground truthing (Figure 5 and 6). The Coastal and habitat mapping and characterization study of Timor Leste identified that there are interactions of coastal marine wild life such as whales, dolphin, rays, dugong and turtles (Figure 7). The results of this recent 2008 study are pending (Edyvane *et al*., 2008) and will be important for the full TDA for Timor Leste.

Figure 5. Focus area of Coral reef observation by Edyvane *et al.*, 2008. Source: Edyvane *et al*. (2008)

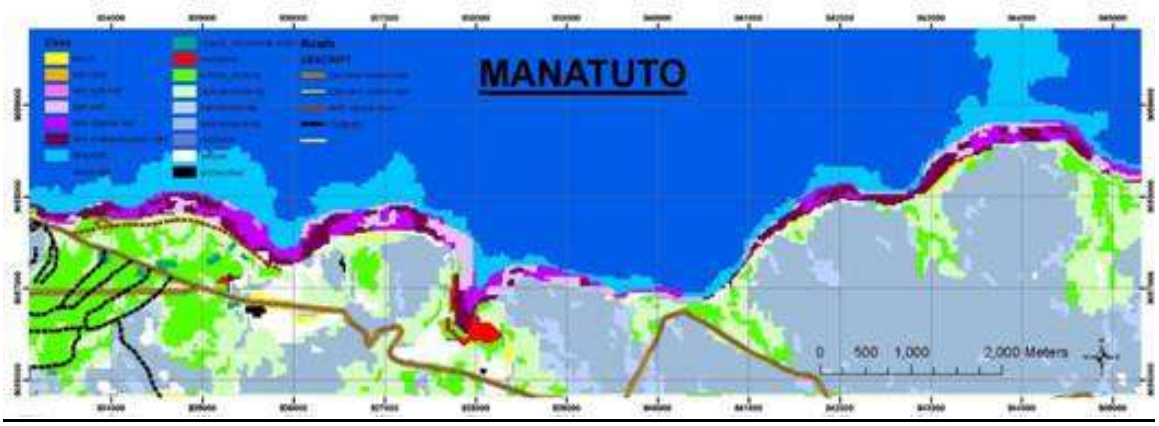

Figure 6. Habitat mapping and characterization. Source: Edyvane *et al*. (2008)

Figure 7. Aerial photography of some part of coral reefs in North of Timor Leste. Source: Edyvane *et al*. (2008)

3.1.4 Mangroves

The edaphic and coastal features of tropical countries, together with the high rainfall and significant river inputs, are particularly favourable to the development of well-structured mangrove forests and as part of multiple-function resource in many of coastal region, mangroves protect coasts from storms, erosion, and floods, and help purify water. They are important feeding sites for many commercially important fish species (mullet, eel and especially milkfish), shrimps, prawns, mollusks, crabs, and sea cucumbers (FAO, 2007).

Mangroves play an important role in the lives and economies, particularly in the coastal regions, of many different countries. They yield timber, fuel wood, poles, thatching material, grass, honey, wax and industrial raw materials for cellulose-based industries. They are major sources of employment and income generation, and many coastal communities are principally dependent on mangroves. Mangrove waters are very rich in fishery resources and act as nurseries and spawning grounds for a large number of species of fish, molluscs and crustaceans. Mangrove forests are also very rich in biodiversity and grow in intertidal zones along coasts and estuaries in areas sheltered from strong tidal action and wind/sea storm. The occurrence and distribution of mangrove species

are governed by parameters like temperature, wind, tidal range and frequency, availability of fresh water, soil type, terrain and salinity. On a local scale, factors like salinity, temperature, frequency and duration of tides, topography, sedimentation, and freshwater influx and light regime interact to produce the environmental settings for the growth, zonation and sustainability of mangroves. The mangrove ecosystem is a very dynamic one, where changes are taking place regularly, and within the range of mangrove habitats most major species grow within a given set of conditions. Any major changes in these conditions may start to bring about changes in the growth pattern of different species, a complete elimination of one or more species resulting from changes in the composition of the forests, or in extreme cases a complete disappearance of the forest. Because of this severe sensitivity to change in habitat conditions, mangrove forests are very susceptible to destruction.

The mangroves species that occur along the coast of Timor-Leste include, *Bruguiera parvifolia, Sonneratia alba, Rhizophora conjugata, Excoecaria agallocha, Avicennia marina, Aegiceras corniculatum, Acanthus ilicifolius, Lumnitzera racemosa, Heritiera litoralis, Acanthus ilicifolius, Achrosticum aureum, Xylocarpus granatum, Corypha utan, Pandanus odoratissimus, Cycas circinalis, Dolichandrone spathacea and Melaleuca leucadendr*on (timorNET, 2007 in Eni, 2007). Mangroves occupy approximately 7,500 acres along the coastline of Timor-Leste. On the south coast, they tend to form small communities at the mouths of streams and in marshy or swampy terrain (timorNET, 2007). There is concern over the condition of mangroves with exploitation for fuel wood in some areas along the north coast (Alongi and de Carvalho, 2008 *in* Wever, 2008). Total mangrove cover has significantly decreased over previous decades from approximately 9000 ha in 1940 to 3035 ha in 2000 (FAO, 2003 *in* Wever, 2008) and 1800 ha in 2005 (FAO, 2007). Mangroves and coral reefs are protected by the UNTAET Regulation 2000/19. Some mangroves, but not all, are also protected under traditional practices (*tara bandu*). Since Timor Leste has a low GDP, most of the population in poverty uses mangrove trees for fuel wood to support their daily needs. The NDFA is currently undertaking a survey for the identification of marine protected areas in several districts that are located along coastal areas. A project on mangrove replanting is underway and a small-scale mangrove rehabilitation program has commenced (Alves, 2007).

3.1.5 Sea grass

Seagrasses are underwater flowering plants that form an important coastal habitat world wide, often occurring in vast meadows which provide nurseries, shelter, and food for a variety of commercially, recreationally, and ecologically important species. Seagrass meadows provide ecosystem services that rank among the highest of all ecosystems on earth. The direct outputs are substantial since highly valued commercial catches such as prawns and fish are dependent on these systems. Seagrasses provide protective shelter for many animals, including fish, and can also be a direct food source for manatees and dugongs, turtles, water fowl, some herbivorous fish and sea urchins. The roots and rhizomes of seagrasses also stabilise sediments and prevent erosion while the leaves filter suspended sediments and nutrients from the water column. Seagrass meadows are thus linked to other important marine habitats such as coral reefs, mangroves, salt marshes and oyster reefs (Bjorg *et al*., 2008). Siltation causes a loss of seagrass species and a reduction of seagrass biomass; the effect is pronounced as the content of silt and clay in the sediment exceeds 15-20% of sediment dry weight. *Enhalus acoroides* is the S.E. Asian seagrass species most resistant to siltation, while *Syringodium isoetifolium*, Cymodocea *rotundata*, and *Thalassia hemprichii* seem the most sensitive.

Species loss from seagrass meadows provides an early warning of detrimental siltation loads, and the relationship between percent of silt and clay in the sediment may be a useful dose-response relationship to set allowable or threshold siltation loads to coastal ecosystems. Siltation effects on seagrass meadows are driven by changes in both the water column and the sediment. High sulfide levels in sediment pore water (1 – 6 mM) can reduce the growth of *C. rotundata* by half, and sediment redox potentials lower than -100 mV reduce the growth and abundance of T. hemprichii. If light availability is high the seagrasses are able to release enough oxygen by the roots to modify sediment conditions making them more favourable to seagrass life. The capacity of seagrasses to maintain sediment conditions suitable to seagrass life depends on plant abundance. Light availability is critical since a 25-30% reduction of irradiance drives pristine seagrass communities into heterotrophy and the sediment becomes more reduced (Terrados and Duarte, 2002). Sea grass beds also protect coral reefs from erosion and provide feeding grounds for the endangered dugong. Sea grass communities occur on inter-reef flats and sub-tidal soft substrates in inshore waters throughout the area of Nino Conis Santana National Park in the east of the island (Anonymous, 2006). The mangrove and sea grass environments are critically important as fish hatchery/nursery habitats and of significant importance to overall health and conservation of marine ecosystems. Indo-Pacific bottlenose dolphins are found primarily in continental shelf waters (< 200 m deep) near shore and in areas with rocky or coral reefs, sandy or soft bottoms, or sea grass beds (Reeves and Horokoru, 2008).

3.1.2 Marine Mammals

Whales are not expected to be common inhabitants of the conservation area, although a number of species have broad distributions which include the permit area. No frequent large whales have been reported in the region and their presence is considered unlikely. Dolphins have been reported as quite abundant in some offshore areas of the Timor Sea and are regularly seen by commercial fishers, with groups of up to 200 reported near Evans Shoal. The oceanic species and populations of dolphins that may occur in the survey area are considered to be nomadic feeders, in contrast to coastal populations that tend to have defined territories (MEO & CEE Consultants, 2002).

None of these species are listed as threatened. Dugongs are a listed migratory species and mostly inhabit the shallow (0-5 m) waters fringing the coast and offshore islands, occurring in close conjunction with the seagrass and algae beds on which they feed. Dugongs have also been reported undertaking relatively prolonged ocean passages from the northern Australian coastline towards Ashmore Reef along the Londonderry rise (Whiting, 1999). However, as there is little or no feeding habitat in the permit area and it is remote from probable or known dugong travel paths, the possibility of their occurrence in the permit area is very low.

A systematic survey of the Timor Sea, supported by the governments of Australia, Indonesia and East Timor, and funded by Environment Australia and the Convention on Migratory Species, was conducted by WWF (Australia/Hong Kong/Indonesia) in November 2002. The aim of the survey was to derive population abundance estimates for small cetaceans in the Timor Sea area. Thirty-two sightings were recorded. Five species were positively identified (15 Indo-Pacific bottlenose dolphins, 1 Common bottlenose dolphin, 5 Spinner dolphins, 7 Spotted dolphins, 2 Unidentified Dolphin groups, 1 Unidentified *Kogia*, 1 Melon-headed whale). The other mammals identified were Pygmy/dwarf sperm whale sp. *Kogia* sp.; Melon-headed whale *Peponocephala electra*; Common bottlenose dolphin *Tursiops truncates*; Indo-Pacific bottlenose dolphin *Tursiops aduncus*; and Spinner dolphin *Stenella coeruleoalba*; (Powell, 2002).

During the Bicuda 2D Timor Sea survey (Eni, 2007) a number of dolphins were found occurring within the area. These species include the Irrawaddy dolphin, the Australian snubfin dolphin, the long snouted spinner dolphin, the spotted bottlenose dolphin, Risso's dolphin, the Indo-Pacific humpback dolphin and the pantropical spotted dolphin. Dugongs (*Dugong dugon*) occur within Timor-Leste waters, in protected areas coinciding with sizeable seagrass beds.

Other marine mammal observations from Eni's Albacora 3D seismic survey (Eni, 2007) by dedicated Marine Mammal Observers provided an important insight into the distribution of whales and dolphins in the Timor Sea. In September 2007, observations recorded a total of 23 sightings of cetaceans comprising approximately 96 individuals (Western Whale Research 2007 in Eni 2008). These included 13 pods of Pygmy blue whales, *Balaenoptera musculus brevicauda*, and 8 pods of unidentified large whales (most likely to be Pygmy blue whales). Two pods of unidentified dolphins totaling 70 individuals were also observed. Given the large survey coverage over deep water (up to 2500 m) and short observation duration of 22 days (with excellent weather) this number of sightings is considered to be high and of very high importance to marine science.

In contrast, the effort for the 3D Seismic Survey in December 2007 observed relatively low numbers of sightings in the Timor Sea (Western Whale Research, 2008 *in* Eni, 2008). A total of four sightings of cetaceans comprising 16 individuals were recorded. These included one unidentified whale, one sighting of two Fraser's dolphins and two pods of unidentified dolphins (Eni, 2008). A press release from Northern territory in December 2008 entitled 'Timor a Global Hotspot for Whales and Dolphins' drew attention to the abundance of cetaceans in Timor Sea based on observations of Marine Mega fauna surveys in Timor–Leste (2009).

Whale sharks (*Rhyncodon typus*) one of the vulnerable, highly migratory wild species listed under CITES, migrate across international borders from to the west coast of North Australia, into the Timor Sea and Timor Leste waters. Whale sharks have been tracked using satellite tags from Western Australia to the south coast of Timor Leste (Figure 8). Indonesian fishermen have reported an area along the south coast of Timor Leste, near to the West Timor border where whale sharks are regularly sighted (Stacey *et al*., 2008).

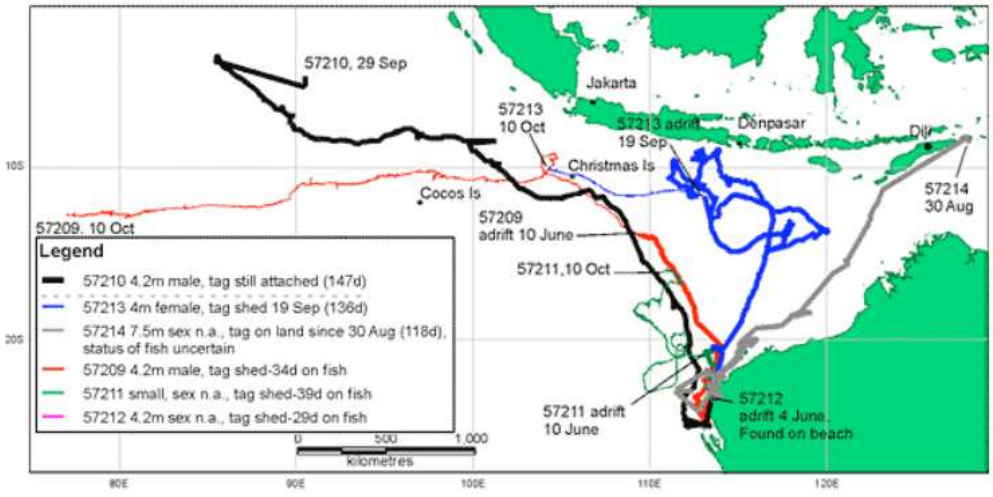

Figure 8. Satellite tagging on whale sharks tracking by AIMS/CDU/CSIRO/NOAA tagged c. 80 whale sharks using 'PAT' & 'SPLASH' satellite tags. Source: **http://www.cmar.csiro.au/tagging/whale /images/ ningaloo_track 10oct.gif** in Stacey *et al*., 2008

3.1.3 Marine Endangered species

In a global perspective, most endangered marine species fall into four main groups: marine mammals, sea turtles, seabirds, and salmon. Of the nineteen species listed as endangered by the National Oceanic and Atmospheric Administration (NOAA) under the Endangered Species Act, nine are marine mammals, five are sea turtles, and two are salmonids. Of the twelve species listed as threatened, two are marine mammals, three are sea turtles, and five are salmonids. Seabirds fall under the jurisdiction of the U.S. Fish and Wildlife Service and eleven species are listed as endangered or threatened under the Endangered Species Act. Different factors threaten the survival and recovery of each of these groups (US Commission on Ocean Policy, 2004).

Because of their intelligence, visibility and frequent interactions with humans, marine mammals hold a special place in the minds of most people. Little wonder that, as a whole, marine mammals are afforded a higher level of protection than most other marine organisms. Nevertheless, they continue to be affected by a wide range of human activities. The biggest threat to marine mammals worldwide is their accidental capture or entanglement in fishing gear (known as bycatch), which kills hundreds of thousands each year. Dolphins, porpoises and small whales often drown when tangled in a net or a fishing line because they are not able to surface for air. Even large whales can become entangled in towing nets or other gear for long distances leading to injury, exhaustion, or death (US Commission on Ocean Policy, 2004).

Other possible causes of marine mammal mortality include the introduction of new diseases, ecosystem changes such as algal blooms, and indirect effects of climate change. These factors may cause several thousand additional deaths each year. Although pollution rarely kills marine creatures directly, it can impair their health, harm their reproductive potential, and eventually lead to their death. Chemicals in fertilizers, pesticides, pharmaceuticals, and other materials can accumulate in the tissues of these animals, especially those with long life spans. Ingestion of marine debris and entanglement in plastic trash can be significant additional sources of mortality. Marine mammal populations may also be disturbed by noise from shipping, oil and gas exploration, ocean drilling, naval operations, oceanographic and geophysical research, and similar activities. In the last ten years, considerable publicity has surrounded the deaths of marine mammals in close proximity to naval operations and geophysical research vessels. Unfortunately, very little is known about marine mammal physiology, including baseline data on hearing, making it difficult to assess the potential biophysical impacts of noise on marine animals. Another factor common to declines in many endangered species is the destruction or degradation of their natural habitat. Thus, the successful recovery of a species depends to a large degree on protection or restoration of its habitat (US Commission on Ocean Policy, 2004).

For centuries, artisanal fishermen have been conducting fishing for sustainable livelihoods in the coastal waters. However recent management issues in combination with access to distant markets have caused a significant increase of effort and yields of many kind of marine species as well as an expansion of area fished. There is a concern over the increase of certain species and the consequence which this has for the population of some species in several areas of world oceans. This is because the species often have a close stock-recruitment relationship and long recovery times in response to over fishing and complex spatial structure.

Several endangered marine species are found in Timor Leste**:** Green turtle; Hawksbill turtle; Leatherback turtle; Loggerhead turtle; Small Giant Clam; Sperm whale; Spinner dolphin; Bottlenose dolphin; Whale shark; (RDTL, UNDP, GEF, ENEP and World Bank, 2005). The status

of threatened or endangered marine species including several turtle species and estuarine crocodiles in the Timor Sea and its adjacent waters are listed in Table 1.

Table 1. Endangered Marine Species in Timor Sea

TAXONOMIC NAME	ENGLISH NAME	IUCN/ CITES
Chelonia mydas	Green turtle EN	CITES
Eretmochelys Imbricata	Hawksbill turtle	CR
Dermochelys Coriacea	Leatherback turtle	CR
Caretta caretta	Loggerhead turtle	EN
Lepidochelys Olivacea	Olive turtle	EN, CITES
Dugong dugon	Dugong	VU
Physeter catodon	Sperm whale	VU
Orcinus orca	Killer whale	LR/cd, CITES
Stenella longirostris	Spinner dolphin	LR/cd, CITES
Tursiops truncates	Bottlenose dolphin	DD
Rhincodon typus	Basking shark	VU
Tridacna derasa	Southern Giant Clam	VU
Tridacna gigas	Giant Clam	VU
Tridacna maxima	Small Giant Clam	LR/cd

Source: **http://pdf.dec.org/ pdf_docs/PDACA921.pdf**

Remarks: Red List categories for endangered species: CR – critically endangered, EN – endangered, VU – vulnerable, LR – lower risk (nt – near threatened, cd – conservation dependent), DD-data deficient

3.2 Fish and Fisheries

Since there is limited information on stock status in the Timor Sea, the current state of the fisheries resource was derived by using an expanded area of water of the Australian Large Marine Ecosystem which relates to Arafura and Timor Sea. These data were use to indicate the general estimated historical landing of groups of species caught by the commercial fleets based on the data from **www.searoundus.org**.

Landings by major groups of species in the North Australian Shelf LME shows that the demersal invertebrate, shrimps, small demersal (< 30 cm) and medium pelagic (30-90 cm length) groups of species dominated the catch. The catch for medium pelagic has increased since 1990. This indicates that exploitation on demersal invertebrate and shrimps is a significant contribution to overall catch, meaning habitat degradation should be seriously taken into account in these fisheries. The increasing landing since 1990 indicates advances in fishing technology or an increased effort operating in the area (Figure 9a).

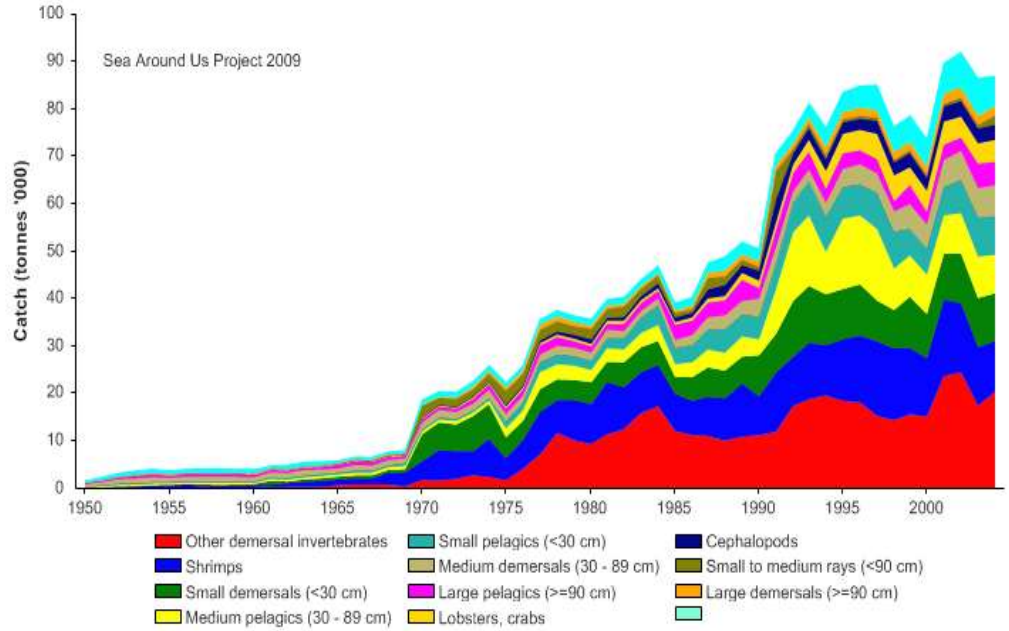

Figure 9a. Landings by group of species in North Australian Shelf LME.
Source: **www.searoundus**, May 2009

The catch was mainly dominated by bottom trawls which contribute around 30% to the total landing. A significant increase of trawl catch occurred between 1970 and 1990, while other types of gear have shown similar trends. The highest fishing pressure in the area is caused by bottom trawls. The selective fishing gears such as troll lines, hooks and traps plays a part in landing along with low fuel consumption fishing gears such as boat seine and beach seine. Regarding the recent state of the art of Timor Leste fisheries, the role of exploitation on fish stocks in Timor Sea is not significant (Figure 10).

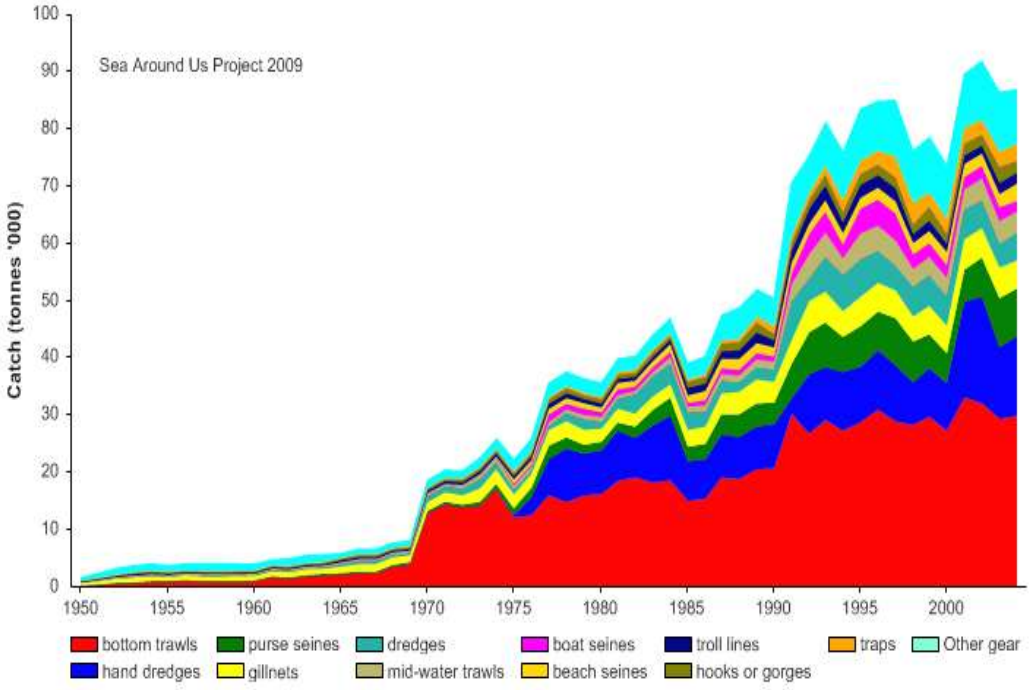

Figure 10. Landing by fishing gear. Source: **www.seaaroundus.org**.

The waters of Timor Leste are defined as all surrounding waters off the north and south coast of the country. These waters extend out to the edge of the off shore Fishing Zone (200 nautical miles). Allocation of use rights were divided into 5 zones i.e. A= 200 m for artesian; B = 3 nm for semi-industrial, C = 12 nm for National Industrial at southern coast of Viqueque; D = 6 nm for foreign semi-industrial at southern coast of Viqueque; E = 18 nm for foreign industrial at southern part facing sahul bank (SHC, February 2009). The artisanal reef fishery on the north coast of East Timor is largely exploited by subsistence fishermen. The principal gears used are nets, with hand-lining and spear fishing undertaken to a lesser degree. There is currently no regulation of net mesh size. Dynamite fishing is practiced to a limited extent compared to previous years. There are currently marine protected areas (MPAs) in East Timor. Traditional systems are in place in some areas, with locally enforced no-take periods, known as tara bandu.

Fisheries sectors contribute by not only supporting the needs of protein supply for the people but also contribute a large amount of foreign currency to the country through export trade. In 1997, fisheries contributed approximately US$ 481,000, less than 1% of all revenues generated, whilst in 2004 this increased to US$ 5.7 million (Anonymous, 2007). Few East Timorese fish as their primary livelihood, although those located in coastal areas may fish for partial subsistence. Some fishing occurs for local markets and vessels from other countries have been known to fish in offshore waters.

The extent of East Timor's fishery resources is known in only on a conceptual, preliminary and unreliable basis. One of the possible pathways to identify the potential fish resource in Timor Sea waters was conducted through a joint survey on Fisheries Research and Oceanographic Observation carried out in the Exclusive Economic Zone of Timor-Leste in September 2005. Aimed at collecting well-needed scientific data and information concerning fisheries development policy, the survey covered biodiversity enumeration, productive potential assessment, comprehensive oceanographic and hydro-biological aspects, policy consideration and establishment of a framework for fisheries development and sustainable exploitation of its fishery resources. The regional fisheries training center, Southeast Asian Fisheries Development Center, (SEAFDEC) organized the technical collaboration between the two countries and the survey was conducted using training vessel MV SEAFDEC during April to June 2005 (Anonymous, 2005).

3.2.1 Pelagic fish resources

The data were collected through fishing with pelagic and bottom vertical longline, drift gillnets, fish traps and squid jigging. A wide variety of typical tropical fish resources were caught during this survey, including 12 species from pelagic long line and 13 species from drift gill nets. The catch rates of economically important species such as tuna and tuna like fish during this period however was rather low. This was probably due to tuna migration during the survey period (RDTL-SEAFDEC 2005). The species caught and weight compositions consists of: Sharks (*Carcharunis falciformes*; *Pseudocarcharias kamoharai*) 17%; Mobula rays (*Mobula japonica*) 11%; Barracuda (*Sphyrna lewini*) 12%; Bigeye tuna (*Thunnus obesus*) 18%; Dolphin fish (*Coryphaena hippurus*); Large snake mackerel (*Lepidocybium flavobrunneum*); Yellowfin tuna (*Thunnus albacares*); Sailfish (*Istiphorus platypterus*); Swordfish (*Xiphias gladius*); Others (*Taractes rubescens; Gympyrus serpens*) with each contribution of less than 5%.

3.2.2 Bottom/demersal deep-sea fish resources

During the 2005 MV. Seafdec survey, bottom vertical longline and fish traps were deployed along the continental shelf in the southern part of Timor Sea to a depth of 100 m. The catch rates showed reasonable catch ability and highlighted that there are many kinds of demersal fish distributed over the EEZ of Timor-Leste. The catch rates of 14 fishing stations of bottom vertical longline ranged from 2.6 to 32.2 kg/100 hooks with an average of 12.3 kg/100 hooks.

The economically important species found were mostly Lutjanidae, Lethrinidae and Serranidae. A group of snappers (Lutjanidae) was the most common fish found in the survey area contributing to around 49% of the total catch by weight. Within this group, there were three economically important species with sizes of more than 20 cm, namely *Pristipomoides typus, P. multidens as the tropical deep-water snapper and Lutjanus vitta.* Small numbers of *Gymnocranius japonicus, Argyrops spinifer and Epinephelus aerolatus* were also found in the area.

The other common group of species in the tropical waters were as follows: Catfish (Ariidae); Trevally (Carangidae); Eels (Congridae); Remora (Echeneidae); Grunts (Haemulidae); Wrasse (Labridae); Emperors (Lethrinidae); Moaru eels (Muraenidae); Threadfin bream (Nemipteridae); Bigeye (Priacanthidae); Guitarfish (Rhinobathidae); Seabreams (Spariidae); Lizzard fish (Synodonteidae); Rabbit fish (Tetraodontidae); Some sharks species consist of : Hound sharks (Triakidae); Wasel sharks (Hemogaleidae); Longtail carpet sharks (Hemicyllidae); Bulkhead sharks (Heterodonteidae); Cowsharks (Hexanthidae); Hammerhead sharks (Sphynidae). Oceanic pelagic sharks and rays are highly mobile species that are not associated closely with the sea floor and primarily live in the open ocean away from continental landmasses.

Qualitative observation through scientific sounders indicated that there are schooling fish in hard and rocky bottomed areas and uneven seafloor and steep slopes off southern parts of the country. They are most likely to congregate at a bottom depth of 90-145 m but fishing is practically difficult to operate in the area.

During the 2005 survey fishing with fish traps was set up in the Timor Sea north Australian shelf. Traps were very effective in capturing *Nautilus pompilius* as one of the common deep sea prawn species in the area. A total of 103 individuals were recorded in the area which indicates a high abundance of this species. The catch rate of oceanic squids from automatic squid jigging appeared rather low at 0.3 individuals/line-hour (Anonymous, 2005).

3.3. Oceanography and climate

A distinct trough – the Timor Trough – separates the Australian continent and the island of Timor. The two landmasses do not share a natural continental shelf. The continental shelf – out to the 200-metre isobath – is a narrow strip along the southern sector of Timor Island whilst being broad off the northern coast of Australia. The legal continental shelves of Australia, as indeed of East Timor and Indonesia, have yet to be defined in accordance with the 1982 Law of the Sea Convention. (Forbes, 2002). The substratum of the Timor Sea is regarded as a highly prospective hydrocarbon reserve region containing substantial condensate and gas reserves. Geological features are the Bonaparte (main) and Browse Basins.

The area of the Timor Sea is administered by the Northern Territory, Western Australia and the Joint Petroleum Development Authority (JPDA) on behalf of Australia and East Timor. The Northern Territory Government administers the Ashmore/Cartier Islands Adjacent Area (on

behalf of the Commonwealth Government) and the NT Adjacent Area. The Timor Sea is the focus of attention. Bayu-Undan, Sunrise and Evans Shoal gas projects and recently completed major oil developments include the Elang/Kakatua, Laminaria/Corallina and Buffalo projects have the potential to generate wealth to the sovereign state. Exploration commitments offshore are high, with the expectation of further oil and gas discoveries in the future which would be stimulated by gas markets in Australia and overseas.

Timor-Leste has two annual seasons and three climatic zones which are the result of monsoon activity. The two distinct seasons are the Northwest Monsoon (wet season) from November to May and the Southeast Monsoon (dry season) from April to September, with brief transitional periods in between (Anonymous, 2006). High rainfall is associated with the Northwest Monsoon and low rainfall with the Southeast Monsoon. Heavy rainfalls are also associated with tropical cyclones and thunderstorm activity. Mean annual rainfall for the Timor Sea region is 1,770 mm (Heyward *et al*., 1997). Winter in the region is characterized by steady easterly and south-easterly winds of 5 m/s to 12 m/s (the south-east trade winds). The summer is characterized by the north-west monsoon, a steady moist west-south-west to north-west wind reaching speeds of 5 m/s for periods of 5 to 10 days. Surface winds in the region, during the September/October transition season possess a westerly component; are light and frequently less than 5 m/s and during the March/April transition season south-easterly shifting to easterly by the end of April. The majority of cyclones occur in the region between January and March, with the most severe cyclones most often occurring in the months December to April (SKM, 2001 in Anonymous, 2008). Most (75%) of these cyclones are not fully mature, having an estimated wind speed of less than 80km/h. Severe cyclones, with wind speeds exceeding 100km/h occur, on average, once every 2.6 years. Seawater temperatures in the Timor Sea region range from 25ºC – 31ºC at the surface and 22ºC – 25ºC below 150 m (OMV, 2003) and down to 10ºC at the seafloor (Heyward *et al*., 1997 in Anonymous, 2008). Other estimates claim that the mean annual temperature at sea level is 27.5ºC and 19.8ºC at 1432 m above sea level (Keefer, 2000 in Anonymous, 2004).

Estimated primary productivity in the Arafura, Timor Seas and its adjacent waters clearly indicated that in the shelf area of Arafura and Northern Territory Australia waters productivity is relatively higher during the southeast than northwest monsoon. (Figure 11).

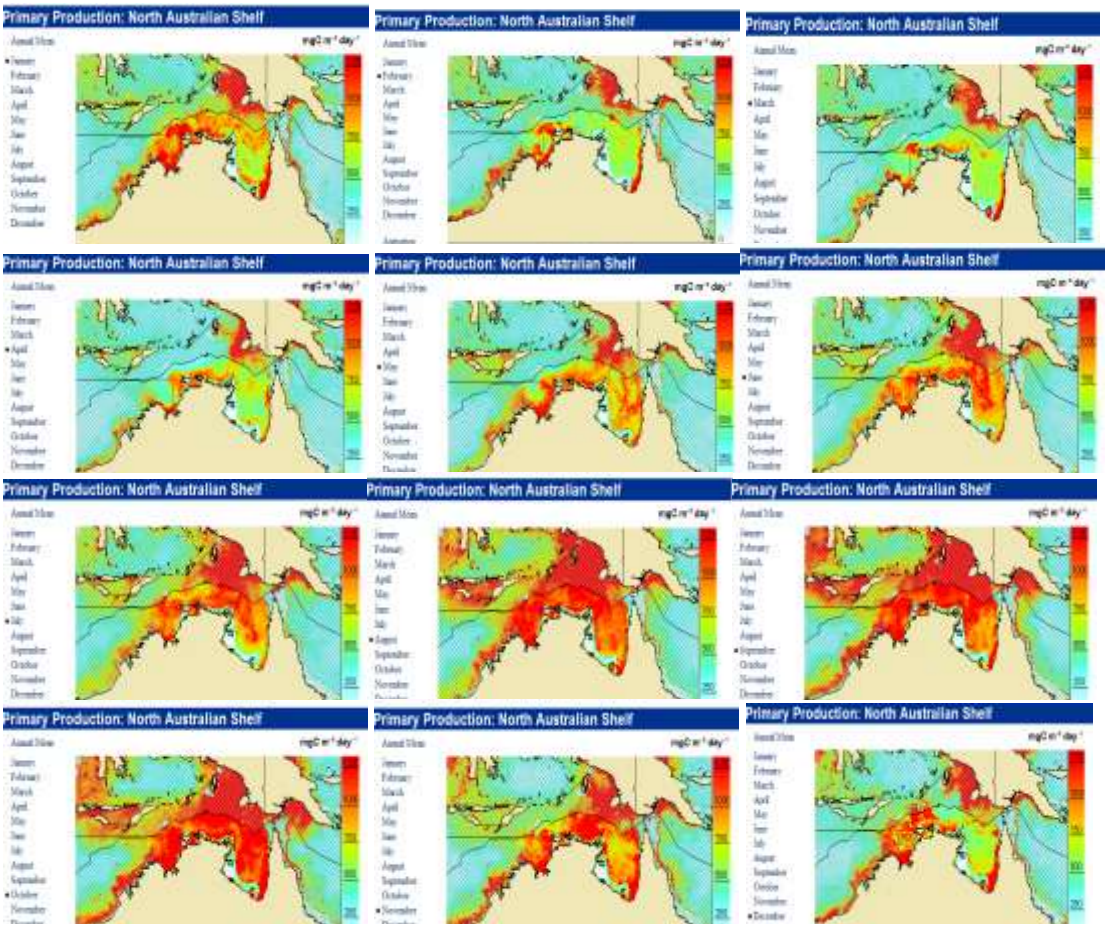

Figure 11. Estimated monthly primary productivity (mgC m^{-2} day^{-1}).
Source: www.seaaroundus.org

4. Gaps in Existing Baseline Information on the Timor Sea Ecosystem

Present knowledge of the environmental situation in East Timor is very limited. The necessary knowledge about ecosystems, biological diversity, and effects of alien species is almost completely lacking. The institutions and legal structures that are to be developed in order to implement responsible and correct management regimes lack the necessary basis for this task. This work is time consuming and complex, and many activities need to take place simultaneously. The appropriate management institution of the East Timorese Government may want to develop the first-generation national Environmental/Biodiversity Strategy and Action Plan as part of the environmental policy development. At the same time systematic work should be started to improve the level of information about the present situation. This work should take the form of a relatively long term, low volume program, adapted to the capacity of East Timorese institutions. It should enlist the collaboration of local communities, district officers of relevant institutions, the University, and other relevant institutions. Any foreign researcher in relevant fields that would want to work in East Timor should also be advised to feed into this program by supplying his or her data. Such a program would be well suited for long term institutional collaboration with an appropriate foreign institution.

Government responsibility for the environment is covered across a number of different ministries. The National Directorate of Environment under the Ministry of economy and Development is the main government body responsible for environmental planning, ecological and

urban environmental services. The Ministry of Agriculture and Fisheries (MAFF) of Timor Leste is responsible for agriculture which contributes 30 percent of the non-petroleum GDP of Timor-Leste and 80 percent of the population is dependent on agriculture, forestry and fisheries.

While the nationwide poverty incidence is around 40 percent, 86 percent of the poor live in rural areas. It also generates an average of 90 percent of the exports, mainly due to coffee. Most farmers practice subsistence farming, planting and harvesting what they need for a simple life-style. This included collecting wild foods and traditional medicines, while the animals are very much left free to grow and reproduce. Production of staple food crops such as rice and maize, dominate the agricultural systems (MAF, 2009).

There have been a number of recent projects and partnerships initiated by the governmental and non-governmental sectors, with involvement of the international research and development aid community, aimed at improving coastal management in the country. The government has joined regional networks such as Partnerships in Environmental Management for the Seas of East Asia (PEMSEA) and has become signatory to inter-governmental environmental protection agreements. Several local-scale efforts such as the establishment of MPAs and the country's first national park have also been important steps in this direction.

In marine and coastal zones mangrove and other specialized coastal vegetation, the shallow seas adjacent to land, coral reefs, and sea grass beds are areas maintained and managed by the main authority. Increasing coastal population caused gradual changes in the fishing pressures in relation to the demand for fresh fish for daily consumption. Gaps in baseline data and information are mainly due to limited human resources, institutional capacity and infrastructure of both Ministries which face severe constraints to provide the recent status of its work plan development.

4.1 Gaps in Biodiversity Information

The marine environment is host to a broad array of biodiversity. For some species data and information containing systematic biological information and features of spatial and temporal variability are not yet available. For most marine species which are known to migrate, this movement can be particularly pronounced in marine environments where many species require different habitats for different life-cycle stages. Much remains to be learned and much of the biological diversity in marine environments has yet to be explained in Timor Leste.

Rich species diversity is reflected in the high number of mangrove trees, finfish and penaeid shrimps, among others, that are associated with mangrove swamps. Because of the severe pressure gradually exerted on mangroves, a number of associated species are among those that could be classified as endangered. Mangroves act as nursery and feeding grounds for finfish and shellfish at some stage or throughout their life cycles. Singh *et al*. (1994 *in* McManus, 2000) obtained studies that show a high correlation between catch in coastal fisheries and the area of adjacent mangroves in study sites such as Indonesia, Malaysia, Philippines, Australia and the US. Although correlation does not imply causation, ecological studies have established the connections between mangroves, coral reefs and seagrass as far as supporting the life cycles of coastal organisms (Robertson and Duke, 1987; Twilley, 1989 *in* McManus, 2000).

Based on the precautionary principle, it is not necessary to unequivocally prove that mangrove destruction will cause a decline in the productivity of dependent biota, and consequently

a decrease in their yields. Until proven otherwise, then, mangroves must be conserved if only for their probable positive relation to coastal fisheries.

Agenda 21, the Convention of Biological Diversity (CBD), the listing of some commercial fish species under CITES, and the FAO Code of Conduct for Responsible Fisheries are some of the initiatives intended to protect biodiversity. Timor-Leste is the latest country to become party to the CBD, ratifying it by accession on 8 January 2007. With the aim of creating the foundation to design and implement effective response measures to achieve the CBD objectives in Timor-Leste, this ATSEA project will allow the country to formulate strategies and actions to manage the sustainable use of marine biodiversity.

A final draft National Biodiversity Strategy and Action Plan (NBSAP) (UNDP) for Timor Leste, as the national report to the Conference of the Parties to the Convention on Biological Diversity was submitted in November 2006 as the 189th party to the Convention. Gaps in its implementation from ministerial level to local community should be resolved through a systematic and acceptable work plan by parties. Local communities in East Timor possess a large amount of knowledge about the local biodiversity through the active collection and use of marine animals, plants and other non-living resource products. A biodiversity survey program must therefore be based upon collaboration with local communities. This would also contribute to awareness rising about the local biodiversity resources and environmental conservation. Developing institutional capacity to undertake these tasks must be integrated into the work program. Monitoring and evaluation on measuring the achievement of the status of biodiversity in the country as part of global significance is needed. Establishment and management of marine protected areas to sustainably benefit local communities should be carried out.

The Coral Triangle Initiative (CTI) on Coral Reefs, Fisheries, and Food Security is an initiative that brings together six governments including Timor-Leste, Indonesia, Malaysia, the Philippines, Papua New Guinea, and the Solomon Islands (Figure 12), and aims at protecting marine life, promoting sustainable fishing, and ensuring food security in the region (Aglionby, 2007). It was initiated by the Indonesian government and was endorsed by participating governments during the APEC Summit in September 2007. The CTI-Regional Plan of Action was launched as a living and non-legally binding document to conserve and sustainably manage coastal and marine resources within the CTI region that takes into consideration laws and policies of each country (Regional CTI Secretariat, 2009).

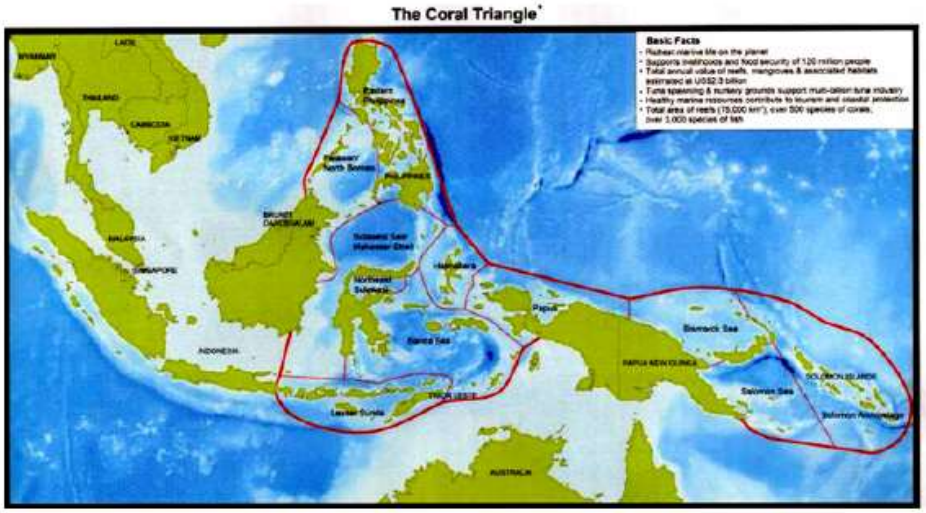

Figure 12. The Coral Reef Triangle Geographical coverage
Source: www.icriforum.org/secretariat/GMDC/ppt/ICRI_GM_DC_CTI.ppt

4.2 Gaps in fisheries information

Marine fisheries in Timor Leste are still not well developed compared to neighboring countries. Fisheries contributed around 1-2% of GDP in 2007 (Freitas Pers. com.) Capture fisheries are mainly dominated by small scale fishing and gear which is operated on a daily scale and distributed mainly along the north coast. Market surveys and field observations during stakeholder consultation on September 2008 and February 2009 showed that catch composition is dominated by neritic pelagic species such as scads (*Decapterus* spp), jack mackerels (Carangoides spp.), Spanish mackerels (*Scomberomorus guttatus*), skipjack (*Katsowonus pelamis*), Sardine (*Sardinella gibbossa*) caught by gillnetters and purse seiners. Some bottom fish were also found in a relatively small quantity such as snapper (*Lutjanus* spp.); grouper (*Epinephelus* sp.) and in some cases lobster.

Little information is available about licensed fisheries vessels operating in Timor Leste waters, although some activities have commenced to tackle issues. Some fishing vessels with inboard engines more than 20 meters LOA probably belong to semi-industrial fisheries which are licensed by the fisheries authority. But little recorded information about catch and effort is available. These fisheries are part of an observer program already established in the semi-industrial fishery industry. A stakeholder consultation held in February 2009, concluded that roughly 5000 fishers exist in the country with 150 fishing centers along the coast. Estimated export volume from 2006 to 2008 was about 868 tons. Some observers reported that they saw fishing vessels operating without a license and some migrating fishers were seasonally operating in Timor Leste waters.

Gaps on base line data fishery statistics such as fishing effort (gear type and boat size), landing composition, fishing trips and number of households by district make it difficult to evaluate the level of exploitation of Timor Leste fisheries. Introducing simple log-book systems to fishers would be very helpful to monitor fishing intensity. Developing indicators for sustainable capture fisheries is also very helpful for the administrators to have a basic assessment of the fishery, even if most of the fishery relates to migrating species, which could be evaluated on a regional basis.

4.3 Gaps in oceanography and climate change information

As a new country, data and information on oceanographic phenomenon and its dynamics are still not available, though there are several publications indicating that the Timor Sea plays a significant role in the Pacific and Indian oceans through flows as stated by Wyrtki, (1961); van Bennekom (1986); and Gordon (2002) *in* Sugiarta (2009).

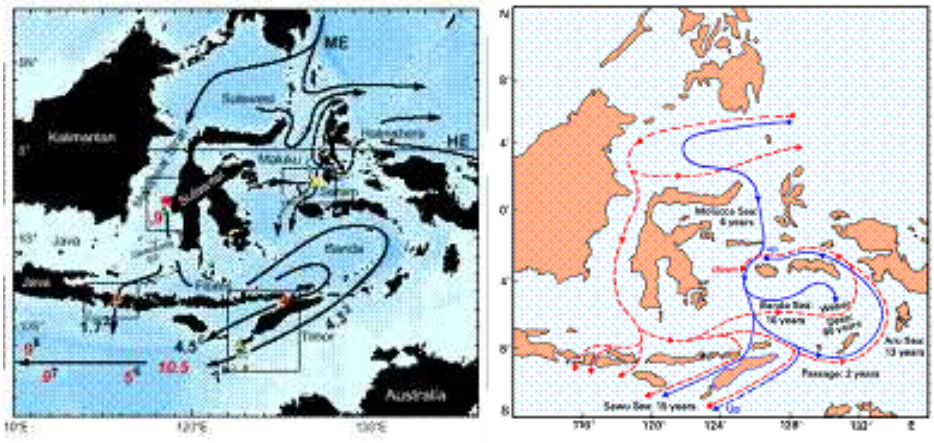

Figure 13. Indonesian Through Flow. Source: Left (Gordon, 2002); Right (van Bennekom 1986)

The numbers of rivers discharging into the ocean plays a significant role in the coastal dynamics and resources. The dynamic of global water mass, seasonal climate changes and variability influence the magnitude of the migratory aquatic resources.

The Government of Timor Leste, through the council Minister, approved the accession of UNFCC (United Nation Framework Convention on Climate Changes) in February 2006 and provided an opportunity for the commencement of the National Capacity on Self-Assessment being implemented by the Government in cooperation with UNDP (Barbosa, 2006). Stocktaking includes collecting and analyzing legal documents such as laws, regulation, plans, policies and programs addressing environmental management; especially climate change issues.

Climate change is a compounding threat to the sustainability of capture fisheries and aquaculture development. Impacts occur as a result of gradual warming at the global scale and associated physical changes, as well as consequences of the increased frequency of extreme weather events. These take place in the context of other global social and economic pressures on natural resources and ecosystems. In addition to action to mitigate the factors driving climate change, urgent adaptation measures are required in response to opportunities for and threats to food and livelihood provision arising from climate variations (FAO, 2009).

In terms of physical and biological impacts, climate change is modifying the distribution of marine and freshwater species. In general, warmer-water species are being displaced towards the poles and experiencing changes in habitat size and productivity. In a warmed world, ecosystem productivity is likely to decline in lower latitudes (i.e. most tropical and subtropical oceans, seas and lakes) and increase in high latitudes. Increased temperatures will also affect fish physiological processes, resulting in both positive and negative effects on fisheries and aquaculture systems (FAO, 2009).

Climate change is already affecting the seasonality of particular biological processes, altering marine and freshwater food webs, with unpredictable consequences for fish production. Increased risks of species invasions and the spread of vector-borne diseases raise additional concerns.

Gaps in such data should be taken in to account when discussing the national plan of action. These will emphasize the activities addressing the institutional, systemic and individual capacity developments dealing with environmental management in the light of adaptation and mitigation of climate changes in particular and other cross-cutting issues in general.

4.4 Gaps in information on human use and impact on biodiversity and fisheries

Fish and fisheries make a major contribution to nutritional security and the fight against hunger and poverty in coastal communities in Timor Leste. Additional fish will be needed by 2020 to meet the needs of the growing population, changing dietary habits and increasing income levels. Regular harvest from capture fisheries could become threatened by the growing pressure on fisheries to reach their maximum sustainable yields.

A number of gaps need to be addressed if the present production from capture fisheries are to be sustained and aquaculture production increased to bridge the gap between supply and the growing demand for fish. This needs commitment from governments to implement policies that foster the growth of fisheries and aquaculture and to allocate adequate human and financial resources to the development of the sector. Increased job opportunities and production does not necessarily lead to food or livelihood security. What is needed is for the poor to have access to food. Hence, if fish and fisheries are to contribute to eradicating hunger and poverty and improving the lives of the poor who depend on fish, a number of challenges need to be addressed. Studies undertaken by The World Fish Center and its partners in nine countries of Asia indicate an alarming decline in coastal fisheries, with biomasses levels down to 5-30 percent prior to the expansion of fishing. This has resulted in a decline in the relative abundance of larger and high value species and an increase in the abundance of smaller, low value fish in the region (Gupta, 2006).

The major challenges to be addressed for increasing fish production from marine capture fisheries on a sustainable basis and maximizing its contribution to nutritional and livelihood security are:

- Control of over-exploitation through regulated fishing. In some cases, the generous development assistance has resulted in more boats and increased pressure on already over exploited fish stocks.
- Introduce the enforcement of seasonal fishing restrictions where fisheries are closed during spawning times.
- Reduction of destructive fishing practices by promoting responsible fishing practices.
- Establishment of an ecosystem approach to fisheries management as opposed to a piecemeal approach.
- Reduction of post-harvest losses and use of by-catch.

A lesson learnt from many countries in the ASEAN region is that most inshore waters have been heavily fished and fishing in distant waters should be encouraged. Measures would involve putting restrictions on the local fishing communities whose livelihoods depend solely on fishing; potentially leading to conflict. Therefore, the implementation of controls on fishing should be accompanied by greater transparency in decision making through stakeholder participation and their involvement in the management of fisheries, i.e., community based fisheries management or co-management. In many countries, this would necessitate changes in existing policies such as:

- Restoration of marine habitat and control of pollution.
- Reduction of the effects of water abstraction on fisheries through inclusion of fisheries in all coastal development projects at the planning stage.
- Incorporation of ecological flow requirements of river floodplain systems into development plans; taking into account the cues needed by the fish for migration and reproduction.
- Regulation of fishing pressure through enforcement of closed seasons.

- Development of a reliable catch data collection system as, unlike marine fisheries, no reliable data are available on the catch, effort and the status of stocks.

The National strategic plan on poverty alleviation has recommended that to relieve hunger and poverty, national policies should restore budgetary priorities for agriculture, forest and fishery (as the engine of economic growth), empowerment of women and building of human capacity in all sectors involved in reducing poverty. While there are ample opportunities for fish and fisheries to make a major contribution to food and nutritional security and to contribute to the eradication of poverty, there are a number of challenges that need to be addressed. What is needed is political will, policy change and effective and efficient implementation.

Marine resources have been negatively impacted by human use patterns in many areas. Habitat destruction, over exploitation, and pollution are all primary concerns and many more factors pose significant threats to marine diversity and productivity. To maintain and protect marine diversity, Marine Protected Areas (MPAs) have been established in diverse geographical regions for a range of purposes. The World Conservation Union (IUCN) defines Marine Protected Areas as any area of inter-tidal or sub-tidal terrain, together with its overlying waters and associated flora and fauna, historical and cultural features, which has been reserved by law or other effective means to protect part or the entire enclosed environment (1998). MPAs offer considerable value for the protection and management of marine resources (Halpern, 2003; Roberts and Bohnsack, 2001 *in* Dorfman, 2009) and are one effective strategy for maintaining biodiversity in the marine environment. While most MPAs offer some form of protection for certain resources, many are not comprehensive in providing protection for all species and ecosystems found there. The IUCN management categories offer one approach to classifying the different forms of MPAs according to management objectives (Dorfman, no date).

Marine reserves generally restrict extractive uses and activities which degrade biological habitats. They offer one important strategy for maintaining biological diversity, but should not be relied upon as a single solution for management. Reducing the effects of pollution from land and freshwater are important resource management strategies as are fishing gear restrictions, catch limits, and other fisheries management techniques, such as timed closures. When reviewing existing MPAs, it is important to recognize the level of protection provided by each designation and any weaknesses or gaps in the protection provided to biological resources. There are more than 100,000 MPAs already in existence, and these management designations have great variability both in their mandate as well as their effectiveness (Dorfman, no date).

5. Recommendations on Measures to Address Information Gaps

Timor-Leste has been a PEMSEA member since 2006. It has signed the Haikou Partnership Agreement for the implementation of the 'Sustainable Development Strategy for the Seas of East Asia (SDS-SEA) (Ministerial Forum, 2006). In the short-term, current capacity constraints will allow the government only to focus on high-priority issues. The government could initially draft a basic national ICM strategy, possibly based on the framework developed by PEMSEA, and focus on a limited number of site-specific pilot projects. In an incremental process, the government could then identify best practices and gradually increase the scope of application.

Measures addressing the information gaps will be carried out through:

- Identification of stakeholders by level of implementation, particularly the institution involved, based on their mission, mandate, programs and activities with close relevance to biodiversity, fisheries and oceanographic issues.
- Establishment of thematic working groups to undertake scoping and stocktaking analysis; develop processes to collect related information from identified stakeholders and relevant institutions through interviews with key persons from institutional stakeholders;
- collecting documents related to laws, regulations, previous, current and future plans, programs and projects;
- conducting desk studies;
- focus group meetings with stakeholders;
- analyzing past capacity assessment and developments, national obligation under conventional legislation policies and programs; and
- summarizing past capacity assessments and identifying the probability of achievable implementations.

Risk assessment should be prepared though mapping the long-term socio-ecological benefits of natural resource use and potential impacts and conflicts, followed by a dynamic institutional and regulatory framework that is accepted by all stakeholders, under the scheme of sustainable benefits, with predictable problems and solutions. Broad skills in management issues will be very important in this process.

NDFA is the main implementing agency on behalf of the government of Timor-Leste. The official establishment of the Nino Konis Santana National Park in August 2007 (RDTL, 2007d) has been a major achievement of the government of Timor-Leste in the protection of coastal habitats. The National Park stretches over an area of approximately 123,590 hectares, including 67,930 ha of terrestrial and 55,660 ha of marine area (de Carvalho *et al*., 2007a). It includes the island of Jaco and the coastline of Lautem district.

6. Main Transboundary Threats to and Impact on Biodiversity and Marine Resources in Timor Sea

6.1 Climate Change

Coral reefs have been affected by an unusually strong el-Niño event in 1998 which caused coral bleaching in many parts of the Indian Ocean. National Oceanic and Atmospheric Administration (NOAA) images on models of thermal stress to coral reefs show that the area most likely to suffer thermal stress is a region spanning Papua New Guinea, the Solomon Islands, and the Far Northern section of the Great Barrier Reef (GBR). Less severe thermal stress is expected in a broader region including the GBR region in Australia. To the west, the model currently predicts a threat of *moderate levels* of thermal stress from southern Borneo across through Timor-Leste to southern Papua New Guinea and Torres Strait. This level of potential stress then picks up in the central GBR and eastern areas extending across Vanuatu and New Caledonia to the east-southeast of Fiji (Figure 14).

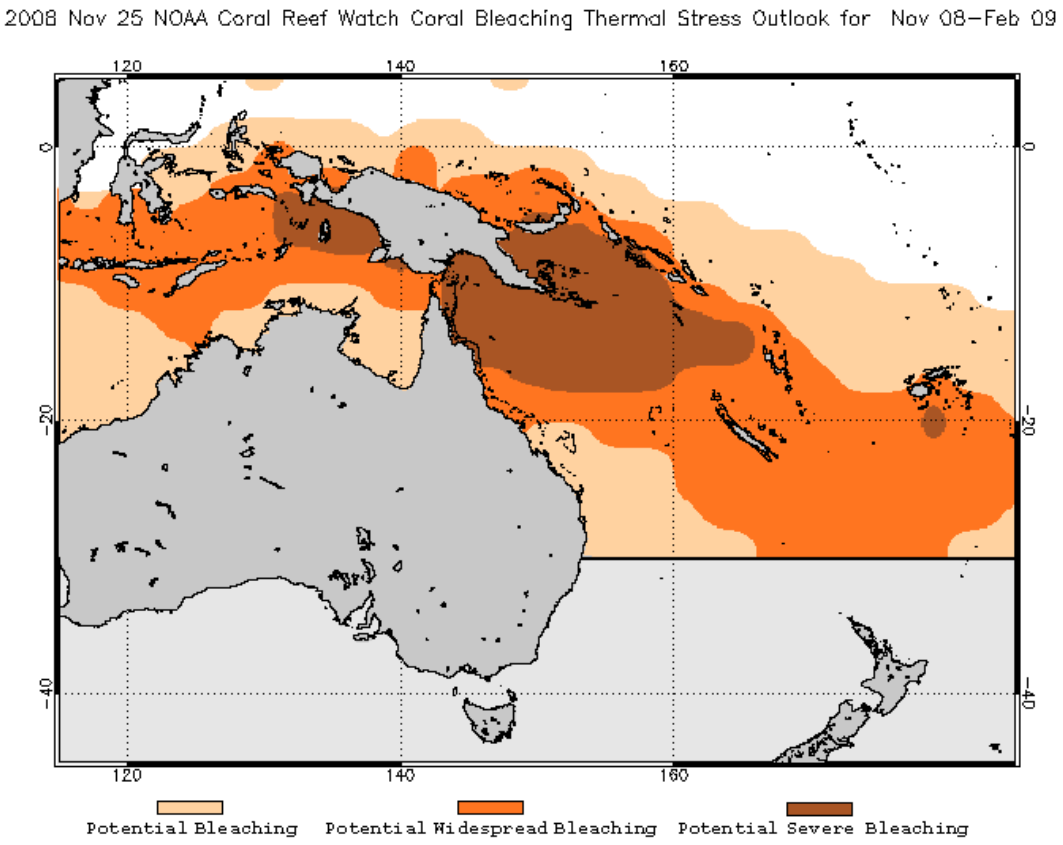

Figure 14. Coral bleaching outlook of potential widespread bleaching affected Timor Sea and its surrounding waters
Source: http://coralreefwatch.noaa.gov/satellite/bleachingoutlook

The coastal zone is more vulnerable to the impact of climate change than other land types. Human activity is very likely to continue to change the composition of the atmosphere during the twenty-first century. This will increase global mean temperature and lead to sea level rise. Global mean surface temperature is projected to increase by between 1.48ºC and 5.88ºC and global mean sea level is predicted to rise by 9 to 88 cm by 2100 (Watson *et al*., 2001 *in* Barnett *et al*., 2007). Because Timor is in a tectonically active region, local land movements are likely to be an important part of relative sea level rise. Given East Timor is relatively pristine coastal environment, a rise of 9 cm over 100 years may pose no significant problems, except possibly for Dili. However, a change of 88 cm may pose some problems. Increased shoreline erosion is possible. Rising sea levels can also cause saltwater intrusion into freshwater aquifers, affecting salinization of water used for drinking and agriculture. Coupled with a potential increase in severe rainfall events, it can also cause more extreme flooding at the mouths of rivers. Infrastructure such as buildings and roads, and activities such as agriculture that are close to the shore may be affected by shoreline retreat. Parts of the main road from Dili to Com via Bacau run close to the water's edge. In some places, such as Oecussi, neap tides can cause inundation of settled and farmed areas with seawater, which suggests that such places are vulnerable to rising sea levels. The capital, Dili, seems at first glance to be moderately vulnerable to sea level rise because it is situated on a coastal plain extending inland to the base of a steep mountain range. It is also intersected by the Comoro, Bemorl, and Benmauc rivers, and although these rarely flood, if climate change increases intense rainfall events, then increased peak flows coupled with sea level rise could cause flooding in Dili. Sea level rise is an important concern because the city contains 19% of the country's population, it

is the seat of government, and it is the location of the vast majority of public services and major international agencies. It is also the site of the country's major port and airport.

Counterbalancing this vulnerability to sea level rise is the remarkably pristine condition of much of East Timor's coastline outside of Dili. Because of the relative lack of development along Timor's coasts, the coping ability of the coastal zone seems high (Barnett *et al*., 2007). Coral reefs everywhere seem relatively free from damage due to human activities. This increases their resilience to sudden rises in sea surface temperature, which in degraded reefs can impede recovery following thermal bleaching (McLean, R. and Tysban, A. 2001 *in* Barnett *et al*., 2007). There are significant stands of mangroves along much of East Timor's coast. These assist in restricting the movement of sediment from the land onto reefs, which can degrade the health of reefs. They also protect shorelines from high-energy waves that cause erosion, and they are breeding areas for many species of fish suitable for eating. This suggests that investments in infrastructure for tourism (which is seen as a means to increase national income) will have to be developed carefully Barnett *et al*., 2007).

Associate effects might include shifting coastline and shoreline erosion, partial loss of tidal ecosystems such as mangroves and seagrass and an increase of flooding. Due to the generally steep terrain of the coastline, human settlements are only expected to damage low lying areas such as Dili, Manatuto region and Oecusse.

6.2 Unsustainable fishing practices including IUU fishing

Timorese fishers are young and rely heavily on fishing as a source of income and food. Despite estimated exploitation levels, the resource condition is perceived to be good (SHC, 2009), but the increase in population in coming years will put pressure on the resource with new entrants to fisheries and the high demand for fish. The estimate total volume and value of catch from the coastal zone is still uncertain. However based on the June 2005 result from household surveys (Baticados, 2005) it was estimated that annually the coastal community landed around 80% of the total catch for Timor Leste (out of about 5,000 tons) with an estimated 1,000 tons landed by illegal, unregulated and unreported fishing vessels operating in the EEZ water. The estimated value was about US$ 5.7 million (Anon, 2007).

Dili fishers, particularly from the small island of Atauro have a higher scale of fishing operation and use various fishing gears compared to fishers from other districts. The catch and effort data are the main base line data to be collected in determining the state of resources and also fishers earning rates. Fish consumption data are also important to measure food security and quantify small scale fisheries (Baticados, 2005).

One of the most significant management challenges for Timor-Leste is that it has been left with a huge governance and capacity gap. A number of deficiencies have been identified with regard to the "system of policies, rules, procedures and institutions that sets out the powers and responsibilities of Government and other stakeholders with regard to environmental and natural resources management" (Anonymous, 2008). These include: a) Absence of legal-regulatory framework; b) Lack of coordinated policy-making; c) Weak enforcement capacities; d) Basic technical, scientific data and information gaps; e) Lack of infrastructure and equipment; and f) Weak institutional structures.

The people have identified agriculture, education and health, as the top three priorities for themselves and for their country. Thus, in general, the top three priorities of the people of Timor Leste are education, health and agriculture including fisheries and forest (jobs/sustainable livelihoods, income and food security). These are also key components for poverty reduction and major elements of the Millennium Development Goals (MDGs),

With the gradual increase in coastal areas occupation, the fishing pressure caused by the subsequent increase in the number of fishing craft/boat/vessels and their technological changes, tactics and strategies to maximize the catch should be identified and well documented through the best statistical landing and effort data. Fishing activity makes a significant contribution to the food security and economic well being of the region. However increased over exploitation and illegal fishing practices cause depletion of many stocks. Timor Sea is the area in which deep and oceanic waters with pelagic migratory fish are the main target species.

IUU fishing occurs in the Timor Sea and has become an important issue related to national Policy and Strategy for Fishery Development (Anonymous, 2007). An ATSEA-Timor Leste Stakeholders meeting and consultation held in Dili in September 2008 and February 2009 also informed that Illegal fishing occurs in Timor Leste waters.

6.3 Alteration, degradation and destruction of coastal and marine habitats

The agriculture, forestry and fishery industries became major contributors (30%) to the GDP in 2001 and more than 40% of the population existed below the national poverty line (Anonymous, 2004 and Candido and Ximenes, 2006). The yearly rural population growth in 2006 was about 4.8% and contributed around 73.5% of total population (World Bank, 2008). It is obvious that the country has a limited capacity to support the basic living needs. Rapid development of coastal cities and towns, villages, the airport and port facilities in Timor Leste, as part of a new developing independent country, will need to be sustainable. This situation could be a major contributor to the upland and coastal habitat degradation within the next coming decade without a proper national development plan.

In the coming years, coral reefs will be the focus of the marine ecotourism programs for the country. Several diving spots are already established by the Ministry of Tourism and concepts on diving and sport fishing licensing is already part of a national tourism action plan. Concerning the need to support the daily life of coastal communities with limited financial capacity and the increasing demand for coral fish consumption the marine tourism could offer an alternative livelihood. Several recent projects to identify the coral reefs status have revealed they are still in medium and high risk condition (Burke *et al*., 2002). Although gaps in the information still exist Timor Leste Marine Parks establishment (e.g. Nino Santana National Parks) will help to sustain the existing coral reefs in the area.

Impacts from upland man-made degradation and modification of catchments areas could threaten coral reef degradation. Monitoring the status of coral reefs along the coast should be carried out to keep biodiversity in good condition. The state financial capacity should be increased to support this status. Environmental conditions in the marine and coastal areas of Timor Leste are good for the north coast. However, increasing market demand on living coral and its associated fishes and destructive fishing practices (bombing coral reefs, and cyanide fishing) (ABC News, 2007 *in* Wever, 2008) could have significant negative impacts on biodiversity and endangered species if it continues. Corals are also harvested for building materials.

6.4 Land-Sea based sources of marine pollution

The extent of pollution in coastal and marine habitats is unknown due to limited monitoring. From previous restricted observation and studies it appears that the scale of environmental pollution is still relatively low and confined to some (mainly urban) areas (Sandlund *et.al.*, 2001 *in* Wever 2008). The main source of pollution in previous years is from household waste (food scraps, paper, plastic, cardboard, bottles, grey-water), construction (metal shaving, used tin, asbestos), agriculture (non-organic fertilizer, pesticides), motor vehicles (smoke, used oil), and tourism (liquid and solid waste) (Conceicao, 2001 *in* Wever, 2008).

Solid waste from imported goods tends to increase significantly since there are visitors from international organizations living and working in the country. Solid waste collection and disposal is currently estimated to be provided for 60% of households in Dili and none in other towns, sewage collection ranges between 60-76% from major urban settlements, urban drainage collection and disposal between 45-55% and rural sanitation covers 13% of all households (Australian Water Research Facility, 2006 *in* Wever, 2008).

Environmental pollution including biological, chemical and physical could impact on the coastal zone in multiple ways. In urban areas, surface runoff, untreated waste water and septic tank leakage can contaminate coastal and marine habitats and pollute ground water. In rural areas, river pollution from agricultural practices such as use of fertilizer and pesticides and increased sediment loads from forest fragmentation can impact on coral reefs and fisheries. Regarding the development progress of Timor Leste, pollution to date is relatively low, though this could change rapidly when economic development takes off. Sectors being developed that could became a source of pollution include industrial estates, business centers, expanding harbor and airport, agriculture, hospital, oil and tourism

Deforestation and catchment degradation could also become a source of land based pollution. With an estimated total forest area of 1.4 million ha, which is equivalent to approximately 53.7% of forested land cover, and in which 350 thousand ha might be under threat of degradation and deforestation due to a long history of exploitation (Nune, 2003). Another historical cause of deforestation is uncontrolled firewood collection. It is estimated that each household requires, on average, 24kg of firewood/day. Increasing population growth and urbanization and fixed forest areas could pose a big challenge in particular for urban areas such as Dili where firewood is scarce (RDTL, 2007 *in* Wever, 2008).

Deforestation in combination with unsustainable agricultural practices has impacted on the catchment condition, contributing to erosion, soil loss, siltation of riverbeds, increased water turbidity, rapid water runoff, landslides and flooding (Australia Water Research Facility, 2006). This has led to an increased amount of sediment carried to estuarine areas and reefs which can impact on productivity and health of coastal ecosystems and in the long-term it could change the species composition and abundance. Moreover it can threaten the ecological integrity of wetlands and coastal reefs (Gao, 2006 *in* Wever, 2008).

In Timor Leste, the impact of increased sedimentation is relatively unknown particularly in the south coast where the continental shelf is wider and has a gentler slope and there are more river deltas and floodplains in which material can be accumulated (ATSEF, 2006 *in* Wever, 2008).

7. Recommendations on measures to address each identified transboundary threat and impact

A synthesis of the broad issues on transboundary problems has been described in order to identify perceived major root causes. The recommendations correspond to the issues of utilization of the resources, understanding of the existing environmental variability and healthy ecosystems. These all relate to global issues and internal capacity building. Prioritising and generic actions on possible pathways for solutions are described as follows:

7.1 Sustainable management and utilization of resources

The policy and strategy for the fisheries development in Timor Leste outlines the general umbrella that should be adopted for its development plan for present and future generations. Five key objectives outlined in Timor Leste Common Fisheries Policy should be strengthened through (i) optimum use and management of living resources, (ii) ensuring the health of its supporting habitats, (iii) facilitating fishing and (iv) aquaculture industry development, (v) developing cost-effective fisheries institutions (Anon, 2007). These fisheries matters are complex from inshore to offshore capture activities. Due to resource depletion in some fishing areas, some the operators move as migrant fishers to the other area seasonally. Some of them are fishing with a bigger size and semi-industrial fleets with higher fishing capacity.

7.2 Assessment on environmental variability

The climate in Timor Leste is expected to be hotter, drier and more variable over coming decades. This means that there will be less rainfall, more el-Nino events and associated droughts. Reduced rainfall produces negative impacts on agriculture productivity as a basis of food security and causes freshwater shortages, while high intense rainfall may result in increased soil erosion, flooding and landslides. By becoming a member of UNFCC in 2006, Timor Leste has the opportunity to receive financial and technical assistance to adapt to climate change to prepare the National Adaptation Plan of Action (NAPA).

Regarding ecosystem impacts and improvement of ecosystem health, management pollution, predictability on “man-made” habitat degradation and its impacts, action should include: capacity strengthening and training on transboundary concerns including setting up the local database management system; regional networking and international linking; assessment and prediction capability on adaptation to climate changes; policy harmonization and development; development of regional framework for assessment and establishment of effective surveillance and enforcement agencies; and development of stakeholder participation structures.

8. Recommendations on potential demonstration sites based on their global significance

The coastal ecosystems in the waters around Timor Leste and its small islands should be managed to conserve biodiversity and to enhance local livelihoods. The potential demonstration sites will contribute to maintaining existing biodiversity (coral reefs, seagrass beds and endangered

species) including adaptation and mitigation of the global climate changes in the trans-boundary waters of ATS and reduce some of the human causes of degradation (e.g. over fishing, endangered species declines and destructive fishing). A work plan on fishery development with easily understood background and perspectives should be generated through common fishery policy and implemented by all stakeholders.

8.1 Some potential activities

- Dili and Atauro Island represent the most densely populated district in the north coast. Lautem district and Jaco island represent the National Park and Marine Protected Area and one district representing the south coast could be set as a priority site in the Timor Leste Biodiversity Action Plan.
- The waters around Dili and Atauro islands are considered as the biggest local fishing ground. The conserved ecosystems will support sustainable fisheries in the region. Recently, the Timorese government has approved a development plan, in which marine tourism and fisheries are important in economic activity. Terrestrial and marine ecosystems, and endangered species are assessed as having a high potential for tourism development.
- Over the recent past, Nino Santana National Park in the eastern part of the country focused on forest conservation, and considered the surrounding marine area as a buffer zone for the park. Further planning and better management of this marine zone are urgently required. Central government could invest strongly in forest protection, reforestation and development of tourist infrastructure. State and private businesses have also invested in tourism and diving spots. They are willing to cooperate in order to foster an environment for sustainable investment.
- Improvement of existing marine and fisheries management, local artisanal fishery markets access to regional markets through capacity building, technical assistance, improved infrastructure, and regulation, and monitoring and consideration of the use of market mechanisms and economic incentives to promote sustainable fisheries practices.
- New and diversified livelihood opportunities for improved food security through community-based fisheries and sustainable aquaculture (i.e. potential for replication of pilot aquaculture initiatives from West Timor to Timor Leste), or small-scale local cultural/marine ecotourism.

Demonstration projects activities will have to cover three levels. There is the special need for awareness, education and capacity building of all stakeholders at all levels. Meanwhile, collection and acquisition of data and information for management purposes, integration mechanisms and awareness education receive more consideration at the district level. Establishment of suitable management models depending on characteristics of ecosystems and recent management will be focused at a sub-site level. The outcomes of the program will be presented clearly at the site level with some areas continuing to be managed in suitable ways and maintained after the closure of the programs.

The immediate objectives of demonstration projects should be to:

- develop and establish a coordinating mechanism among central and district sectors in the management of coral reefs and seagrass beds in coastal waters;
- execute studies and monitoring activities in order to collect data and information for planning and management purposes;

- enhance public awareness and improve management capacity for policy makers, managers and local communities in resource conservation and environment protection;
- improve environmental management (reforestation, waste management) to minimise negative impacts on coastal ecosystems;
- establish important sites managed as pilots with the involvement of park authorities, local fishermen, tourist sector operators and others as appropriate;
- execute pilot activities in financial sustainability at demo sites; and
- the participation of different stakeholders in activities to enhance the living standards of local communities via sustainable fisheries and involvement in tourist activities.

These activities will help all related departments at the state level, district authorities, businesses and communities in the country to increase their awareness of the importance of coastal ecosystems and the need to harmonise development and conservation. Management capacity of National Parks, Ministry of Environment and Economics, Ministry of Agriculture and Fisheries including fishery protection and district representatives will be strengthened to meet the management requirements. Information exchange and management integration with Australian and Indonesian colleagues should be developed and shared as part of a pilot project demonstration as bilateral partnerships on an ecosystem approach to sustain ATS marine biodiversity.

Marine Protected Areas (MPAs) feature heavily in Timor-Leste's policies for sustainable living resources, with the Nino Konis Santana National Park and Marine Park established at the eastern end of the Island. The park has been identified as possibly being of World Heritage value.

Recognizing the importance and potential of coastal and marine resources, despite its limited financial capacity and competing development priorities, the Timor-Leste Government recently completed a joint 'Timor Leste Coastal Marine Habitat Mapping for Tourism and Fisheries Development Project' including a suite of 6 projects in partnership with CDU/AIMS/NRETAs/ANU/UNDP. This work will greatly assist the TDA and SAP/NAP processes and identification of potential projects to be implemented under ATSEA.

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Resume of Stakeholders Consultation

Dili 19-20 February 2009.

Date	Time	Place	Person involved	Activities, data and information on (legal aspects, Institutional Capacities, Draft Policies, Relevant Issues, Path of solution)	Document available
18/2	01 pm		1,2,3	Arrived at Dili	
	03 pm		1,2,3	Day to day consultation schedule	
19/2	08 m	Division on National Parks Directorate of Forestry Secretary state for Agriculture, Forest and Fisheries	2,3,4,5,6,7, 8	- Technical information, existing law and regulation but not declared yet - Declaration of National Parks, - Concept of Action Plan (postponed due to limited financial capacity - National Park of Nino Konis Santana - Map of Marine Parks (200 m from the coast line fot subsistence fisher) - Species protected - Endemic species of seasonal sea worms for foods, lake ?? species depleted due to introduction of tilapia for aquaculture. - There is certain similar fresh and marine water fish species - World heritage (ANU finding on archaeology) - Socio-Cultural specific, local wisdom - Biodiversity values of marina species - CBD-IUCN - MPA (58,000 Ha, 3 nm) - Data base Flora Fauna available - Data base Birds available - Data base Marine Fauna (under preparation under collaboration with NT - Sept-Nov are nesting period of sea turtles (sp ??) in south coast of TL - Law and regulation still on discuss at Ministerial level - Loss biodiversity – low capacity to support basic living needs - Mangrove fragmentation due to population migrate to coast - Limited economic and social structure - Land degradation impact on coral reefs - Difficult to monitor and assessment - poorly plan natural resources	- Map of Marine Parks - Book The Birds of TL - Important Bird Area in TL

Date	Time	Place	Person involved	Activities, data and information on (legal aspects, Institutional Capacities, Draft Policies, Relevant Issues, Path of solution)	Document available
	10.30 am	Directorate of Forestry	2,3,10	- Legal Institutional Aspects - All law and regulation still on process at secretary state of environment, ministerial and parliament levels. - Basic regulation (UNTAET) and improved gradually to State law and regulation - regulation 17-2000, deter illegal logging - regulation 19-2000, protected area (15 sub areas including marine, islands and birds) - rapid legal and technical guideline (UNTAET transition) - National Forestry sector policy (3 languages) as a baseline on implementation - Forest Management Ministerial decree will be declared in April 2009 - land degradation due to habitat modification (no data but visual indicators, 1 hour rain, Dili always flood recently - coral reef degradation - Forest Fragmentation - ratification on CBD, climate change, land and Habitat degradation - GEF Watershed Management - GEF Sustainable Land Management (SLM) - GEF Clean Development Management (CDM) - intensive and regular ministerial meeting and consultation - Man made plantation on tertiary forest area - Strengthening ministerial coordination meeting	
	12 am	Break			
	02 am	Ministry of economy and development National Directorat of Environment	2,3,11, 12.	- environment law and regulation (adopted from INA) - environmental impact assessment (adopted from INA) - pollution controls (2003) - environmental impact assessment (2003) - 2008 pollution control and EPA under support by World Bank - issue on Oil spill - Birds Protection Area Survey (2003-2008) - Habitat degradation - Strengthening the Basic environmental ACT - Marine and Mountain Biodiversity not available - collaboration with WWF to study on Protected Area and explore species - Forest Fragmentation (Primary, Secondary, Tertiary - Wild grass dominated the land (probably due to invasive species) - Habitat degradation worst due to population growth and limited jobss - Extension program not available due to limited staffs and capacity - weaknesses of Dissemination and implementations at district and sub district levels	

Date	Time	Place	Person involved	Activities, data and information on (legal aspects, Institutional Capacities, Draft Policies, Relevant Issues, Path of solution)	Document available
				- Lack of public awareness	
	05 am	Break			
20/02	09 am	National Directorate of Tourism	2,3,13	- Draft Policy and strategy on process to Counsellor Minister - Land, Marine and cultural Ecotourism - Prior to Marine tourism - core product : Diving TL (expose in S'pore) to promote visit TL - Sport fishing is one of the tourism object - Concept on licensing on Diving and Sport Fishing - Zoning at North coast (Dili. Liquisa, Baucau, Los Palos; no data in south coast - HRD, Promotion and Community Based Development. - International legal instrument UN World Tourism Organization - problem : Accessibility, infra structure, Aviation, communication, electric power, high living standard, limited accommodation - Foreigners come to TL, Indonesia, China, Australia, S'pore, Korea, Philippines. - Environmental Impact Assessment - Kyoto Protocol - MoU with Private company of S'pore - 3 cluster Tourism Zone	- Draft Map of Tourism Zone - Draft Tourism Policy
	10 am	Secretary of State for Environment Directorate of Environment	2,3,11	- Activities under Multilateral environmental Agreements - Ratification on Convention : CBD, Climate Change, Land Degradation, UNCCD, UNFCC - GEF through INC (identification on problem related to climate changes) - Kyoto Protocol - UNFCC COP (14) - Stocking consultation - National Adaptation Plan of Action (NAPA) under UNFCC - National Biodiversity Strategic Action Plans (NBSAP's) under CBD (Marine, Mountanious, Agricultural, Forest, Inland (lake, river, freshwater), Island (Jaco, Atauro) - Program of Work on Protected Area (PoWPA) - Sustainable Land Management (SLM) under UNCCD - CTI (Coral, Fisheries, Food) - Partnership in the Environmental Management for the Seas of East Asia) PEMSEA to organize an integrated coastal resource management. - ATSEF, a joint project among three countries (Australia, Indonesia and Timor Leste) to conserve transboundary marine biodiversity among these countries - GEF Country Support Program, deal with environmental education and public awareness campaign. - Vienna Convention and Montreal Protocol still under cost-benefit analysis	- NBSAPs - Activities under Multilateral Environment Agreement

Date	Time	Place	Person involved	Activities, data and information on (legal aspects, Institutional Capacities, Draft Policies, Relevant Issues, Path of solution)	Document available
				- inception workshops (sharing idea between share holders) - Designated National Authority (DNA) approved Clean Development Mechanism (CDM)	
				- Inter Ministerial Workshops (evaluate program, constrain and achievement) - Alternative energy (Solar, Biogas, Hydropower) are being proposed - Degradation of Local wisdom	
	11.30 am	FAO-counterparts	2,3,14	- FAO – coastal community development program - Report not in English - Survey of coastal community states - Data not available due to no officer in charge	
	12 am	Break			
	02 pm	Secretary state for Agriculture, Forest and Fisheries Directorate of Fisheries and Aquaculture	1,2,3, 16,17,18,19,20,21,22, 23,24,25	- Structure organisation still on progress to be declared - Policy at State Secretary and National Director on Fisheries and Agriculture. - Technical policy at 4 Directorate i.e. Dir. Fisheries Inspection, Fisheries Resource Management, Aquaculture and Salt culture, Industrial and License - Fisheries Inspection : (MCS, violation, infrastructure) - Fisheries Resource Management (Conservation, Coastal management, Fisheries Resource, Research) with Database concept on estimation annual production, catch by gear, identification protecting area, empowerment coastal community, fish stock assessment, updating total allowable catch. With estimated total population of 923,198 people (2004), 5000 among them are fishers of 1095 groups. 151 fishing centers. Problems : lack of data collecting specialist, no landing place, inadequate human, technical, financial and infrastructure capacity to access all 13 (?) districts and more than 30 sub district, no guideline on conservation on mangrove, coral reefs, seagrass. Fish more difficult to catch, some certain species tend to disappear, mangrove fragmentation due to high fuel price, decline of commercial stocks and non-optimal harvesting techniques. Uncertain ecosystem status and its variability. Limited support of dissemination of fisheries law, habitat degradation due to limited alternate livelihoods, deterioration in water quality around the estuarine due to land and river degradation (continuous river sand exploitation related to building constructions. Inadequate tool assessment. Two type of coastal community (the indigenous community with local wisdom on protecting area and migrating temporary mountain inhabitant with lack of public awareness). MPA pilot project exist in Bobonaro and Atauro. Limited transportation, fish price very low at landing place. Some fishing gears improvements exist at Atauro. Gill net with 2 pieces length, hand line and bottom longline. FAD's operated through a group of fisher on 8 month a year with catch ranged between approximately 1 ton/month/group fisher. Lack of gear and fisher capacity.	- Draft A Policy and Strategy for the Fisheries Development 2007. - Final Report of Thailand and Timor-Leste Joint Survey on Fishery Research and Oceanographic Observations in the exclusive economic zone of Timor Leste.

Date	Time	Place	Person involved	Activities, data and information on (legal aspects, Institutional Capacities, Draft Policies, Relevant Issues, Path of solution)	Document available
				- Industry and Licensing (License, fishing port, Laboratory, Fishing gear, extension). Recently there are 5 fishing licenses to boat > 20 GT long liners, joint with Thai fishing company, observer on each operating vessels in Southern part of the Island. Since 2006 a total of 868.2 tons of fish were exported. Narrow coastline and EEZ deep-drop-off water trench. Problems:	- Draft Report on Socio-economic Issues in Fishing community and indicators to monitor and evaluate sustainable fishery development in Timor Leste
				Observer reported there are some illegal fishing boat occurred at some fishing zone. Migrating traditional fishers found at certain fishing season. No baseline data on estimated harvesting strategy. Average domestic price was 1.50 USD/kg (2007). Fishing contribute around 1.4% (2004) and 2% of GDP (2007). Catches dominated by small and large pelagic fish, some large food demersal and deep coral fish are currently being landed. - Allocation of use rights were divided into 5 zones i.e. A= 200 m for artesian; B = 3 nm for semi-industrial, C = 12 nm for National Industrial at southern coast of Viqueque; D = 6 nm for foreign semi-industrial at southern coast of Viqueque; E = 18 nm for Foreign Industrial at southern part facing sahul bank. - Aquaculture (Mariculture, Aquaculture, Pest Prevention, Saliculture) info not available	monitor and evaluate Sustainable fishery development in Timor Leste.
	05 pm	Break			

No.	Person involved	Expertise
1	Mr. Agusto Fernandez	TL ATSEF Focal Point/ Director of Fisheries Resource Management
2.	Mr. Constancio DS Silva	TL NC ATSEA- Head of Prosecution of Fisheries Inspection of NDFA
3.	Mr. Duto Nugroho	TL NC ATSEA – Biodiversity and Oceanography
4.	Mr. Fernando Santana	Head of Divisi of National Parks
5.	Mr. Pedro. Pinto	Technical staff on National Parks
6.	Mr. Gil Fernandez	Technical staff on National Parks
7.	Mr. Adelino Rozario	Technical staff on National Parks
8.	Mr. Constantino Hornay	Technical staff on National Parks
9	Mr. Manuel Mendez	Nat. Director of Land Protection and Nat. Park
10.	Mr. Mario Ribero Munez	Nat. Director of Forest
11.	Mr. Carlos Ximenez	Nat. Director of Environment
12.	Mr. Mario Ximenes	Finance and Administration
13.	Mr. Jose Quintas	Nat. Directorat of Toursm
14.	Mr. Fernando Da Silva	Env Advisor
15.	Mr. Narciso Almeda Carvalho	Nat. Director of Finance and Admin of MAF
16.	Mr. Constancio Santoz	Sub div. MCS
17.	Mr. Albino Soares Pinto	Sub div. Aquaculture
18.	Mr. Henrique S. Barreto	Sub div. Aquatic Resource Management
19.	Mr. Joni Freitas	Sub div. Industry-License
20.	Mr. Celestino DC Barreto	Sub div. Fish Resource Management
21.	Mr. Orlando H. Khalis	Sub div. Fishing Technology
22.	Mr. Junior PS Carvallo	Sub div. Fish Resource Management
23.	Mr. Fernando da Silva	Sub div. Aquatic resource
24.	Mr. Rafael P. Gonzales	Sub div. Marine Resource Management
25.	Mr. Pedro Rodriguez	Sub div. Fishing Port

SOCIO-ECONOMICS AND DEVELOPMENT NEEDS OF COASTAL COMMUNITY IN THE ARAFURA AND TIMOR SEAS

By: Luky Adrianto

Executive Summary

Of the three Indonesian provinces within the ATS region: NTT, Maluku and Papua, NTT is considered one of the poorest and least developed provinces, with approx 30% of people living below the national poverty line in 2002 (AMSAT, 2009). The total population in the three provinces of ATS is 1.7 million (2006), the majority of which reside in the East Nusa Tenggara Province (approx 1.1 million people), followed by Maluku (380,000) and Papua (250,000). Approximately 50% of the population of NTT lives in coastal villages.

Each of these provinces contain diverse ethno-linguistic groups engaged in various multiple livelihood strategies, with some villages almost entirely dependent on agriculture and some who are entirely reliant on marine-based resources for food and income. The region is characterized also by high numbers of out migration especially in NTT. Migrating fishers and often families of Bajo, Bugis, Butonese, and Makassarese from other areas of eastern Indonesia travel seasonally to key ports and fishing grounds searching for high commercial value products such as trepang, trochus shell, live reef fish, and shark fin. They compete for largely open-access and unmanaged resources (small scale fishers are exempted from licensing), contributing to declining habitats and reef resources in some areas. Various groups also engage in transboundary fishing in the Arafura and Timor Seas.

Fishers from various settlements in NTT - districts of Rote Ndao, Kupang and Alor, both within and surrounding islands are engaged in transboundary fishing in the Timor Sea. For example in 2008 over 550 fishers from Rote and Alor were active at Scott Reef inside the AFZ. These fishers and their families are among the poorest of the poor, with recent World Bank statistics citing 53% of fishing families below the poverty line (Fox 2009). Many of these fishers in ATS region occupy a weak link in the marketing chain, which is often dominated by a few key buyers or managers with ties into S.E. Asian markets, lack of infrastructure and access to capital, limited assets, perishable nature of products sought, limited access to markets and marketing skills and poor business planning (AMSAT, 2009).

In Maluku Province, 92% of the area is sea. The main town of Dobo has long been a trading centre for marine products and a staging post for voyages into shared seas to target a variety of products. Fishers from Aru Islands, Kei Islands (Tual) and Tanimbar Islands (Saumlaki) as well as smaller islands to the west of Tanimbars depend on local resources for fishing and aquaculture. Main activities include reef fisheries, pearling and bottom trawling for fishing and seaweed, as well as grouper aquaculture and some distant shore voyaging. The Province also hosts various communities of maritime ethnic groups such as Bajo, Bugis and Butonese who engage in migratory livelihood activities particularly to Aru and Tanimbar Islands.

In Papua, the port town of Merauke provides a focus point for ATS fisheries, both industrial and artisanal scale and a number of settlements (e.g. Pintu Air on the periphery of Merauke, the fishing village of Lampu Satu (2 km to the east) and the boat building village of

Kumbe (60 km to the Northwest) host indigenous people and fishers belonging to migrant Bajo, Bugis and Butonese who access shark and trepang in the Arafura Timor Seas. Local communities engage in small scale coastal fishing, working as laborers, and trading along the Eastern Arafura Coast. There are a number of local fishermen from elsewhere, dominated by the Bugis and Butonese, mostly in the Mimika District. Very few indigenous people of Papuan descent live on this coast.

In terms of community livelihoods in East Nusa Tenggara (ENT), out of 2,543 villages in this province, 639 of them are considered as coastal villages with a total population of 1.1 million or 29% of total population in East Nusa Tenggara Province. Among these people, 101,522 people or 9% of total villages depend on the coastal and marine resources as fishers and 9,996 people as fish farmers. Indrawasih (2005) reported that fishers of East Nusa Tenggara originated mainly from outside of East Nusa Tenggara from places such as South Sulawesi (Bugis tribes) and South East Sulawesi (Buton tribes). Although they originated from outside this region, the government of East Nusa Tenggara considers them as local people, for example in the Oesapa Village, Kupang District, or fishers from Buton who are known as local people in Namosain Village, Kupang Town. Fishers from these two tribes (Bugis and Buton) are acknowledged as the fishers who taught local fishers from Rote Ndao and Timor. Most of them are traditional fishers who use small fishing vessels and traditional fishing gears such as net and fishing line. The levels of income from artisanal fishers and industrial fishers are variable. Industrial fishers typically use more sophisticated fishing gears and equipment to catch more economically valuable fish species.

Similar to the ENT region, most coastal communities in the Maluku Region of ATS (Aru Islands, Maluku Tenggara and West Maluku Tenggara) are fishers and depend on marine fisheries resources. In the case of Aru Islands District for example, the number of fishers reported were 24,693 which are dispersed into three sub-districts; P.P Aru (8,849 fishers), Aru Tengah (8,812 fishers) and Aru Selatan (7,037 fishers) (Aru Island District Local Fisheries Agency, 2008). Non-powered boats dominate the structure of fisheries in the Aru Islands. The total number of fishing vessels is 2,542 units, 50% of which are non-powered fishing vessels followed by motored-fishing vessels (843 units). In the Aru Islands traditional fishing gears such as line-fishing, spoon-fishing and collection-fishing dominate. The total number of this type of fishing gears is 14,677 units or 76% of total number of fishing gears in Aru Island District.

In terms of fisheries production, Aru Islands District is reported to catch around 24,966 tons with a value of approximately IDR 128 Billion. Using the cateris paribus assumption, it is estimated that the economic value of fish production per fisher in Aru Island District is IDR 5 million per fisher/per year or not more than IDR 433,103 per fisher/per month, which is a relatively high income for local fisher households. The net value is not more than IDR 250,000 per fisher/per month. Common fishing activities in this area are trawl fishing. In some cases, trawl fishing has been claimed as the source of increasing water turbidity which affects the productivity of mariculture in the Aru Islands District, such as pearl culture, and in the long-term can increase potential conflict between traditional fishers. Benjina is one fisheries activity center in Aru Islands. This location is used as a fishing base for one leading fishing company in Indonesia namely DGS (Daya Guna Samudera Company).

From a social perspective, local fishers in Aru Island are claimed to have a transitional civilization due to the history of Kei Islanders who came in to this area in ancient times. However, from a physical point of view, the original local fishers of Aru Island are more like Papuans who do not want to be called Kei Tribes, but do not want to be called Papua tribes either. *Sasi* culture (a

traditional resources management usually practiced in Maluku) is not well-known to be practiced in Aru Islands (Maanema *et al.*, 2006).

The other important region of Maluku which is included in the ATS region is Maluku Tenggara District. The southern and eastern part of this province shares a border with the Arafura Sea. This district is geographically located between 4-7 degrees LS and 131-133 degree BT. This district consist of two islands namely Kei Besar Island and Kei Kecil Island. The center for administrative activities for this district is in Tual, located in Kei Besar Island. The district of Maluku Tenggara is dominated by sea. The total area of this district is reported to be 56,000 km^2. From this area, 93% is sea area and 7% or 4 000 km^2 is land.

A common livelihood of the people of Maluku Tenggara District is fisheries. In this district, shark fishing is common. The fishers who engage shark fishing are generally from Buton, Bau-Bau and Wawoni of South East Sulawesi. This fisher group comes from Dobo, Kepulauan Aru and is based in Ut Island. Other target species of fishers in Maluku Tenggara District are Bonito (Cakalang). Indrawasih (2007) reported that it is not only Buton-originated fishers who are engaging shark fishing, but also people from Tual. Similar to East Nusa Tenggara fishers, the main fishing ground for fishers from Tual or other islands in Maluku Tenggara District are the territorial waters between Indonesia and Australia. In this case, shark fishing is risky because it is illegal with a high possibility of being caught and arrested by Australian authorities (*Illegal Fishing*). In the case of Maluku Tenggara Barat, there are 17 sub-districts (kecamatan) that are dominated by fishers. Kecamatan Tanimbar Selatan has the largest number of fishing gears at 1,875 units, followed by Kecamatan Tanimbar Utara at 1,667 units. The other sub-districts that have large numbers of fishing gears are Kecamatan Wuar Lalobar, Kecamatan Mdona Hier, and Kecamatan Selaru (DKP Maluku Tenggara Barat, 2007).

In Papua ATS region, for example in Merauke District, the condition of coastal communities is relatively similar with other types of fisheries in other ATS regions. It is dominated by small-scale and traditional fisheries which can be seen from the structure of fisheries as reported by official local fisheries agencies. In 2003, the number of non-powered fishing vessel was 1,906 units followed by 286 out-board vessels. In the case of inboard fishing vessels, it is dominated by fishing vessels with more than 200 GT capacity (195 units), followed by 165 100-200 GT vessels and 157 30-50 GT vessels. Fishers of Merauke mainly use floating gill-net and fixed-gill-net. In 2003, these fishing gears were reported to be 5,492 floating gill-nets and 6,219 fixed gill-nets in use. The main products of fisheries from Merauke such as fish-skin (*kulit ikan*), fish-fin-and-bones (*sirip dan tulang ikan*), fresh-fish, and fish-bubble (*gelembung ikan*), were marketed to other islands as well as exported over-seas to countries such as Hong Kong and Japan.

In the Papua ATS region, not everyone depends on fisheries for their livelihood. For example, the Asmat District is dominated by forest area; therefore, more than 90% of the local people depend on forest resources. However, there is certainly the potential for fishing practices in this district. Crabs, shrimps and squid are examples of fisheries resources which are easily found in the waters of Asmat District but still not yet utilized by local fishers. Most fishing activities in this area are undertaken by foreign fishers from South Sulawesi (Maanema *et al.*, 2006). In the case of Mimika District, fisheries are main livelihood of local people. However, similar to other regions of the ATS, the fisheries in Mimika are dominated by small-scale and traditional fisheries.

In terms of fishing gear, gill-net is very common in Mimika. This type of fishing gear dominates the structure of fishing gears in Mimika by constituting more than 69% of total fishing gear. The other dominant fishing gears are long-line, traps and other line-type fishing. Production

of fisheries in Mimika District is dominated by Barramundi, Crabs, Shrimps, Shark-fin-fish, and other fishes. In terms of culture-related fisheries, the people of Mimika are different from other districts in Papua ATS, especially in terms of fish consumption. People of Mimika have a relatively high level of fish consumption which is reported to be 37 kg/capita/year, which is higher than national amount of 25 kg/capita/year. The local tribe of Mimika includes both Amungme and Komoro tribes who live in the coastal area. Amungme tribe live along the area of Tembagapura and Akimugah, while the Komoro tribe live in the area east of Etna Bay to Otakwa River (Maanema *et al*., 2006).

Both tribes have special local beliefs that land (including coasts and oceans) are very important assets/resources for them. For Amungme people, land is believed to be a mother and good, while Komoro people believe that land is the mother of life. With these beliefs, resources conservation should be considered as most important for development in this area.

Section 1
Key Socio-Economics and Community Development Issues in the Coastal Areas of ATS Region

1.1. Geographical Distribution and Composition of Population

The Arafura and Timor Seas (ATS) are ecologically linked through the so-called Wallacea Biodiversity Line which is endowed with high biodiversity of coastal and marine resources including renewable resources such as fishes, coral reefs, macro and micro algae, and non-renewable resources such as oil, gas and other mineral resources. Within this area, coastal communities have, for centuries, been dependent on the resources through important livelihood systems such as fishing. In this regard, coastal communities are considered one of the fundamental pillars of the Arafura and Timor Sea Ecosystem Management

Administratively, the ATS area is the interconnected waters of three countries of Indonesia, Timor Leste and Australia. In the Indonesian context, ATS covers 11 districts from the western part of ATS (Rote Ndao District, East Nusa Tenggara Province) to the eastern part of ATS (Merauke District of Papua Province). Table 1-1 shows the districts in the context of Indonesia ATS.

Table 1-1. Districts and Provinces of Indonesia ATS

No	District	Province
1	Rote Ndao	East Nusa Tenggara
2	Kupang	East Nusa Tenggara
3	Timor Tengah Selatan	East Nusa Tenggara
4	Belu	East Nusa Tenggara
5	Aru	Maluku
6	Maluku Tenggara	Maluku
7	Maluku Tenggara Barat	Maluku
8	Merauke	Papua

No	District	Province
9	Mappi	Papua
10	Asmat	Papua
11	Mimika	Papua

Source: ATSEF (2006)

As can be seen in Table 1-1, most of ATS administrative areas are dominated by East Nusa Tenggara, which in a socio-economic context, implies that the dynamics of fishers and other resource users in this province should be a priority for consideration. Figure 1-1 below shows the administrative boundaries of ATS in the context of socio-economics dynamics of the resource users in this area.

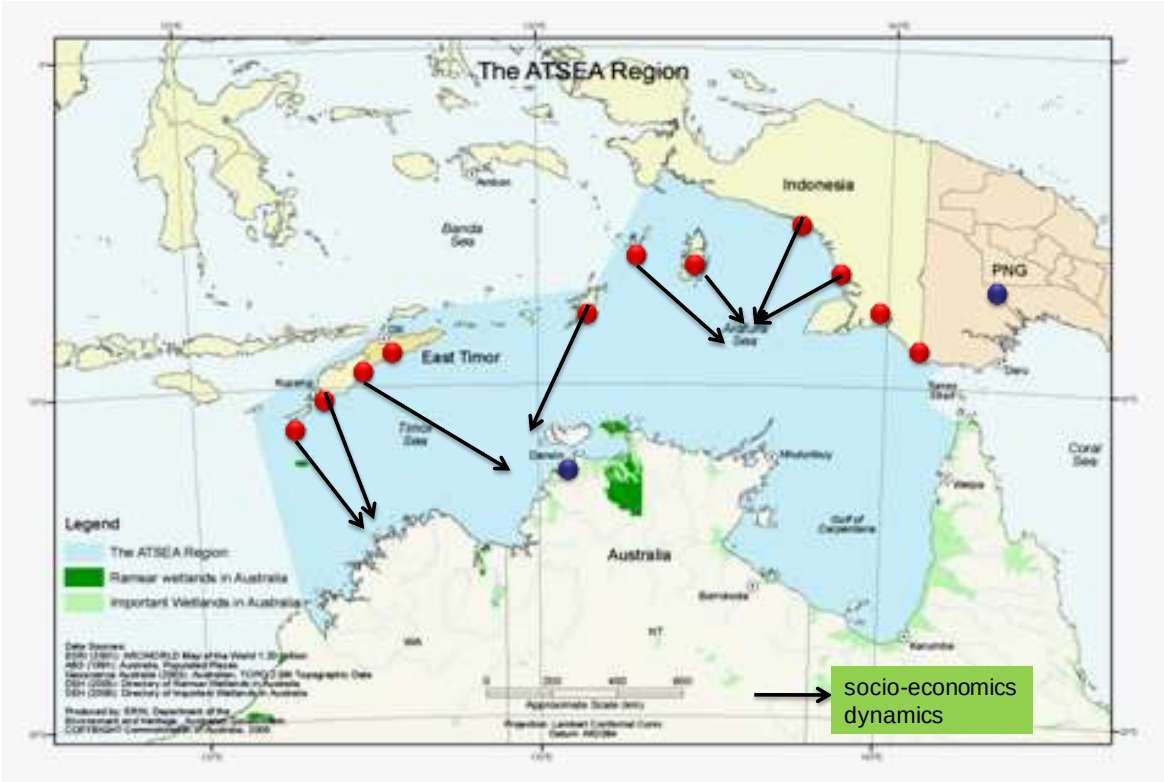

Figure 1-1. Map of Indonesia ATS Region

One of the fundamental aspects of resources in the coastal and marine areas is the demographic situation. Total population in the districts of ATS is 1.7 million which is dominated by East Nusa Tenggara Province, followed by Maluku and Papua. Figure 1-2 shows the comparison of populations by district in ATS.

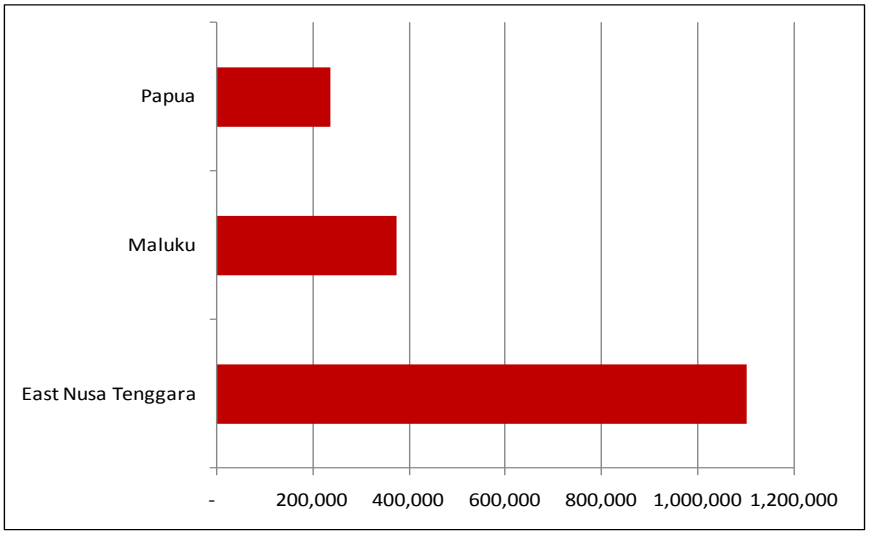

Figure 1-2. Population Number of ATS

A description of population, ethnic and indigenous resources users in ATS according to district is given below.

A. East Nusa Tenggara Province

A.1. Rote Ndao District

Rote Ndao is one of the districts under the administrative boundary of East Nusa Tenggara Province. The total population of this district in 2006 is 106,271 composed of 53,766 males and 52,505 females. The largest sub-district of Rote Ndao is the coastal sub-district. Figure 1-3 shows that the population in the Sub District Rote Barat Laut is the largest in the Rote Ndao District, followed by the Rote Barat Daya and Lobalain.

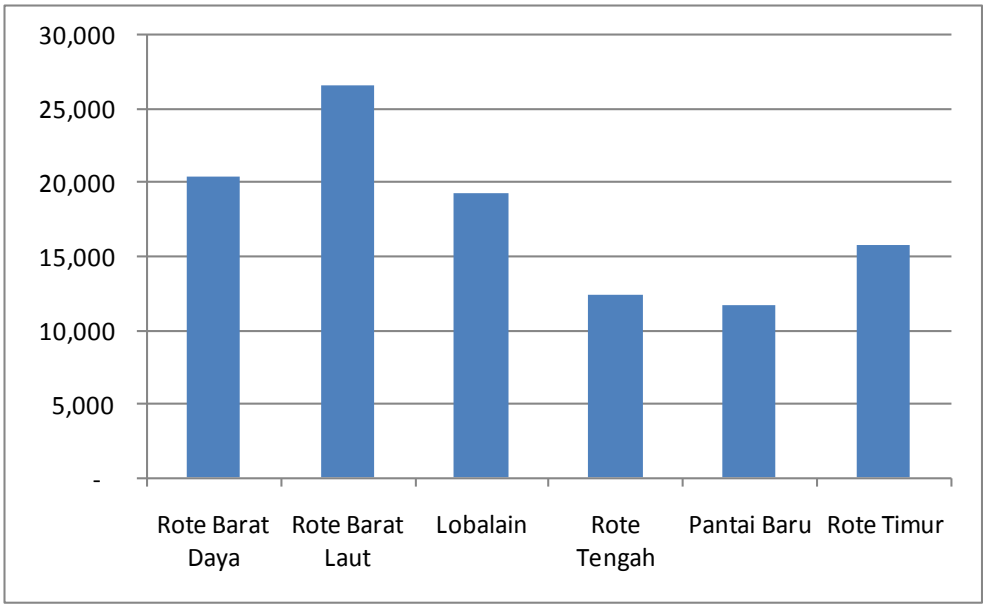

Figure 1-3. Population Composition of Rote Ndao District (2006)

In the context of sex ratio, the population structures in most of the sub-districts in Rote Ndao have more males than females, with Rote Tengah as an exception (Figure 1.4). From a gender perspective, standard patrilineal communities exist in the region.

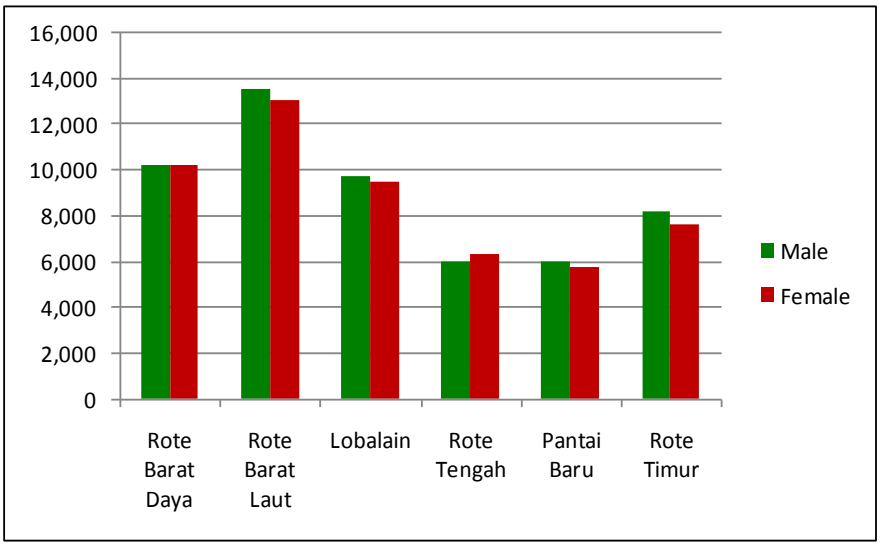

Figure 1-4. Composition of male and female population in the Rote Ndao District

Lobalain Sub-District is the most-dense sub-district with more than 120 people per km^2 living in this sub-district. It is followed by Rote Barat Daya Sub-District and Rote Barat Laut Sub-District. The other sub-districts have considerably lower population density. Figure 1-5 shows the density of Rote Ndao District according the sub-district in 2006.

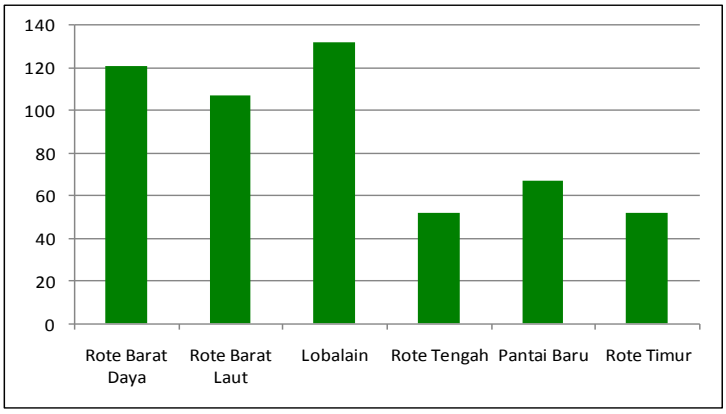

Figure 1-5. Population Density of Rote Ndao District (2006)

A.2. Kupang District

Kupang is the central capital district of East Nusa Tenggara Province, with a total area of 5,898 km^2. The total population of this district in 2006 was 195,790. As presented in Figure 1-6, Kupang Timur Sub-District (kecamatan) is dominating the population structure due to its position as the central hub of the district. This figure is followed by Kecamatan Kupang Tengah and Sabu Barat. The smallest population in Kupang District is in the Kecamatan Ambang Barat Daya.

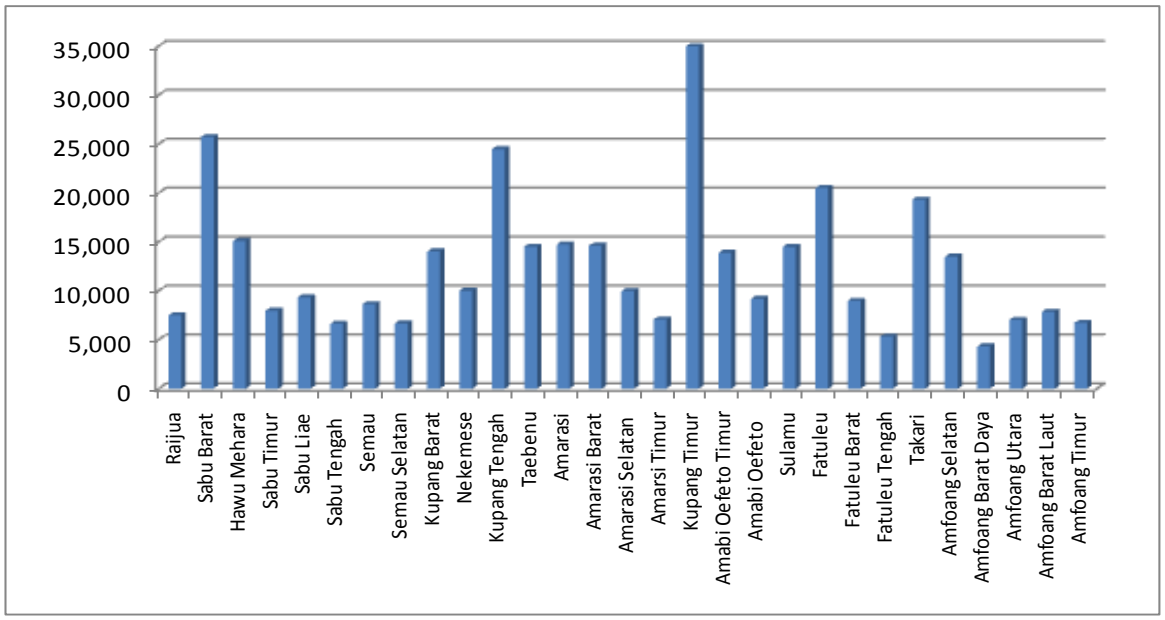

Figure 1-6. Total Population of Kupang District by Sub-District

Similar to Rote Ndao, the number of males is usually higher than females in the sex composition of population (Figure 1-7).

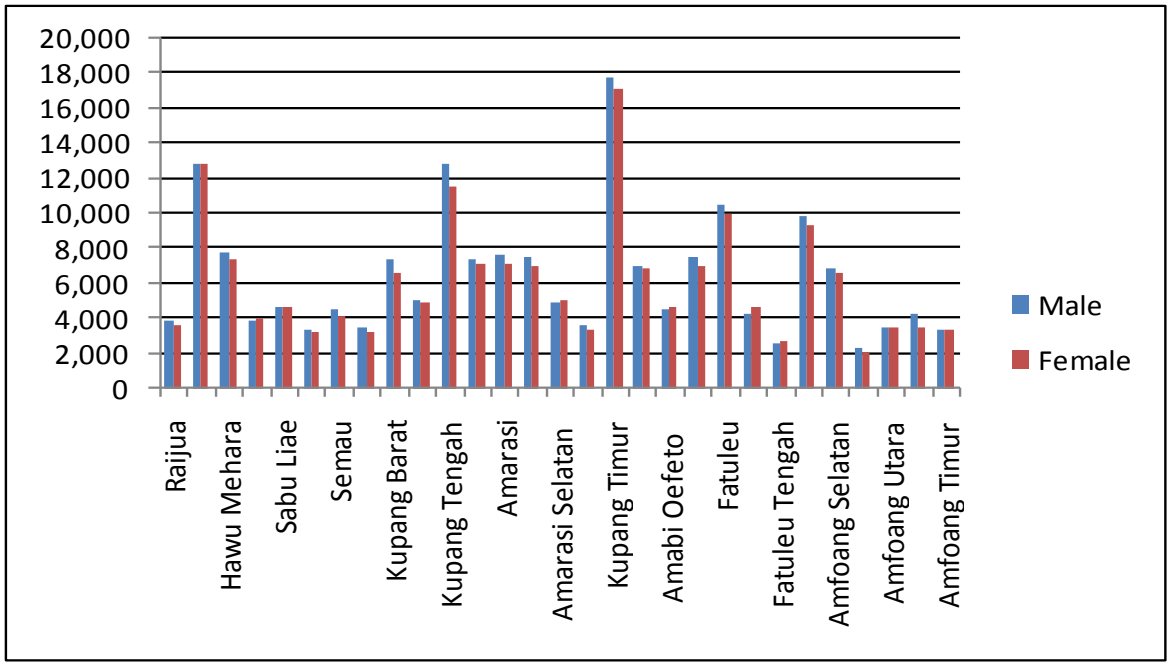

Figure 1-7. Population Composition of Kupang District (2006)

Sub-districts Kupang Timur and Kupang Tengah could be considered as the most-dense sub-districts. This is due to the position of these sub-districts as part of the capital district of East Nusa Tenggara Province. Figure 1-8 shows the population density of Kupang District according the sub-districts.

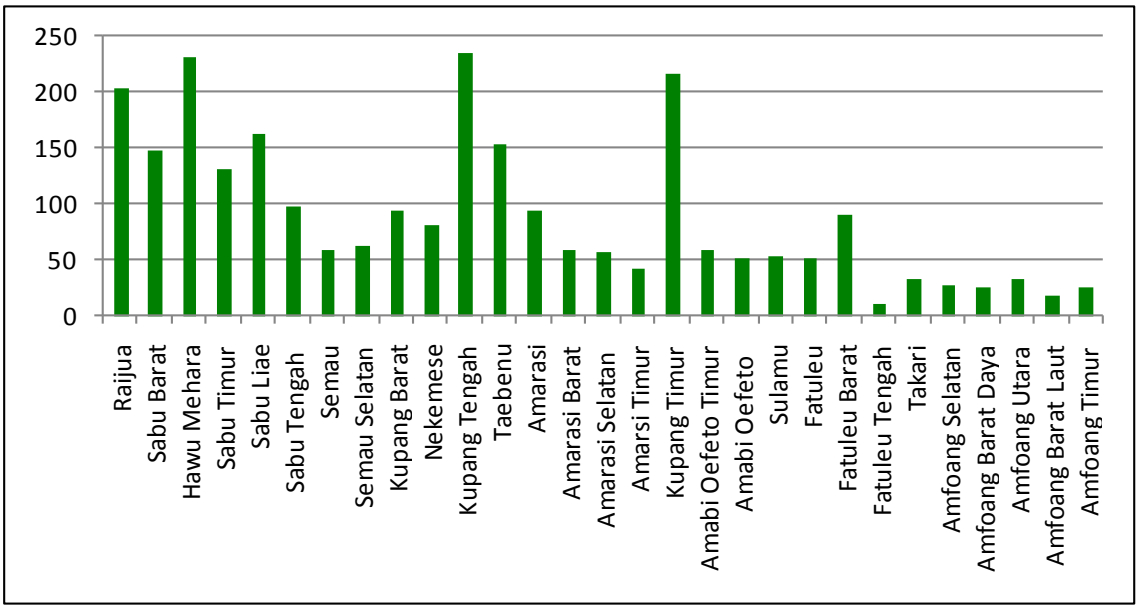

Figure 1-8. Population Density of Kupang District (2006)

A.3. Timor Tengah Selatan District

Another district within the East Nusa Tenggara Province which includes part of ATS is Timor Tengah Selatan District (TTS District). TTS district has an area of 3,947 km^2 with a total population of 421,980 (2005). Kecamatan Amanuban Barat is the most populated sub-district in TTS District, followed by Kecamatan Amanuban Selatan and Kota Soe.

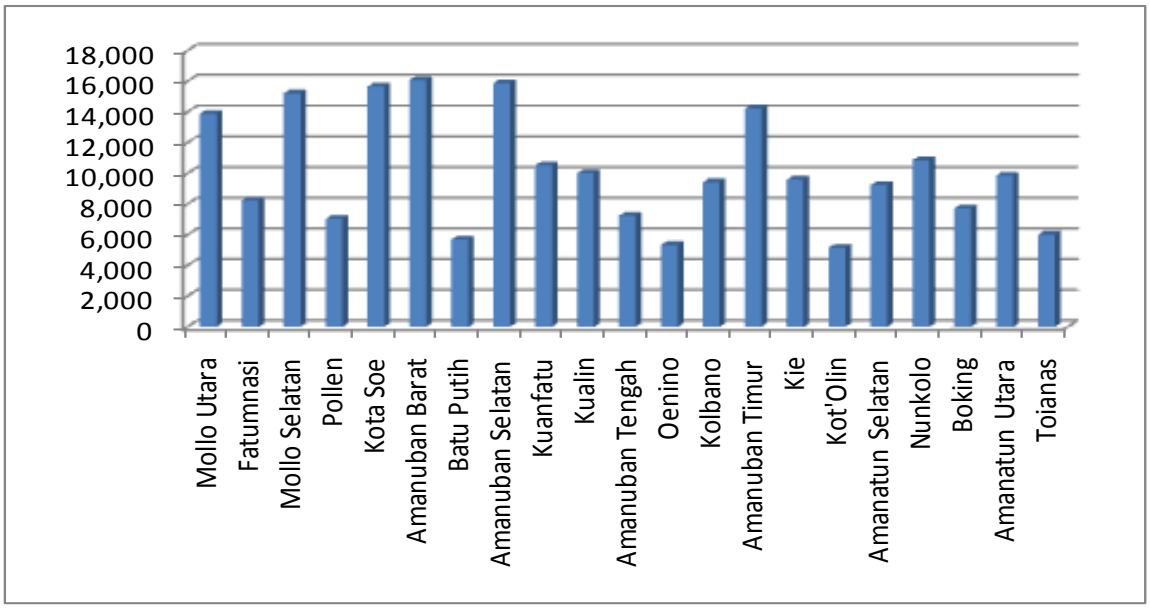

Figure 1-9. Population of TTS District, East Nusa Tenggara Province

There is no significant difference in the male/ female composition of TTS population. Figure 1-10 below shows the population composition in TTS District (2005).

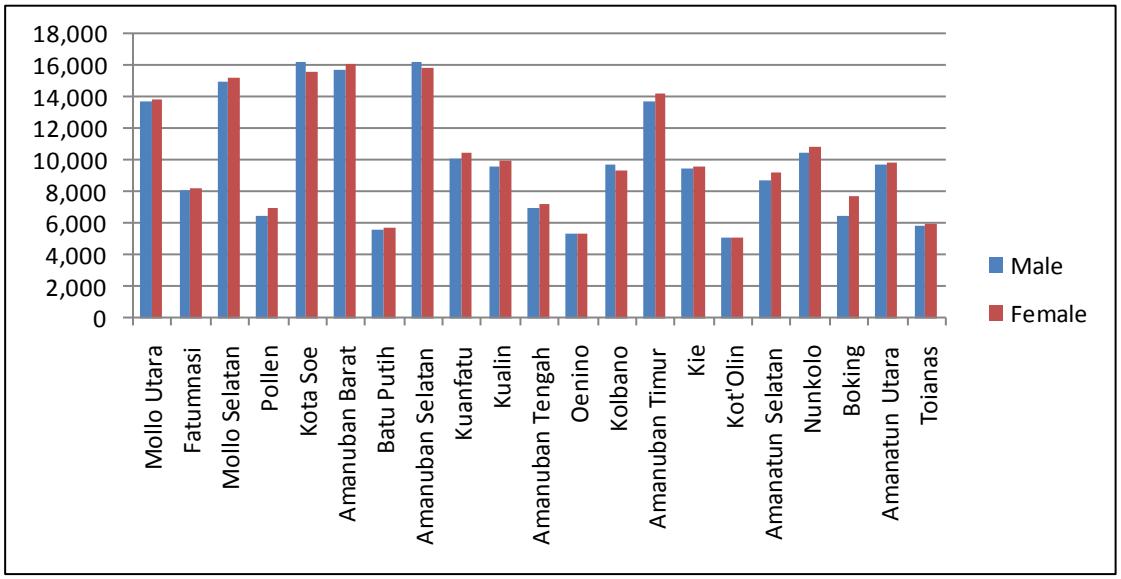

Figure 1-10. Population Composition of TTS District (2005)

In the context of population density, sub-district Kota Soe is the most-dense sub-district. Figure 1-11 shows the population density of TTS District according the sub-districts.

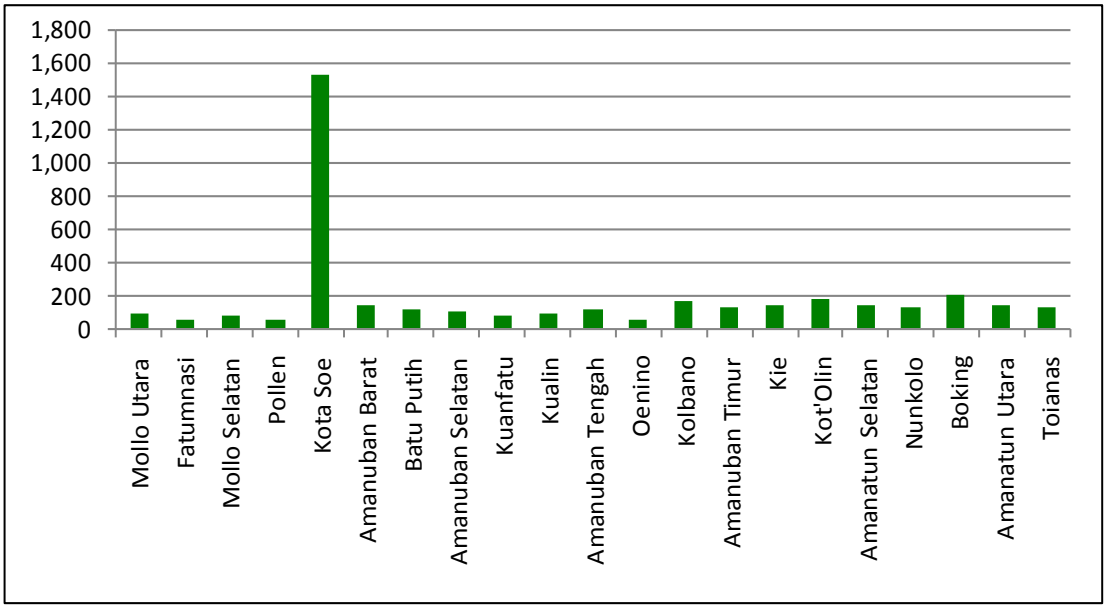

Figure 1-11. Population Density of TTS District (2006)

A.4. Belu District, East Nusa Tenggara Province

Belu is another district of East Nusa Tenggara Province. The total area is 378,882 km^2 and the total population is 378,882 (2006). As presented in Figure 1-12, Sub-District Malaka Tengah is the most-populated sub district in Belu, followed by Kecamatan Kota Atambua, while Kecamatan

Nanaet Dubesi has the lowest population in the district. This district has a coastal border and some of the local population fish in local waters.

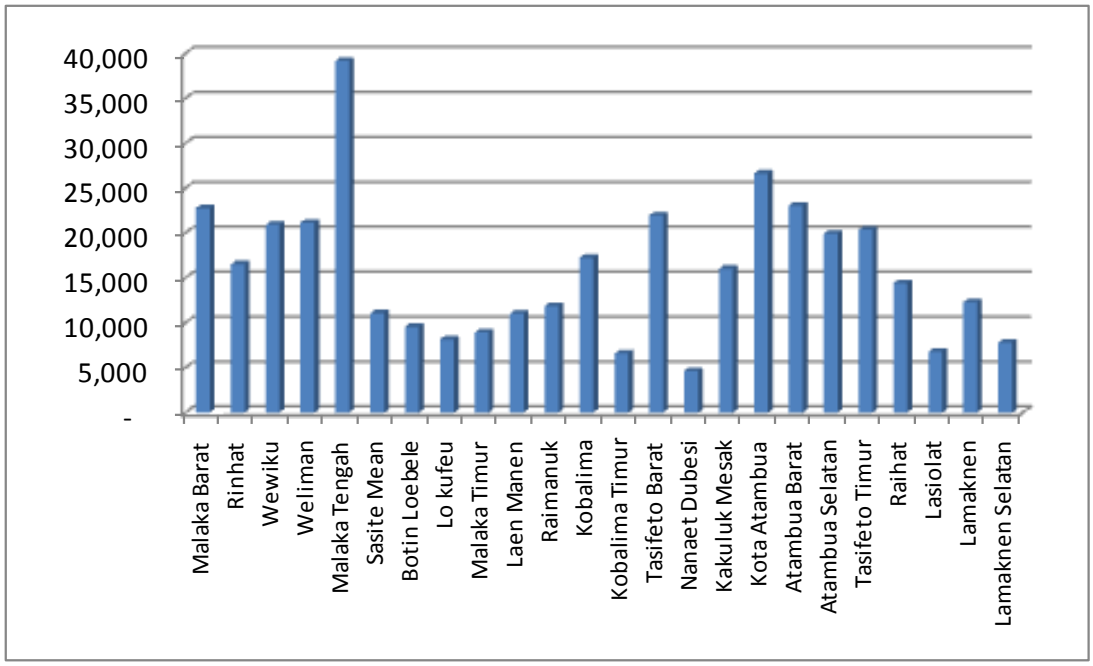

Figure 1-12. Population of Belu District by Sub-District (Kecamatan)

In terms of sex ratio, the composition of population in Belu District seems to be heterogeneous compared with other previous districts. In Belu, some sub-districts have more females than males. This could be explained by the high social status of females. Figure 1-13 shows composition of population by female and male.

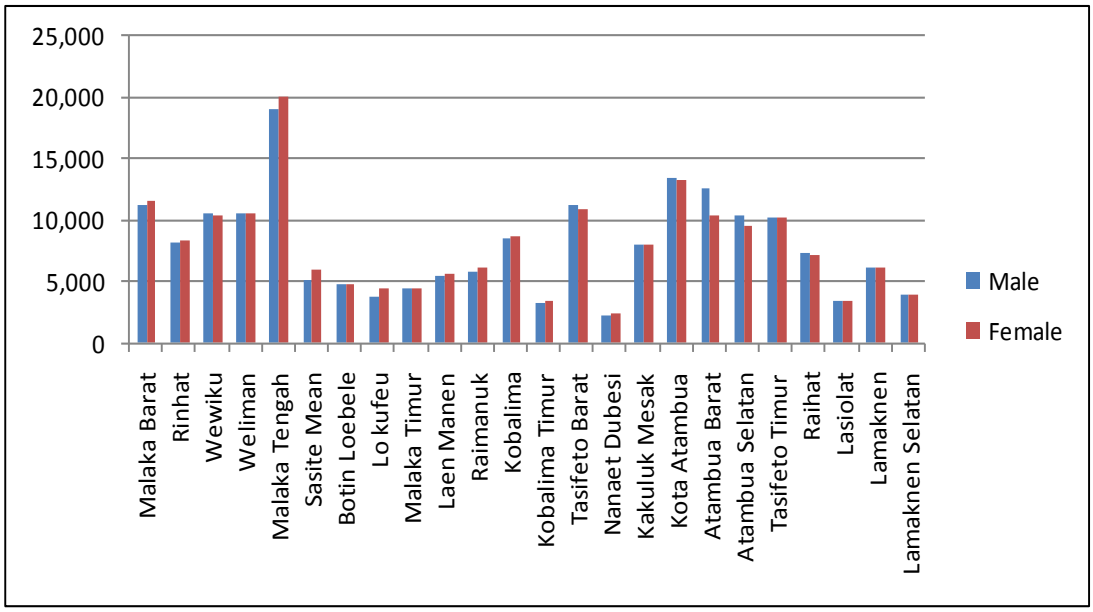

Figure 1-13. Population Composition of Belu District (2005)

In the context of population density, there are three sub-districts within the Belu District which are considerably the most-dense namely Kota Atambua, Atambua Barat and Atambua Selatan (Figure 1-14).

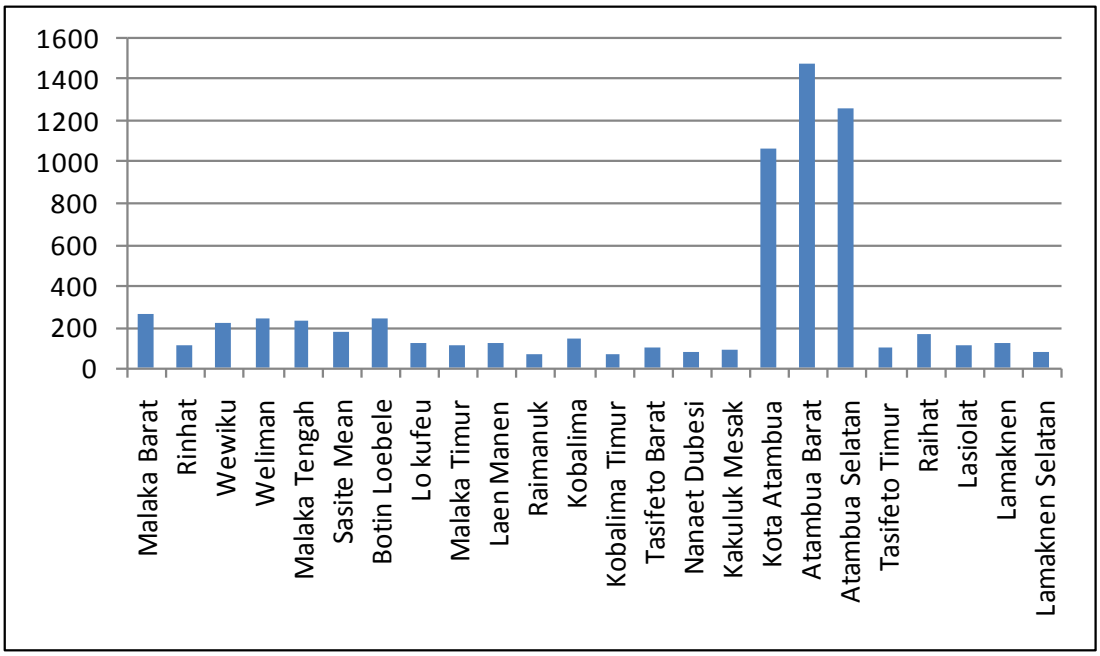

Figure 1-14. Population Density of Belu District (2006)

B. Maluku Province

B. 1. Maluku Tenggara District

Maluku Tenggara District plays an important role in the socio-economic dynamics of the region. Maluku Tenggara District has varied population levels among sub-districts. Sub-District (Kecamatan) Kei Kecil is the densest with a population of 37,330 or 24.86% of the total population of Maluku Tenggara District (150,160 in 2006). Figure 1-14 presents the composition of population by sub-district.

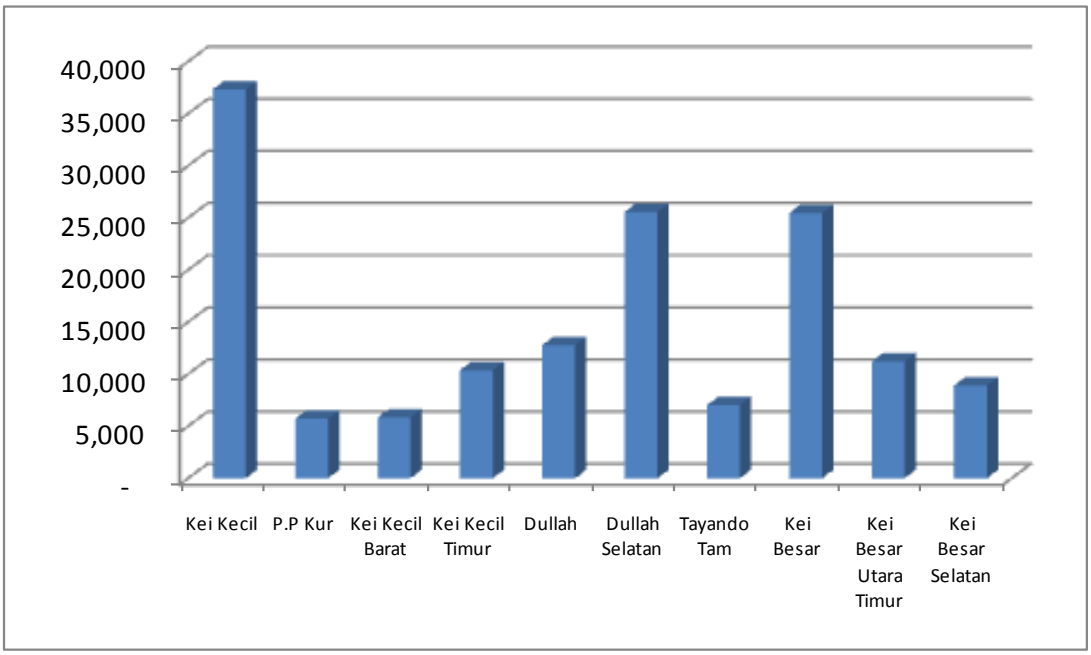

Figure 1-14. Population Structure in Maluku Tenggara District

In terms of sex ratio, the population structure of Maluku Tenggara District has a higher number of females compared with the same structure in the districts of East Nusa Tenggara Province (Figure 1-15).

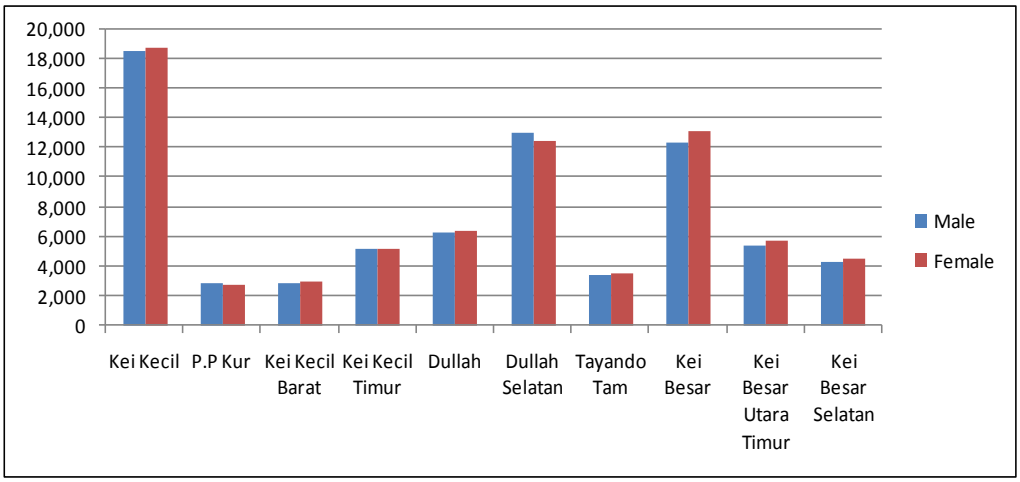

Figure 1-15. Population Composition of Maluku Tenggara District (2005)

B.2. Maluku Tenggara Barat District

Similar to Maluku Tenggara District, Maluku Tenggara Barat (MTB) District also plays an important role in the socio-economic dynamics in the region. Tanimbar Selatan Sub-District (Kecamatan) has the highest population level among the sub-districts in Maluku Tenggara Barat District (Figure 1-16).

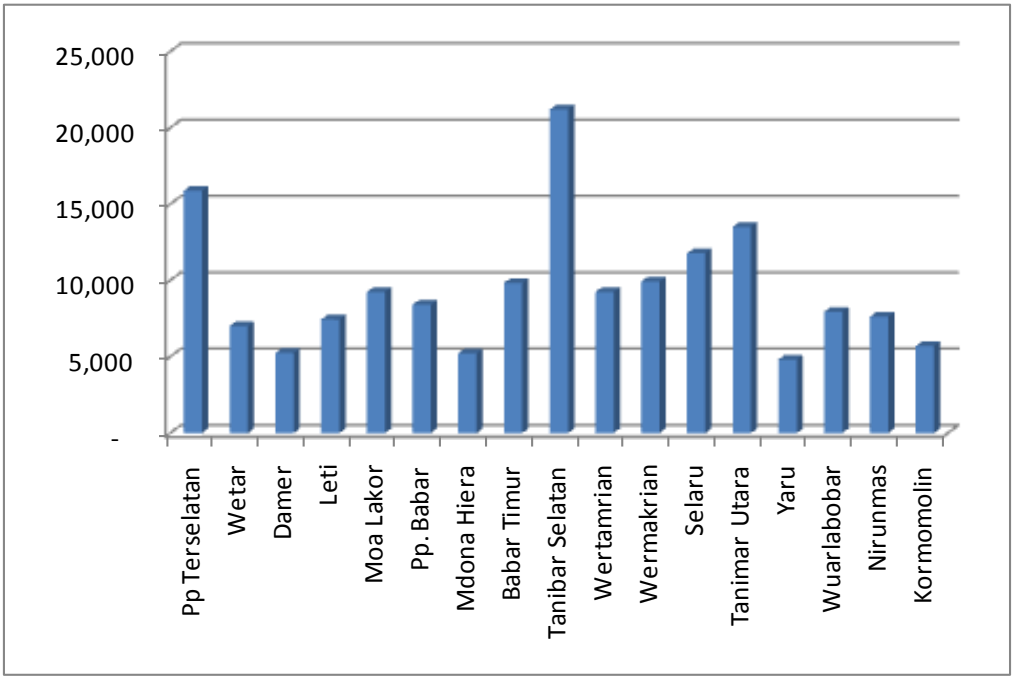

Figure 1-16. Population in Maluku Tenggara Barat District

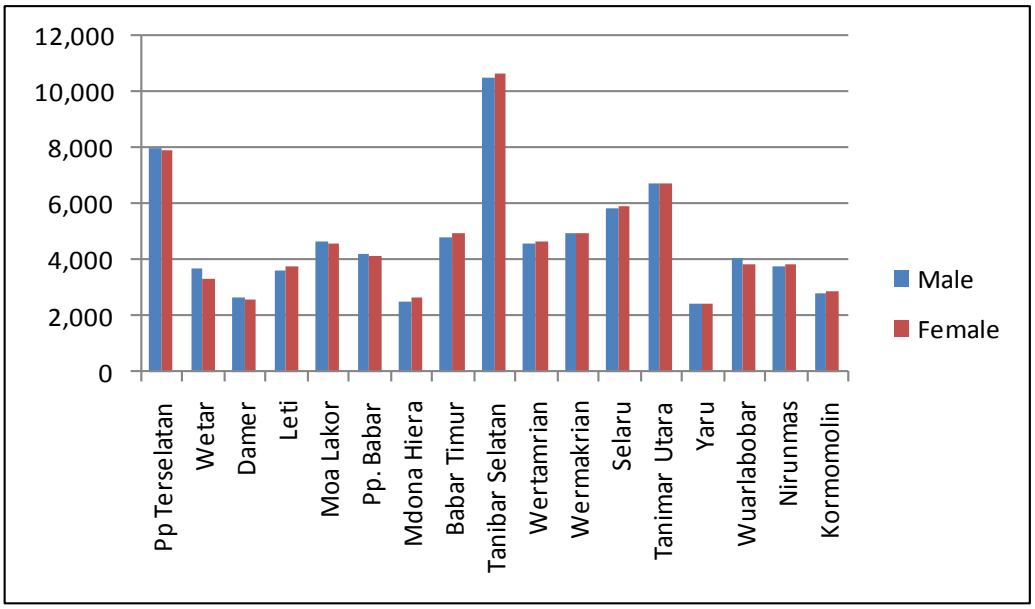

Figure 1-17. Population Composition of Maluku Tenggara Barat District (2006)

B.3. Aru Islands District

Aru Islands District used to be a part of the Maluku Tenggara District. Based on National Act No 40/2003, the Aru Islands were appointed as a new, separate district from Maluku Tenggara. P.P Aru Sub-District is the most-populated area of this district with a population of 28,249 (2003). It is followed by Aru Tengah Sub-District (23, 751) and Aru Selatan Sub-District (13,819). Figure 1-18 presents the composition of population according to sex and sub-district in Aru Islands District.

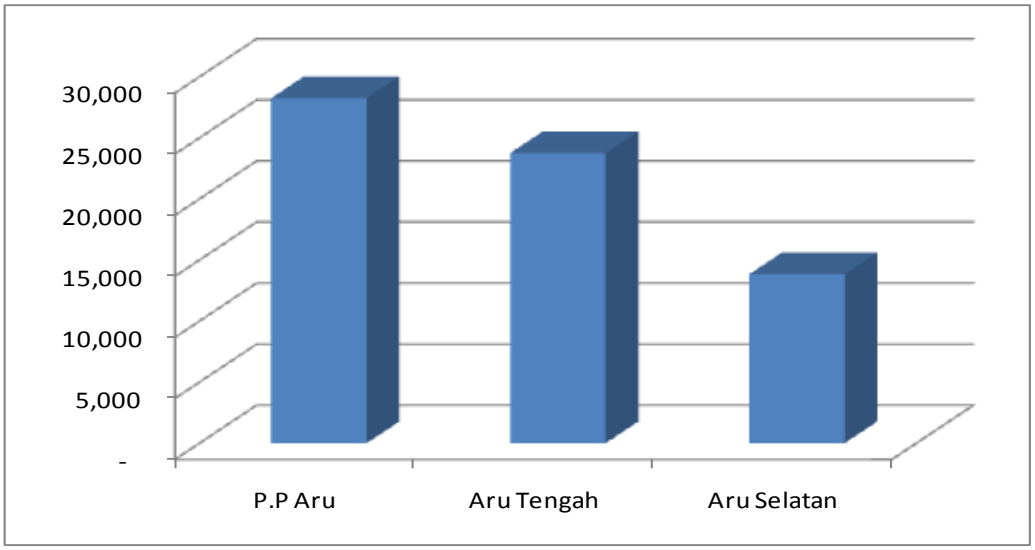

Figure 1-18. Population Structure in Kepulauan Aru District

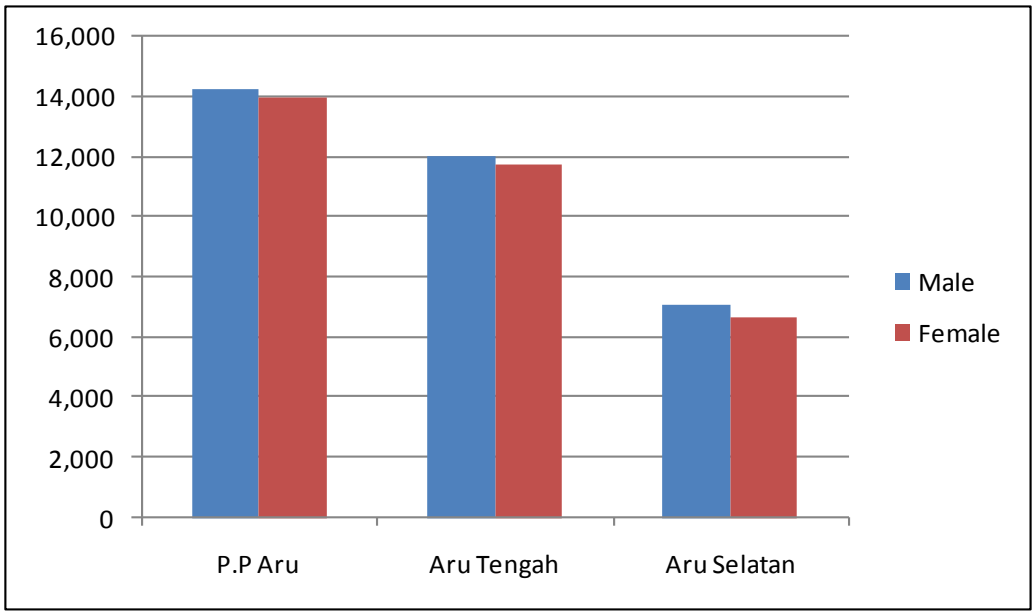

Figure 1-19. Population Composition of Aru Islands District (2005)

In terms of density, P.P Aru Sub-District is also dominant in terms of highest density in the region. In general this density level is still considerably low compared to other districts within ATS. In P.P Aru Sub-District, the population density is 0.14 person/ha, followed by Aru Tengah (0.098) and Aru Selatan (0.070) (Figure 1-20)

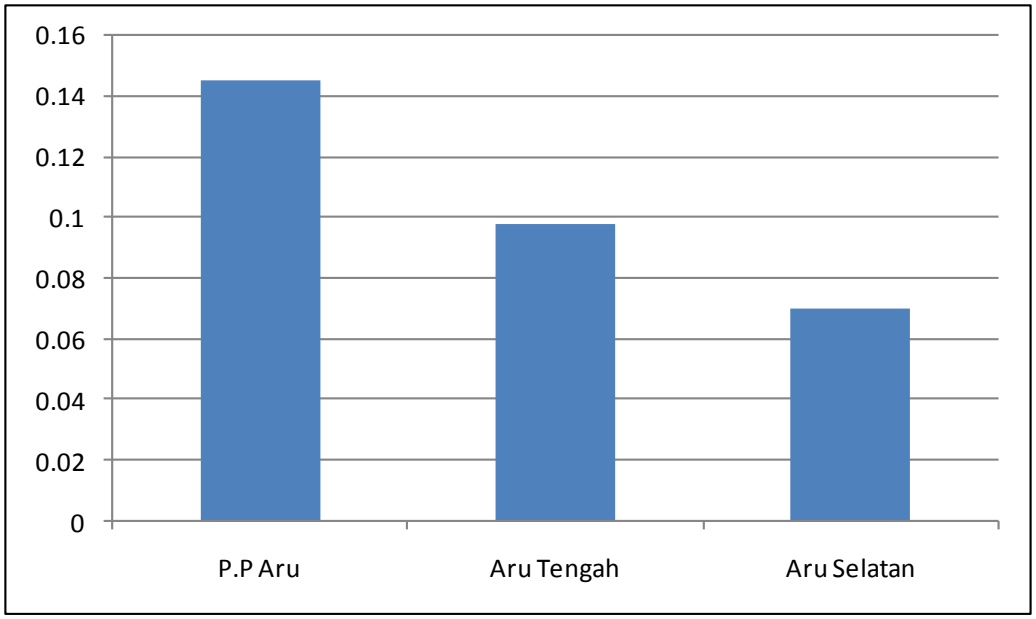

Figure 1-20. Population Density Aru Islands District (2005)

C. Papua Province

C.1. Asmat District

The third province within the ATS is the Papua Province which consists of the Asmat and Mimika Districts. Asmat District has three sub-districts, Sub-District Pantai Kasuari, Sub-District Atsy and Sub-District Awa Erna and is the most-densely populated. Total population of Asmat District is 59,037 (2004). As presented in Figure 1-21, the population of Asmat District is concentrated in the coastal areas such as Pantai Kasuari with a total population of 13,640 followed by Atsy as the second largest sub-district (kecamatan).

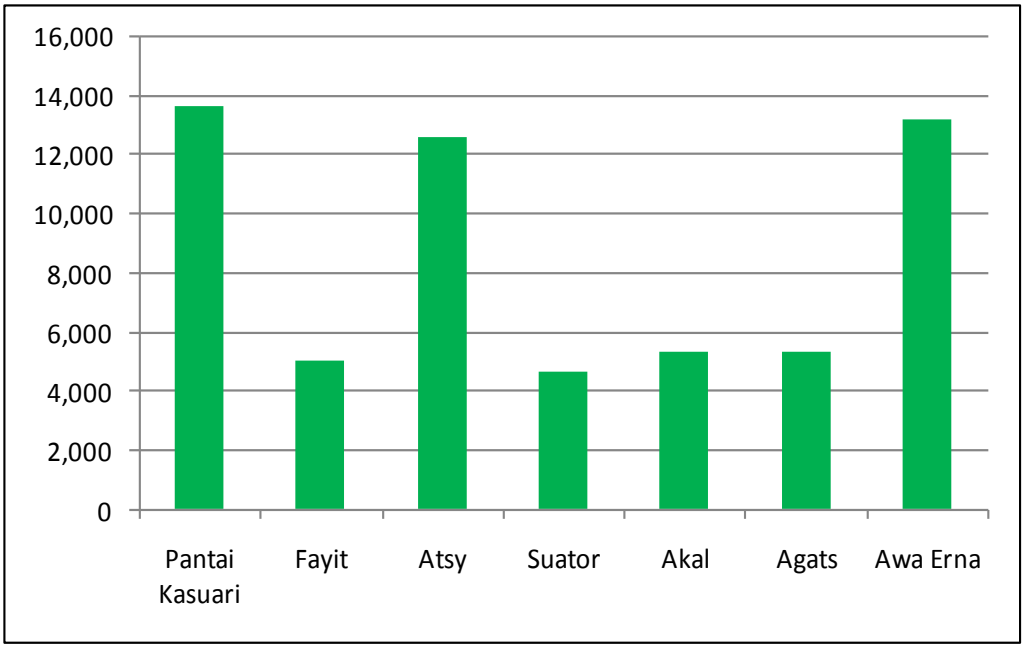

Figure 1-21. Population Composition of Asmat District (2004)

Pantai Kasuari Sub-District is considered as the most-dense sub-district in the Asmat District. The population density of this sub-district is 5.93 person/km^2, followed by Fayit (5.21) and Atsy (2.950). Figure 1-22 presents the population density of Asmat District according to sub-districts.

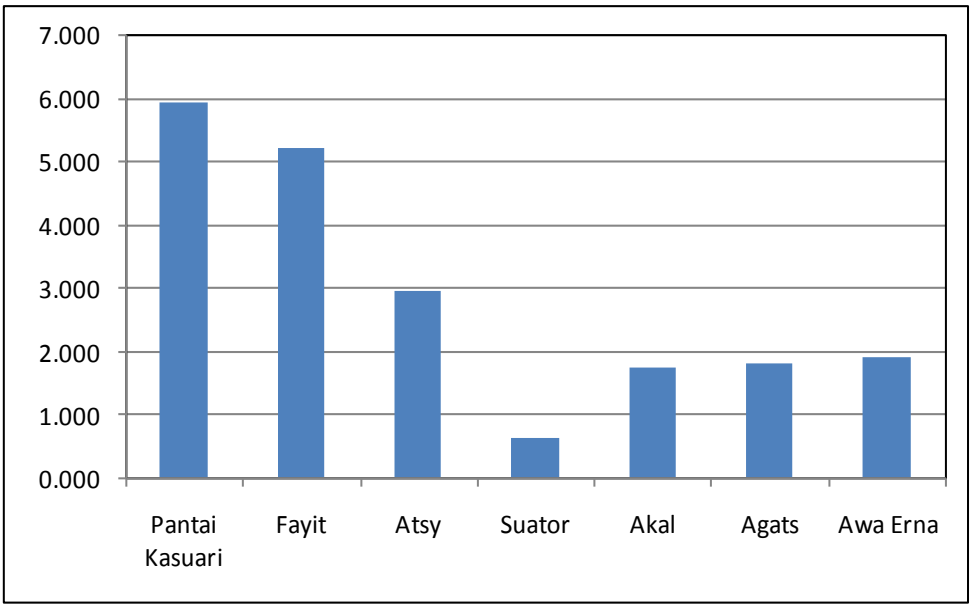

Figure 1-22. Population Density Asmat District (2004)

C. 2. Mimika District

Along with the Coast of Middle-Eastern Papua Island, Mimika District is a part of this ecosystem region of ATS. Population in Mimika District is concentrated in three sub-districts namely Mimika Baru, Kuala Kencana and Tembagapura. These three sub-districts are considered as the center of economic activities due to the presence of multi-national mining companies in this area. As presented in Figure 1-23, the population of Mimika Baru Sub-District dominates the structure of population in this area. The total population of Mimika Districts was 177,102 in 2006 while Mimika Baru had 93,466 or 52.77% of the total.

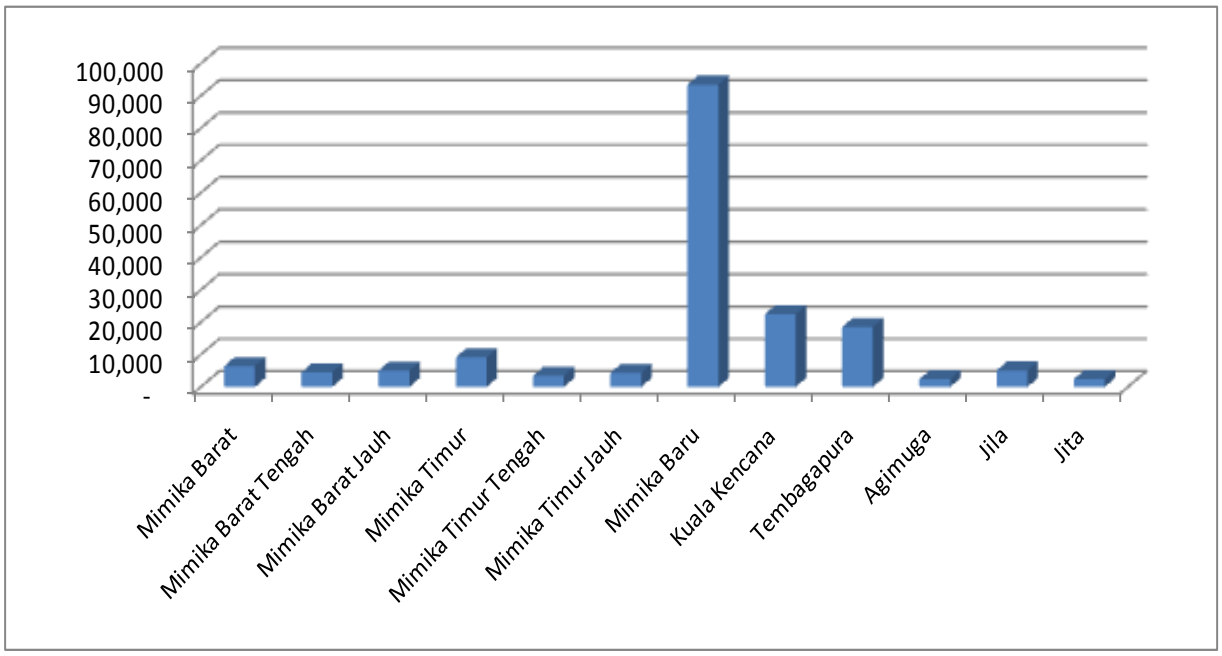

Figure 1-23. Population in Mimika District

As can be seen in Figure 1-23 the number of males is higher than females. The community structure in this district is dominated by male-related livelihoods. The Role of females is mainly to support male work as is usual in the culture of Papua tribes.

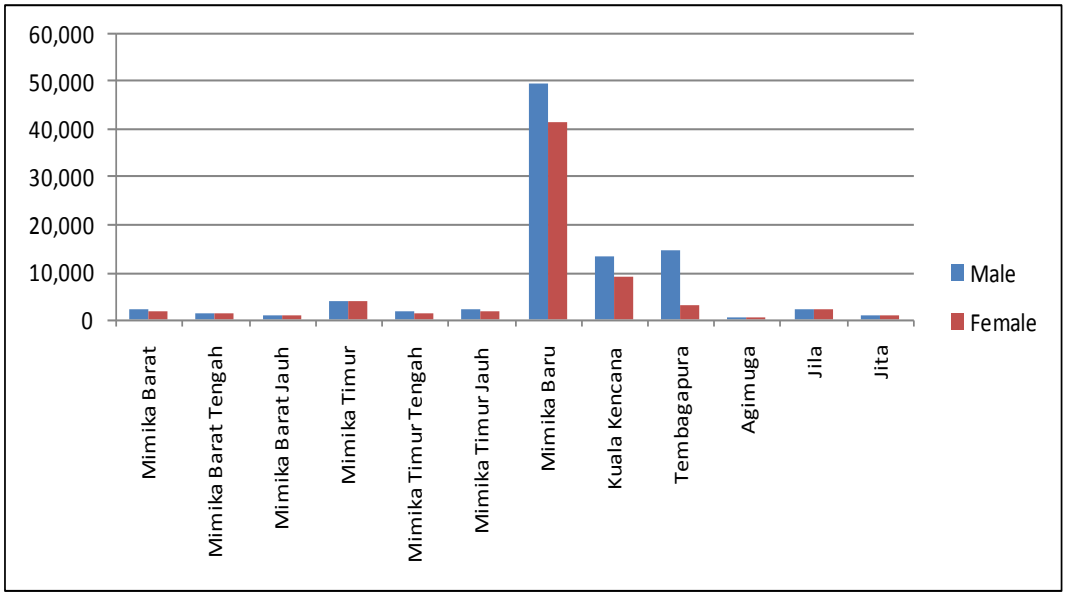

Figure 1-24. Population Composition of Mimika District by Sex (2006)

Similar with the District of Asmat, the highest population density in the Mimika District is found in the most socio-economically viable areas such as Kuala Kencana and Mimika Baru Sub-District. In Kuala Kencana Sub-District, population density is 41.20 person/km^2 and Mimika Baru is 41.18 person/km^2. Figure 1-25 below presents the density of Mimika Districts according to Sub-Districts in 2006.

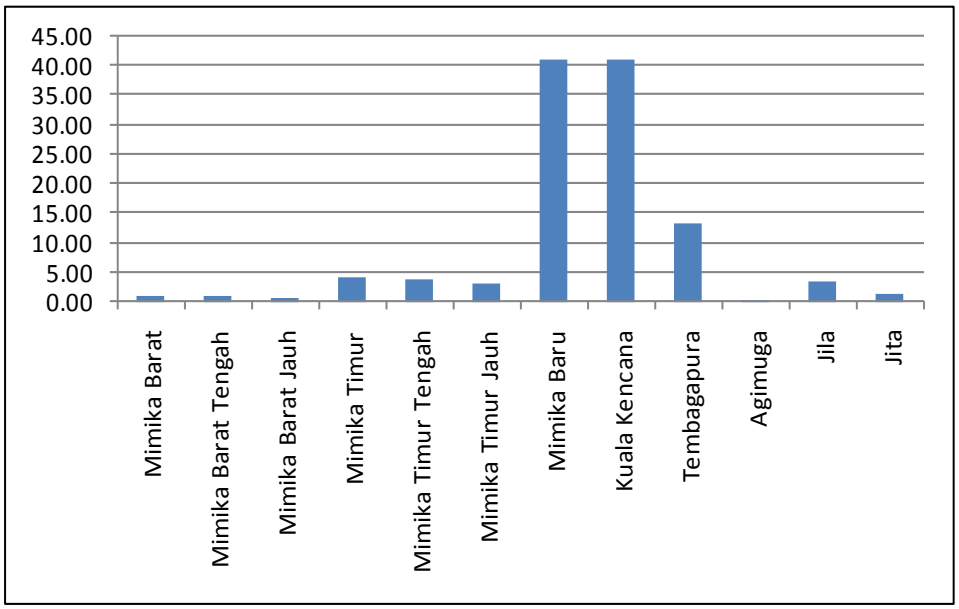

Figure 1-25. Population Density Mimika District (2006)

1.2. Socio-Economics Characteristics and Issues

As mentioned previously, resource users are one of the important stakeholders in managing and governing the ATS. In this regard, socio-economic characteristics of these resource users, based on the administrative region, should be identified in order to set up the appropriate policies that directly and indirectly affect their livelihoods. Several key socio-economic indicators will be used in this report such as income, education level, remoteness, etc.

A. East Nusa Tenggara Region

Districts Rote/Ndao and Alor (located to the north of Timor Island) have the largest number of fisher communities in NTT and include the overwhelming majority of the fishers who engage in fishing in Australian waters. They also include the majority of small scale trepang fishers who access areas in the Australian Fishing Zone. Important fishing communities exist in Kupang City and Kupang District in terms of the ATS region. In Timor Tengah Selatan District it is mainly Kolobano which is important for fishing communities (James Fox pers. comm. 2009 with Natasha Stacey)

A.1. Social Characteristics

Two groups, namely "original inhabitants" and "migrants", depend on marine and coastal resources in NTT Province. These two groups are scattered in various settlements in the areas. One group refers to Rote Ndao and Kupang (Timorese) people/fishers; the second group refers to the communities of Bajo, Butonese and Makassarese populations who have settled in the area. All of these groups live in the same fishing settlements on the Island of Rote. In following section, the social characteristics of East Nusa Tenggara are focused on some main fishing settlement such as Pepela and Oelaba in Rote Island who depend on marine resources in the ATS region (Figure 1-26). This information is adapted from Fox *et al.* (2002).

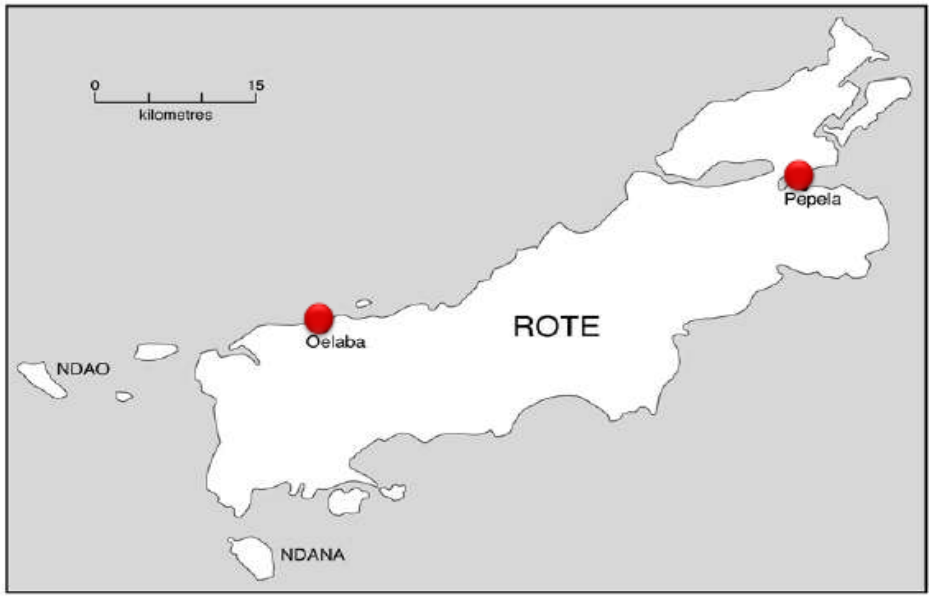

Figure 1-26. Main Fishing Settlement in Rote Island, East Nusa Tenggara Province (Source: Fox, 2002)

As reported by Fox (2002), Pepela in NTT is one of main fishing settlements for transboundary fishing activity. Pepela village is located in the northern part of Rote Island. Similar to other regions in Indonesia, Pepela is formed by several levels of administrative entities, by sub-village (*dusun*) and part of the larger village complex (*desa*) so called Londalusi (Fox *et al*., 2002).

Londalusi Village itself consists of 5 sub-villages namely Papela, Eahun, I'iyah, Oebalo Lain, and Daehuti. Fox *et al*. (2002) furthermore reported that the sub village of Eahun serves as the capital of the district of East Rote (*Kecamatan Rote Timur*) so Pepela is only 2 kms from the administrative government in East Rote. According to Fox *et al*. (2002), Eahun was previously the capital of the historical domain of Oepao, first recognized by the treaty with the Dutch East India Company in 1690. Among these five sub-villages, Eahun and I'iyah are more closely linked with the Pepela. Two other sub-villages are not closely linked as there are more local farmers rather than fishers (Fox *et al*., 2002).

Pepela is linked to other fishing villages on Rote, Flores, Alor and Timor from which both captains and crew are recruited (Fox *et al*., 2002). Since ancient times, Pepela has been a settlement frequented by Bajau Laut who regularly sail into Australian waters. A Bajau Laut community also exists at Tanjung Pasir in Pepela. Most of these Bajau originate from the Tukang Besi Islands (WAKATOBI) in Southeastern Sulawesi and continue to maintain close contacts with their home villages. The initial founding of Pepela is not clear. Local traditions recount the arrival and settlement of Muslim immigrants at the beginning of the 20 century. These initial settlers are said to have come from Southeast Sulawesi, particularly Binongko in the Tukang Besi Islands. These early settlers included a mix of Butonese and Bajau but also Madurese and a number of families of Arab origin. Many settlers came by progressive migration via other predominantly Butonese and Bajo settlements on the islands of Alor, Pantar and Flores (Fox *et al*., 2002; Stacey, 2007).

The numbers of fishers in Pepela depend on the monsoon. Fox *et al*. (2002) reported that during the west monsoon from January to April, winds and waves limit fishing. Furthermore only the Bajau are reported to fish regularly during this season (Fox et.al 2002). The vast majority of the population, however, is involved in fishing during the east monsoon from May to June and again from September to December. July and August are a time of strong winds and most fishermen curtail fishing during this period. Interruptions to fishing force most families in Pepela to seek other sources of income. Occupations that contribute additional income vary but include local trading, particularly of dried fish, and local construction, boat building and repair. No one in Pepela is reported to own agricultural land nor is anyone involved in farming or gardening. (Thus rice and other basic food stuffs must be purchased locally or obtained by trading fish) When in need, most families borrow from wealthy local perahu owners (for whom they work and to whom they may well be related) or from traders. Most Pepela families are bound by bonds of dependence based on kinship and debt.

The differences in wealth among families are evident in the settlements. As a whole, Pepela is not a poor village. It has electricity and 92% of the population relies on it for household lighting. Local researchers noted that there were more electric goods in Pepela than in the town of Ba'a, the island's administrative centre. Fifty-two percent of families own a radio and 37% own a television set. In 1996, there were already 43 parabola antenna in Pepela (Fox *et al*., 2002).

Another important fishing area in Rote Island is Oelaba. This settlement is located on the north coast of western Rote Island (Fox *et al.,* 2002). Similar to Pepela settlement, Oelaba is one of five sub-villages (dusun) within Oelua Village. The other five sub-districts are Oelua, Oedai, Lasi Lai and Helotula. Oelaba has the highest population in terms of number of household heads (HH or *kepala keluarga*), with 178 HH followed by Helotula (126 HH), Lasi Lai (121 HH), Oedai (116 HH) and Oedai (111 HH) (Fox *et.al.,* 2002),

Furthermore, Fox *et al.* (2002) also reported that most fishers in Oelaba are also traders so that when they are not sailing, they often engage in selling their goods in markets that are held on a

rotating basis in different parts of the island. In turn, these traders purchase lontar syrup locally for their inter-island trade. When not involved in sailing or trading, men seek employment as laborers or in other service industries. When their husbands are away, wives also engage in local trade. Attitudes to education in Oelaba are similar to those in Pepela and quite unlike the generally positive attitudes throughout the rest of Rote. Education is not highly valued. In a research survey carried out in Oelaba, 70% of those surveyed had completed elementary school but only 13% had finished junior high school and only 7% had completed senior high school. This lack of education has little to do with a lack of facilities. There are three elementary schools and one junior high school in the village of Oelua. The senior high school is located in a neighboring village 6 km from Oelua. Oelaba's sailing and trading network extends to ports in several provinces in eastern Indonesia: Kupang and Alor in Nusa Tenggara Timur, Bau Bau in Sulawesi Tenggara, Donggal in Sulawesi Tengah, Ujung Pandang in Sulawesi Selatan and Surabaya in Jawa Timur. One of the main destinations in this network is Bau Bau on Buton, Sulawesi Tenggara (Fox *et al*., 2002).

There is considerable occupational mobility: many, if not most, experienced crew members expect eventually to be able to captain a perahu, and many experienced captains manage to own their own vessels. There is far less of a divide between perahu owners, captains and crew members in Oelaba than in Pepela since most individuals are also involved in trading. Local trading on Rote supplements inter-island trading and in some cases, local trading can earn almost as much as inter-island trading. Differentials in income, however, are still prominent. Based on a research survey conducted in Oelaba, a perahu owner in 1997 who was also engaged in local trade could earn Rp 7,500,000 ($A 46,876) compared with a crew member of a perahu who might only earn Rp 500,000 ($A 313,000). The single most prominent source of income for all levels of fishermen was said to derive from voyaging to the Ashmore and other reefs in the Australian Fishing Zone (Fox *et al*., 2002).

There is not yet data available on the average education levels of the population however it can be estimated by looking at the number of education facilities. High numbers of education facilities demonstrate high interests of local government to increase the quality of education of local people and communities. Table 1-2 presents the education facilities in East Nusa Tenggara ATS region.

Table 1-2. Education Facilities in the East Nusa Tenggara Region ATS (unit)

Education Facilities	Elementary School (SD)	Junior High School (SMP)	Senior High School (SMA)
Rote Ndao	106	20	12
Kupang	222	53	12
TTS	309	35	7
Belu	190	14	5

Source (BPS, 2006)

The other indicator is the number of enrolled students in the regions. In this region, it is revealed that Kupang District has a relatively high number of students enrolled in the ES, JHS and SHS (Figure 1-27).

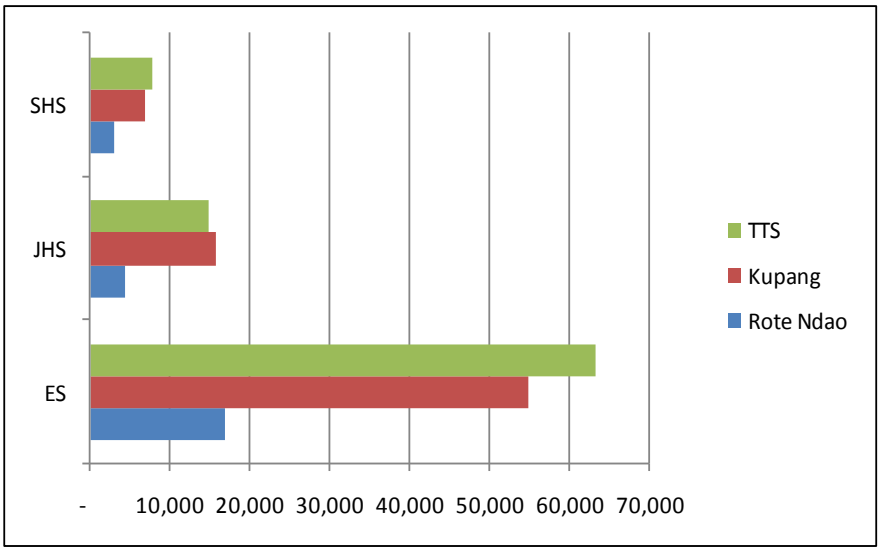

Figure 1-27. Number of Students Enrolled in East Nusa Tenggara ATS (ES=elementary school (SD); JHS = Junior High School (SMP); SHS = Senior High School (SMA))

B. Maluku Region

B.1. Social Characteristics

One well-known socio-economic limitation in the context of ATS is education level. In the Maluku Tenggara District, the number of people enrolled in educational institutions is 37,226, consisting of 20,250 male and 16,976 female population. This number of enrolled population is relatively high compared to total population including the non-educated (204 people) and those no longer in the education system (16,459 people) (Maluku Tenggara District, 2007). Table 1-3 shows the education level of Maluku Tenggara District, Maluku Province.

Table 1-3. Education Level of Maluku Tenggara District, Maluku Province (people).

Age Group	Not Enrolling	Schooling	Drop Out
7-12	68	19,211	-
13-15	136	8,744	757
16-18	-	7,810	3,906
19-24	-	1,461	11,796

Source: Maluku Tenggara District (2007)

Table 1-3 shows that the number of people who drop-out of school seems to be increasing according to the age group. It can be said that people in Maluku Tenggara Barat are not interested in the education level perceived relative to the older age group.

In Maluku Region, one of the common customary laws is known as Sasi. In Kei Islands, the local community is bound by Sasi Customary Regulation. According to Maluku Tenggara District (2007), there are three phases of Sasi Development in Kei Islands, i.e. (1) *Dolo* phase, (2) *Larwul* phase and (3) *Ngabal* phase. In the Dolo phase the norms and rules of community are organized in terms of the primitive, the strong, and the winner. Dolo was a term for such people who were very arrogant and in the past it was well-known to be the stereotype of Jailolo and Ternate people (*Dolo Soin Ternat Wahan*).

The second phase of Sasi development in Kei Islands is the *Larwul*. This customary regulation was set-up by nine *kampung* in the meeting held in Elaar-Ngursoin (Rahail (1993) in Maluku Tenggara Barat District (2007)). The essence of this phase is that of distribution of rights between nine *kampung* and is acknowledged to be at the roots of the Kei Islands people. This phase created common local cosmology of Maluku people called Patasiwa (pata = rumpun, *group*; siwa = *sembilan*, nine), and is well-known as the roots of criminal related customary law of Sasi.

The third phase of Sasi is Ngabal, a customary law of the Kei Islands community, which was initiated in a location on the western coast of Kei Besar Island. The essence of this local customary law is the distribution of rights in terms of non-criminal related activities. In its development, the phase two and phase three have grown fast and become the fundamental basis for existing Sasi customary laws up until the present. The local terminology for the integration of these two phases is *Larwul Ngabal*. Regarding this Sasi, the unit of customary territory in Kei Islands consists of *Ohoi, Utan and Lor*. Table 1-4 presents the territorial hierarchy of customary law in Kei Islands.

Table 1-4. Territorial Hierarchy of Customary Law in Kei Islands, Maluku Tenggara District

No	Territorial Customary Unit	Region Equivalent	Customary Institution
1	Ohoi	*Kampung*	In each ohoi, there are *Kepala Kampung* (head of *ohoi*), complete with other supporting structure such as members meeting called *Seniri*.
2	Utan	Village (*desa*)	In each utan, there is institution so called Orang Kaya (village leader), big tribe (Soa), and *seniri*.
3	Lor	Sub-District (*kecamatan*)	In each lor, there is a "king" level institution which is group of Soa and seniri.

Source: Rahail (1993) in Maluku Tenggara District (2007)

In the Maluku Tenggara Barat District, social situations of the local community are different to those of Maluku Tenggara District. According to Maluku Tenggara Barat District (2006), sasi has been decreasing in terms of its application compared to ancient times. There are two types of sasi in Maluku Tenggara Barat, namely terrestrial-based *sasi* (*sasi darat*) and marine-based *sasi* (*sasi laut*). Sasi laut involves customary laws related to the usage of marine resources such as lola and sea cucumber (*teripang*), while sasi darat is related to the harvesting of coconuts and other agricultural-based production. In terms of local compliance, the people of MTB comply less with sasi laut compared to sasi darat. In the case of sasi darat, there are still several villages that are using sasi darat for regulating the harvest of coconuts. However, due to land problems which contribute to the decreasing production of coconuts, the application of sasi darat has recently decreased.

Similar to Maluku Tenggara District and Maluku Tenggara Barat District, social conditions in Kepulauan Aru District are characterized by the local customary laws such as sasi dan pela. In Kepulauan Aru District, sasi is well-known for the case of sasi laut in governing marine resource use among the community. In local villages of this district, traditional property rights of land and "meti" (intertidal area of coastal zone) still exist. Therefore, in some cases, conflict between villages happens due to overlap of marine resource uses. For example, conflict of resources uses between Apara Village and Karey Village where fishers are known to cause conflict by straying onto other village-controlled lands. Nevertheless, there is also the "pela" system which is dedicated

to reduce long-term ecological and social conflicts. In the case of resource uses, pela is similar to a Polluter Pays Principle. People who poach from land belonging to other villages must pay for the consequences of their actions.

B.2. Economic Situation

The structure of the population is dominated by "keluarga pra-sejahtera" or the pre-welfare family/household. In 2006 the total number of households categorized as "keluarga pra-sejahtera" was 17,545 or just over half the total sample of 32,547 households (Maluku Tenggara Barat District, 2007). Table 1-5 shows the welfare status of households in Maluku Tenggara District.

Table 1-5. Welfare Status of Household in Maluku Tenggara District

Kecamatan *District*	**Jumlah KK Yang Didata** *Total Chequed Of Family*	**Tahapan Keluarga Sejahtera** *Family Prosperity Ranking*				
		Pra Sejahtera *Pre-Prosperous*	**Sejahtera** / *Prosperous*			
			I	**II**	**III**	**III +**
1	2	3	4	5	6	7
1. Kei Kecil	7.505	2.163	1.855	2.374	875	238
2. P.P. K u r	1.148	956	130	44	17	1
3. Kei Kecil Barat	1.398	863	377	152	6	0
4. Kei Kecil Timur	2.556	1.776	474	303	3	0
5. Dullah Utara	2.903	945	800	1.044	86	28
6. Dulllah Selatan	5.201	1.474	1.073	1.157	894	603
7. Tayando Tam	1.297	1.101	93	87	9	7
8. Kei Besar	5.646	4.473	940	172	34	27
9. Kei Besar Utara Timur	2.744	2.419	440	60	10	2
10. Kei Besar Selatan	2.149	1.375	296	141	5	0
2 0 0 6	**32.547**	**17.545**	**6.478**	**5.534**	**1.939**	**906**
2 0 0 5	-	-	-	-	-	-
2 0 0 4	**19.331**	**8.118**	**6.045**	**2.566**	**640**	**181**
2 0 0 3	**28.191**	**15.539**	**7.738**	**2.793**	**1.138**	**1.013**
2 0 0 2	**42.039**	**22.385**	**12.599**	**4.241**	**1.587**	**1.227**
2 0 0 1	**40.403**	**22.983**	**11.532**	**3.587**	**1.297**	**644**

Source: Maluku Tenggara District (2007)

To identify the income level in Maluku Tenggara District, total expenditure of food and non-food consumption was used. In this case, total expenditure for food consumption of local population especially in the context of rural areas increased during 1990-1999. In 1990, total food items consumed by rural people of Maluku Tenggara District was about IDR 17,248 per capita and in 1999 increased to IDR 74,538 per capita. This increasing food consumption is indicative of the welfare status of people in rural areas of Maluku Tenggara District (Table 1-6).

Table 1-6. Food Consumption Expenditure Level of Maluku Tenggara District (IDR)

Pengeluaran *Expenditure Item*	Daerah Perdesaan *Rural Areas*			
	1990	1993	1996	1999
1	6	7	8	9
I. MAKANAN *FOOD ITEMS*				
1. Padi-padian / *Cereals*	3.709	3.842	6.250	16.432
2. Ubi-ubian / *Tubers*	1.281	2.024	2.479	5.498
3. Ikan / *Fish*	2.458	3.121	4.660	10.626
4. Daging / *Meat*	351	311	449	897
5. Telur dan Susu / *Eggs & Milk*	482	605	819	2.310
6. Sayur-sayuran / *Vegetables*	1.746	2.164	2.517	7.767
7. Kacang-kacangan / *Legumes*	523	388	445	1.062
8. Buah-buahan / *Fruits*	1.122	1.114	1.059	2.523
9. Minyak dan Lemak / *Oil & Fats*	1.143	1.440	1.811	5.451
10. Bahan Minuman *Beverage Stuffs*	1.754	1.976	2.429	6.071
11. Bumbu-bumbuan / *Spices*	628	704	914	2.814
12. Konsumsi Lainnya *Miscellaneous Food Items*	68	102	131	638
13. Makanan dan Minuman Jadi *Prepared Food and Beverage*	1.025	1.420	2.150	5.876
14. Minuman beralkohol *Alcoholic Beverage*	84	227	142	265
15. Tembakau dan Sirih *Tobacco & Betel Leaves*	1.274	2.140	2.832	6.308
Jumlah Makanan *Total Food Items*	**17.248**	**21.578**	**29.083**	**74.538**

Source: Maluku Tenggara District (2007)

Expenditure on non-food items per capita for people in the rural areas of Maluku Tenggara District increased dramatically from 1990 to 1999. In 1990 total expenditure for non-food consumption was IDR 25,345 per capita and in 1999 it increased to IDR 110,108 per capita. This implies that expenditure of food consumption is only 40.37% of total expenditure, less than expenditure for non-food consumption (59.63%). Table 1-7 presents the composition of expenditure for non-food consumption of the population in Maluku Tenggara District.

Table 1-7. Non-Food Consumption Expenditure Level of Maluku Tenggara District (IDR)

Pengeluaran *Expenditure Item*	Daerah Perdesaan *Rural Areas*			
	1990	1993	1996	1999
1	6	7	8	9
II. BUKAN MAKANAN *NON FOOD ITEMS*				
1. Perumahan, Bahan Bakar, Penerangan & Air *Housing, Fuel, Lighting & Water*	4.087	5.695	7.983	15.584
2. Aneka Barang dan Jasa *Miscellaneous Goods & Services*	1.349	2.148	2.800	8.325
3. Pakaian, Alas Kaki dan Tutup Kepala *Clothing, Footwear & Headwear*	1.708	2.636	2.754	7.322
4. Barang Tahan Lama *Durable Goods*	467	1.057	1.152	2.545
5. Pajak Pemakaian & Asuransi *Consumption Taxes & Insurance Premiums*	108	232	291	420
6. Keperluan Pesta & Upacara *Parties & Ceremonies*	468	679	673	1.374
Jumlah Bukan Makanan *Total Non Food Items*	**6.187**	**12.447**	**15.653**	**35.570**

Source: Maluku Tenggara Barat District (2007)

The island communities of Kepulauan Aru District depend on coastal and marine resources. Therefore, fishing activities are the most dominant livelihood of the community of Kepulauan Aru District. The population of Kepulauan Aru District is dominated by the pre-prosperous household (family) group (keluarga pra-sejahtera) which is 10,813 household units or 70.05 % of total number of sample household units (Kepulauan Aru District 2007). Table 1-8 presents the welfare situation in the Kepulauan Aru District.

Table 1-8. Welfare Situation of Household Unit Sample in Kepulauan Aru, Maluku Province

Sub-District	Number of Household Sample	Welfare stage of Household				
		Pre-Prosperous	Prosperous I	Prosperous II	Prosperous III	Prosperous III +
P.P Aru	7,095	4,699	1,421	488	295	192
Aru Tengah	5,042	3,523	1,057	354	80	28
Aru Selatan	3,298	2,591	501	151	36	19
Total	15.435	10.813	2.979	993	411	239

Source: Kepulauan Aru District (2007)

C. Papua Region

Papua Province is the one of the most important provinces in the ATS region. Along the ATS region, there are four districts which are administratively part of Papua Province, namely Merauke, Mappi, Asmat and Mimika. Maanema *et al*. (2006) elaborates that social characteristics are mainly dominated by the variation of tribes. Usually there is a dominant tribe in a district. In Merauke for example, the dominant tribe is the Marind Tribe who are friendly and welcome strangers. In this context, fishers from Bugis tribe and Makassar tribe from South Sulawesi are welcome in this district. In Somkai village, the Marind community lives together with the Bugis and Makassar tribes in harmony. In Merauke, customary law still exists. If they want to build a house, Marind tribe people want to build it on their own land although it is located far away from the coast or village where they work (Maanema *et al*., 2006). Releasing assets such as land through customary law is more efficient than with formal certification by the government. In the case of coastal and marine resource related use, there is no special customary law. In this case, everyone can catch fish without any prohibition in Merauke (Maanema *et al*., 2006).

According to Maanema *et al*. (2006), in Asmat Districts the situation is less tribal based as there are fewer original tribes left in the area. They catch the fish for their daily needs as subsistence fishers. Furthermore most of the people in Asmat, for example Agats Sub-Districts, live in sub-standard conditions. The houses and other basic infrastructure in the village are in very poor condition (Maanema *et al*., 2006). One of the social characteristics of the Asmat people is their art which is well known internationally. They produce what is internationally called "Patung Asmat". They have unstable social norms although they have a customary institution called "Lembaga Masyarakat Adat Asmat" (LMAA). This institution does not have a standard structure, while according to their beliefs, "moyang-moyang" is the first institution, followed by "jew" (customary houses) as their second institution and LMAA as the third (Maanema *et al*., 2006).

Different situations can be revealed from the case of Mimika District. In the context of social characteristics, this district population is dominated by the Amungme and Komore Tribes (Maanema *et al*., 2006). The Amungme tribe predominantly lives in Tembagapura and Akimugah region, while the Komoro tribe lives in Mimika from the east of Etna Bay to the Otakwa River (Maanema *et al*., 2006). Social relationships of the Amungme people are patrilineal. The Komoro tribe has different family relationship which is characterized by a matrilineal system.

In terms of tribe structure, the head of the Amungme tribe (kepala suku) is called "Me Nagawan". There are three levels of Me Nagawan i.e. "Amung Netorei (tribe), "Nerek Netorei (family), and "Nol Netorei (family relations). In the case of Amungme tribe, they have a customary board (dewan adat) which consists of the Kampong Board (Dewan Kampung), Region Board (Dewan Wilayah) and Tribe Board (Dewan Suku) (Maanema *et al*., 2006). Supported by the local government, the customary board has transformed into "Lembaga Adat Masyarakat Amungme" (LEMASA). For the Komoro tribe, the head is called "Weyaiku". "Imakateri" which is the terminology for the "kepala klan" (sub-tribe leader), and "we" is terminology for "pemimpin keluarga" (leader the family). Similar to the Amungme tribe, the customary structure (Dewan Adat) in Komoro consists of "Dewan Suku", "Dewan Kampung" and "Dewan Wilayah" and has been transformed by the local government to "Lembaga Masyarakat Adat Komoro" (LEMASKO).

Section 2
Livelihood of Coastal Communities in the Indonesia ATS Region

2.1. East Nusa Tenggara Region

A. Livelihood in the Resources Context

East Nusa Tenggara Province is located in the southern part of Indonesia and is geographically situated at the area of 8^{o}-12^{o} S and 118^{o}-125^{o} E. Spatially, this region can be considered as an archipelago dominated by islands such as Flores, Sumba, Timor, Alor, etc. According to Indrawasih (2005), the number of islands in this province is 566 of which only 42 are inhabited.

As described in the previous section, East Nusa Tenggara Province consists administratively of 13 districts, 1 town, 171 sub-districts and 2,543 villages. Among these villages, 639 villages are considered as coastal villages with a total population of 1.1 million or 29% of the total population in East Nusa Tenggara Province. Among these people, 101,522 people or 9 % of total villages depend on coastal and marine resources as fishers and 9,996 people as fish farmers.

Indrawasih (2005) reports that fishers of East Nusa Tenggara mainly originate from places outside of East Nusa Tenggara such as South Sulawesi (Bugis tribes) and South East Sulawesi (Buton tribes). Although they are originally from outside this region, the government of East Nusa Tenggara has considered them as local people, for example in the Oesapa Village, Kupang District, or fishers from Buton who are known as local people in Namosain Village, Kupang Town. Fishers from these two tribes (Bugis and Buton) are acknowledged as the fishers who taught local fishers such as from Rote Ndao and Timor. Most of them are traditional fishers who use small fishing vessels and traditional fishing gears such as net and fishing line. A type of fishing vessels used by the local community of Rote Ndao is presented in Figure 2-1.

Figure 2-1. Type of Fishing Vessels in Rote Ndao, East Nusa Tenggara Province

Fishing is not their only livelihood in the context of total income per fisher household. Usually they combine fishing and agricultural activities so that the fishers of East Nusa Tenggara are well-known as part-time fishers (*nelayan sambilan tambahan)*. In the case of Rote Ndao District, the situation of the fishers is presented in Figure 2-2. As presented in Figure 2-1, the situation of fishing activities in Rote Ndao varies according to sub-district.

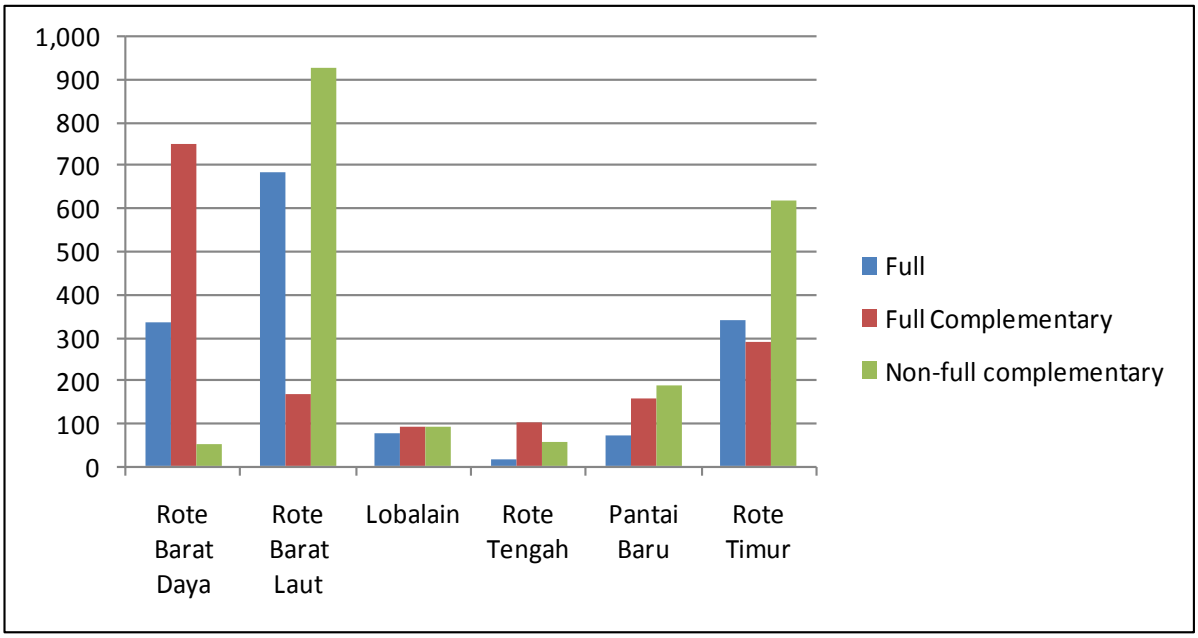

Figure 2-2. Fishers Composition in Rote Ndao District

Different situations are revealed in the case of Kupang District, where most of the fishers in this district are categorized into fulltime fishers. In Sulamu sub-district for example, the total number of fulltime fishers is just over a thousand which is the majority of fishers in this sub-district. Figure 2-3 presents the structure of fishers in Kupang District.

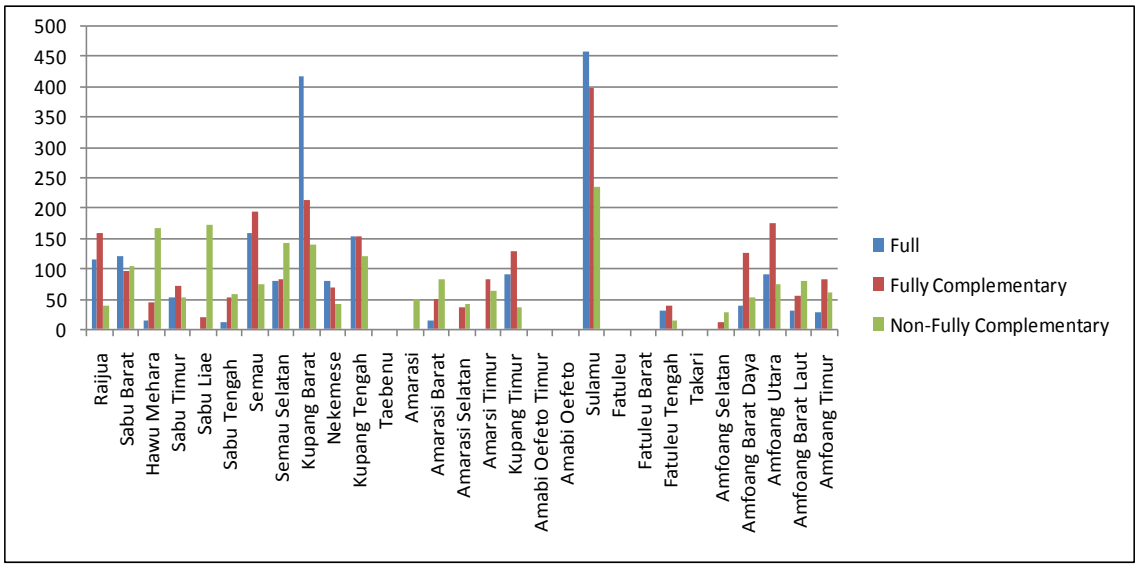

Figure 2-3. Fishers Composition in Kupang District

In the case of Timor Tengah Selatan (TTS) District, a different indicator is available in order to give an overview on fishing in this area. In the TTS district, most of the local fishers use non-powered fishing vessels (*perahu tanpa motor*) and practice non-boat fishing activities (*perikanan tanpa perahu*). Table 2-1 presents detailed information on fishing structure in the TTS district.

Table 2-1. Fishers Structure According the Type of Technology in TTS District.

No	Type of Vessel	Number of Unit
1	Non-Boat Fishing Vessel	181
2	Non-Powered Fishing Vessel	416
4	Outer Board Fishing Vessel	20

Source: TTS District of Fisheries Agency (2005)

In the case of Belu District, part-time fishers dominate the composition of local fishing communities at just over 1000, while full time fishers total 971.

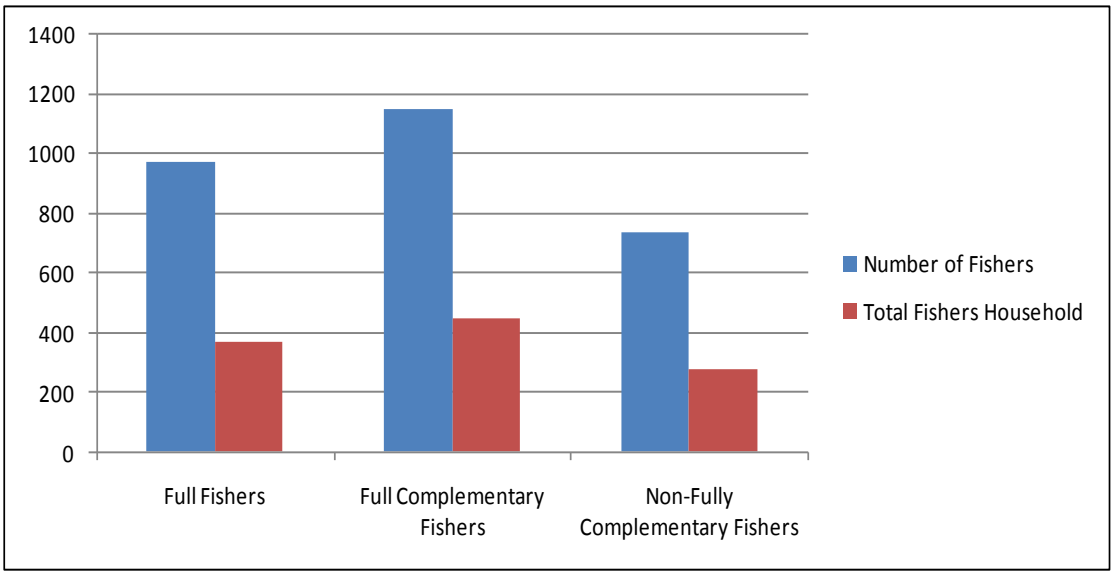

Figure 2-4. Structure of Local Fishers in Belu District

The main fishing ground in East Nusa Tenggara (ENT), stretch over several locations such as Kupang Bay waters, Sulamo coastal waters, Flores Sea waters, Sawu Sea, Timor Sea to the foreign adjacent waters, and North Australian waters. This also includes some small fishing grounds around the Timor Gap, as well as the islands and reefs located to the south of Rote – namely Scott reef (Pulau Dato) and Setingapatam Reef. In the past other reefs in the area where accessed by Indonesian fishers such as Ashmore Reef, Rowley Shoals, Dato Island and Bawah Angin Island (Indrawasih, 2005). Sawu Sea is a very important fishing ground for marine resources such as shrimp and some economically valuable pelagic fish including skipjacks.

Fishers who are active in the MOU Box waters of the Timor Sea usually come from Oelaba and Pepela Villages, Rote Ndao as well as other islands in the NTT to catch some high economic value sedentary species such as *trochus*, *teripang (*sea cucumber). They use small-vessels without motors called *lambo*. Some other fishers use bigger boats and inboard-motorized vessels so that they can catch fish at fishing grounds located more than 190 nautical miles south of Kupang. Table 2-2 shows some geographical positions of fishing grounds for local fishers of ENT.

Table 2-2. Some Geographical Positions of Fishing Ground of ENT Local Fishers

No	Geographical Positions
1	11^{o} 43' 814" S, 123^{o} 21' 063"
2	11^{o} 47' 399" S, 123^{o} 25' 632"
3	11^{o} 47' 267" S, 123^{o} 23" 743"
4	11^{o} 46' 220" S, 123^{o} 26' 900"
5	11^{o} 48' 954" S, 123^{o} 18' 352"
6	11^{o} 44' 792" S, 123^{o} 15' 671"

Source : Indrawasih (2005)

Fishing activity in the border area between Indonesia and Australia is a very serious issue in terms of bilateral relationships between the countries. Local fishers are attracted to areas like the Timor Gap to fish highly valued marine resources like shark fin.

In terms of fishing technology, many local fishers use gill-nets such as bottom-gillnet and surface-gillnet, and also bottom-longlines. In the case of other fishers, especially transboundary fishers, they are categorized into three groups (Indrawasih, 2002). The first group is the fishers using *lambo* without modern fishing gears. This group usually catches sedentary species by diving without any supporting tolls such as compressors. Annually, the most well-known season for fishing sedentary species is around the end of July or the beginning of August until October. A typical fishing vessel for this fisher group can be seen in Figure 2-5 below.

Figure 2-5. Typical Fishing Vessels of *Lambo* (Wahyono, 2008)

The second group targets the same fish as the first, but they use more modern fishing gears with motorized vessels, usually inboard, and the size of fishing vessels are around 2-3 gross-tonnage (GT). This type of fishing vessel is usually called a *perahu body jolor*. In terms of fishing gears, they use supporting tools for diving such as compressors and relatively more-sophisticated diving technology compared with the first group. They also use a GPS (global positioning system) and maps (Indrawasih, 2005).

Indrawasih (2005) reported that it is the third group of local fishers who using inboard motorized vessels catch sharks to harvest fins. The typical fishing vessels are the same as those used by the second group but they use long-line fishing gears to catch sharks. A summary of typology and characteristics of the three groups of fishers in ENT is presented in Table 2-3 below.

Table 2-3. Typology of Fishers in East Nusa Tenggara Province

Group	Fishing Vessel	Fishing Gear	Fish Target
I	Non-motored vessels (*perahu lambo*)	Diving without gear and compressor	Sea Cucumber, Trochus and other sedentary species
II	Inboard motored vessels (*perahu body*)	Diving with compressor	Sea Cucumber, Trochus and other sedentary species
III	Inboard motored vessels (*perahu body*)	Bottom longline	Sharks

Source: Adopted from Indrawasih (2005)

According to the official data of the Local ENT Fisheries Agency, there are many types of fishing gears used by local fishers. These include purse seines; floating nets, pole and line, gill-nets, trammel nets, etc. Moreover, official reports from this fisheries agency also state that *perahu lambo* dominates the structure of fishing vessels in the ENT Province with 14,175 of 27,469 units of total vessels (Table 2-4).

Table 2-4. Structure of Fishing Fleets in ENT Province (2003)

No	Type	Unit
1	Non-Motored Vessel	14,175
2	Outer Board Vessels	7,376
3	Inboard Vessels	5,918
	Total	27,469

Source: Modified from Indrawasih (2005)

Not all fish caught by local fishers have high prices. However many local fishers specialize in catching only high value fish such as sea cucumber and sharks. This phenomenon is called price-driven fishing theory as mentioned by Sumaila (2000). In the case of fisheries in ENT, Table 2-5 presents list of price of high economic value fishes.

Table 2-5. List of Price of Economic Value Fishes

No	Fish	Price (IDR/kg)
1	Sea Cucumber	140,000 - 200,000
2	Shark fin	300,000 - 1,000,000

Source: Indrawasih (2005)

As reported in Table 2-5, high value fisheries commodities are usually exported through quarantine mechanisms and governed by the Local Quarantine Agency (Kantor Karantina Hasil Perikanan). Table 2-6 below shows the situation of exported fisheries commodities as reported by Kantor Karantina Hasil Perikanan in East Nusa Tenggara Province.

Table 2-6. Frequency of Fisheries Commodities Reported by Kantor Karantina Hasil Perikanan of East Nusa Tenggara

No	Type of Fish	Frequency of Trading	Number of Trading	
			Life Fishes	Dead Fish
1	Tenggiri	884	-	54,441
2	Grouper (kerapu)	63	1,003	-
3	Yellow tail	107	-	15,400
4	Shark fins	109	-	36,778
5	Teri	134	-	44,003
6	Baramundi	49	-	44,003
7	Milkfish	16	-	849
8	Lobster	424	4,840	-
9	White Shrimp	25	-	709
10	Sea Cucumber	81	-	35,820
11	Pearls	30		600
12	Seaweed	7	-	38,900

Source: Modified from Indrawasih (2005)

B. Transboundary Fisheries: Livelihoods and Resource Conflicts

Transboundary fishers are defined as the fishers who engage in fishing out of national boundaries and into the territorial waters and exclusive economic zones such as in the case of Indonesian fishers travelling into Australia (Adhuri, 2005; Stacey, 1999). Transboundary fishers from East Nusa Tenggara Province can be characterized as follows (Adhuri, 2005).

Transboundary fishing in Australian waters has a long and diverse history. Over centuries different groups have sailed to the north and northwest coasts in search of high value commercial products largely destined for markets further to the north in S. E. Asia. These fisheries have adapted to changing circumstances, legal impositions and maritime boundaries.

There is a number of different fishing areas accessed.

1. The MOU Box (includes waters surrounding Ashmore Reef, Cartier Island, Scott reef, Seringapatam Reef and Browse Island). According to the MOU between Australia and Indonesia, first established in 1974, traditional Indonesian fishing is allowed in a 'box' area in the Timor Sea. Certain arrangements exist in terms of access (only sail powered boats and non-motorised equipment is permitted) and species allowed to be collected and so on (see Stacey 2007).
2. Further to the south – Rowley Shoals (Bawah Angin) which is closed to Indonesian fishermen and thus illegal under Australian law using motorized vessels
3. Timor Gap waters, along both sides of the borders between Australia and Indonesia, fishing mainly for shark in motorized vessels (in the past vessels used were sail powered lambo)
4. Around oil rigs along the Sahul Banks in the Timor Sea south of Timor Island along both sides of the border (in the past vessels used were sail powered lambo)

In the NTT in the last 5 years or so the fishing activity can be characterized into three groups of transboundary fishers. The first group use traditional sailing vessels, called perahu lambo, without engines. This group of fishers is usually based in Pepela and Oelaba Villages, Rote Ndao. These groups of fishers have targeted species of shark fin, caught using handlines but more frequently using bottom set long lines, trepang and other sedentary species and reef fish. Using wind as their power, the season for fishing activities is around July-August until the end of October every year.

The second group use smaller motorized vessels called *bodi*. Their target species is shark fin and they use long line fishing gear. This group of fishers is usually based in Papela Village, Rote Island.

The third group of fishers are using similar fishing vessels as bodi - perahu motor - and are also using inboard engines. In some cases, they are also using a GPS to support their fishing activities. Target species of this group are sedentary species such as sea cucumber and trochus. This group generally engages in illegal activity under Australian law.

Figure 2-6 shows the bodi vessel and small engine, village houses in Rote and a diver who has experienced medical problems following a case of the bends in diving for trepang.

Figure 2-6. Type of Transboundary Fishers in East Nusa Tenggara (Pepela) (Wahyono, 2008)

There are four main fishing grounds for transboundary fishers, namely Timor Gap waters, Ashmore Reef waters, Pulau Dato waters and Bawah Angin waters. These are all local names derived from the fishers (Adhuri, 2005). Lambo fishers and Body fishers who target shark fin fish in the area surrounding Ashmore Reef, while the body fishers who use GPS and other modern equipment fish in the Timor Gap, Bawah Angin and Pulau Dato waters (Figure 2-7).

Stacey (2007) elaborates that Bajo departing from either Mola or Pepela usually finance their shark fishing voyages through credit arrangements. Dependence on credit is commonplace in the artisanal fishing communities of Southeast Asia and is 'closely bound up with the nature of fishing' (Sather, 1997: 132 *in* Stacey, 2007), where 'the peaks are sharper and the valleys deeper' (Alexander, 1982: 58 *in* Stacey, 2007). The highly variable and fluctuating returns from fishing mean that at certain times of the year income is not sufficient to cover daily household expenses or the costs of education, life cycle rituals, and religious feasts, fishing equipment or boat maintenance. Most households dependent on this economic activity do not have any significant cash savings nor do they own the assets required to guarantee a conventional bank loan.

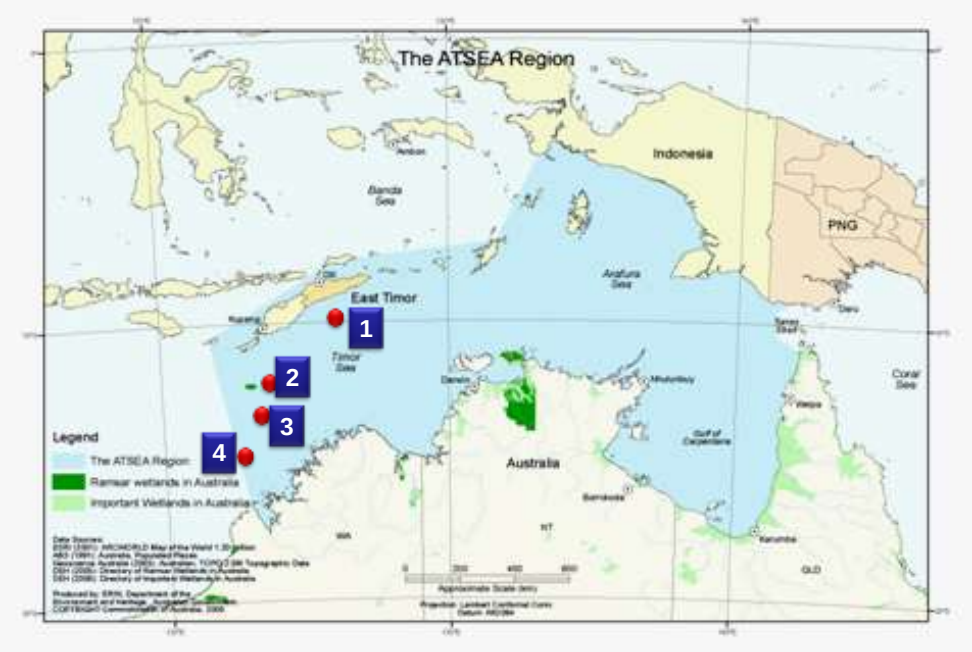

Figure 2-7. The Main Fishing Ground of Transboundary Fishers of East Nusa Tenggara (1=Timor Gap; 2=Ashmore Island; 3=Pulau Dato; and 4=Bawah Angin waters)

Recent research into the prevalence of transbounday fishers from the East Nusa Tenggara has been initiated by the group of scientist of Lembaga Ilmu Pengetahuan Indonesia (LIPI) (Adhuri, *et al.*, 2005). In their report, it has been revealed that not all fishers from East Nusa Tenggara engaging in fishing outside of Indonesia's territorial waters. It was found by using their GPS data that some transboundary fishers from Merauke remained within the territorial waters of Indonesia. Figure 2-8 presents the location of fishing ground based in fishers GPS data.

Figure 2-8. Fishing Ground of Transboundary Fishers of East Nusa Tenggara

2.2. Maluku Region

A. Livelihood in the Resources Context

Similar to the ENT region, most coastal communities in the Maluku Region of ATS (Aru Islands, Maluku Tenggara and West Maluku Tenggara) are fishers and depend on marine fisheries resources. In the case of the Aru Islands District, for example, the number of fishers is 24,693 which is dispersed into three sub-districts which are P.P Aru (8,849 fishers), Aru Tengah (8,812 fishers) and Aru Selatan (7,037 fishers) (Aru Island District Local Fisheries Agency, 2008).

Moreover, similar to the ENT region, non-powered boats dominate the structure of fisheries in the Aru Islands. As shown in Table 2-7, of the 2,542 fishing vessels, half are non-powered followed by motored-fishing vessels as of 1005 units. Table 2-7 presents detailed number of fishing vessels of Aru Islands District.

Table 2-7. Number of Fishing Vessels in Aru Islands District

No	Sub District	Non-Powered Vessel	Outer-board vessels	Inboard Vessels	Total (unit)
1	P.P. Aru	552	93	376	1,021
2	Aru Tengah	594	45	306	945
3	Aru Selatan	391	24	161	576
	Total	**1,537**	**162**	**843**	**2,542**

Source: Aru Island District (2008)

In the Aru Islands traditional fishing gears such as line-fishing, spoon-fishing and collection-fishing are the most popular; constituting 75% of the total number of fishing gears in Aru Island District.

Aru Islands District is reported to produce around 24,966 tons of fish valued at around IDR 128 billion. Using the cateris paribus assumption, it can be revealed that economic value of fish production per fisher in Aru Island District can be estimated at IDR 5 million per fisher/per year or not more than IDR 433,103 per fisher/per month, a relatively high income for local fisher households. The net value is not more than IDR 250,000 per fisher/per month.

The most common fishing activity in this area is trawl fishing. In some cases, trawl fishing has been claimed as the source of increasing water turbidity which affect to the productivity of mariculture in Aru Islands District such as pearl culture and in the longterm can increase the potential of conflict with the traditional fishers. Benjina is one of the fisheries activities center in Aru Islands. This location is used as fishing base for one of the leading fishing company in Indonesia namely DGS (Daya Guna Samudera Company).

From social point of view, local fishers in Aru Island are claimed having transition civilization due to the history of Kei Islanders who came in to this area in ancient times. However, from physical point of view, the original local fishers of Aru Island are more like Papuans so that they do not want to be said as Kei Tribes, but do not want to be said as Papua tribe either. *Sasi* culture (a traditional resources management usually practiced in Maluku) is not well-known to be practiced in Aru Islands (Maanema, *et al*., 2006).

The other important region of Maluku which included in the ATS region is Maluku Tenggara District. The southern and eastern part of this province has direct border with Arafura Sea. This district is geographically located between 4^{o} - 7^{o} S and 131^{o} - 133^{o} E. In terms of geo-ecologically position, this district consist of two scatter islands namely Kei Besar Island and Kei

Kecil Island. The center for administrative activities of this district is in Tual, located in Kei Besar Island. District of Maluku Tenggara has dominant sea area compared with the land. Total area of this district is reported to be 55,932.25 km^2. From this area, 92.83% is sea area and 7.17 % or 4.009 km^2 is the land.

The district of Maluku Tenggara Barat consists of 10 sub-districts (kecamatan), 226 villages (*ohoi*) and 4 areas equivalent to villages. From a total of 145,616 people, 15,475 are fishers and are included in the number of 2,325 fishing households. Table 2-8 shows fishing villages, population and number of fishers in Maluku Tenggara District.

Table 2-8. Fishing Villages, Population and Number of Fishers in Maluku Tenggara District

Sub District	Number of Villages	Population	Number of Fishers	Number of Fishers Group
Dullah Utara	11	10,701	1,075	35
Dullah Selatan	8	14,121	1,160	40
Kei Kecil	36	35,721	1,465	100
Kei Kecil Barat	10	6,172	1,120	38
Kei Kecil Timur	29	11,370	1,080	30
Tayando Tam	6	6,087	665	20
Kur	15	5,938	647	17
Kei Besar	62	24,581	2,875	85
Kei Besar Utara	30	10,320	2,630	75
Kei Besar Selatan	23	9,285	2,758	98

Source: Indrawasih (2007)

As previously mentioned, the most common livelihood for the people of Maluku Tenggara District is fisheries. In this district, shark fishing is common. Shark fishers generally come from Buton, Bau- Bau and Wawoni of South East Sulawesi. This group comes from Dobo, Kepulauan Aru and is based in Ut Island. Other target species of fishers in Maluku Tenggara District are Bonito (Cakalang). Indrawasih (2007) reported that it was not only Buton-originated fishers who engaged in shark fishing, but also people from Tual. Similar with the case of East Nusa Tenggara fishers, the main fishing ground of fishers from Tual or other island in Maluku Tenggara District is the border Indonesia-Australia territorial waters. In this case, shark fishing is risky in terms that it poses high possibility to be arrested by Australian authority due to illegal entry to other country waters without permission (*Illegal Fishing*). Figure 2-9 shows the fishing activity of fishers from Maluku Tenggara District in the context of ATS region. Fishing base map of shark fishing is also presented in Figure 2-10.

In the case of Maluku Tenggara Barat, there are 17 sub-districts (kecamatan) which are dominated by fishers. As can be seen from the fishing gears composition, Kecamatan Tanimbar Selatan has the largest number of fishing gears as reported of 1,875 units, followed by Kecamatan Tanimbar Utara of 1,667 units. The other sub-districts that have large number of fishing gears are Kecamatan Wuar Lalobar, Kecamatan Mdona Hier, and Kecamatan Selaru (DKP Maluku Tenggara Barat, 2007). Table 2-9 presents 5 largest kecamatan in terms of number fishing gears in Maluku Tenggara Barat District.

Table 2-9. Five Largest Kecamatan in terms of Number Fishing Gears in Maluku Tenggara Barat District.

No	Sub District (Kecamatan)	Type of fishing gear						Total (unit)
		Beach seine	Gillnet	Lift Net	Fixed Trap net	Trap	Line	
1	Mdona Hier	-	499	16	9	214	619	1,357
2	Selaru	1	735	27	19	166	116	1,064
3	Tanimbar Selatan	1	816	40	12	162	844	1,875
4	Tanimbar Utara	1	550	51	22	244	799	1,667
5	Wuar Labobar	-	616	44	21	199	577	1,457

Source: Maluku District (2006)

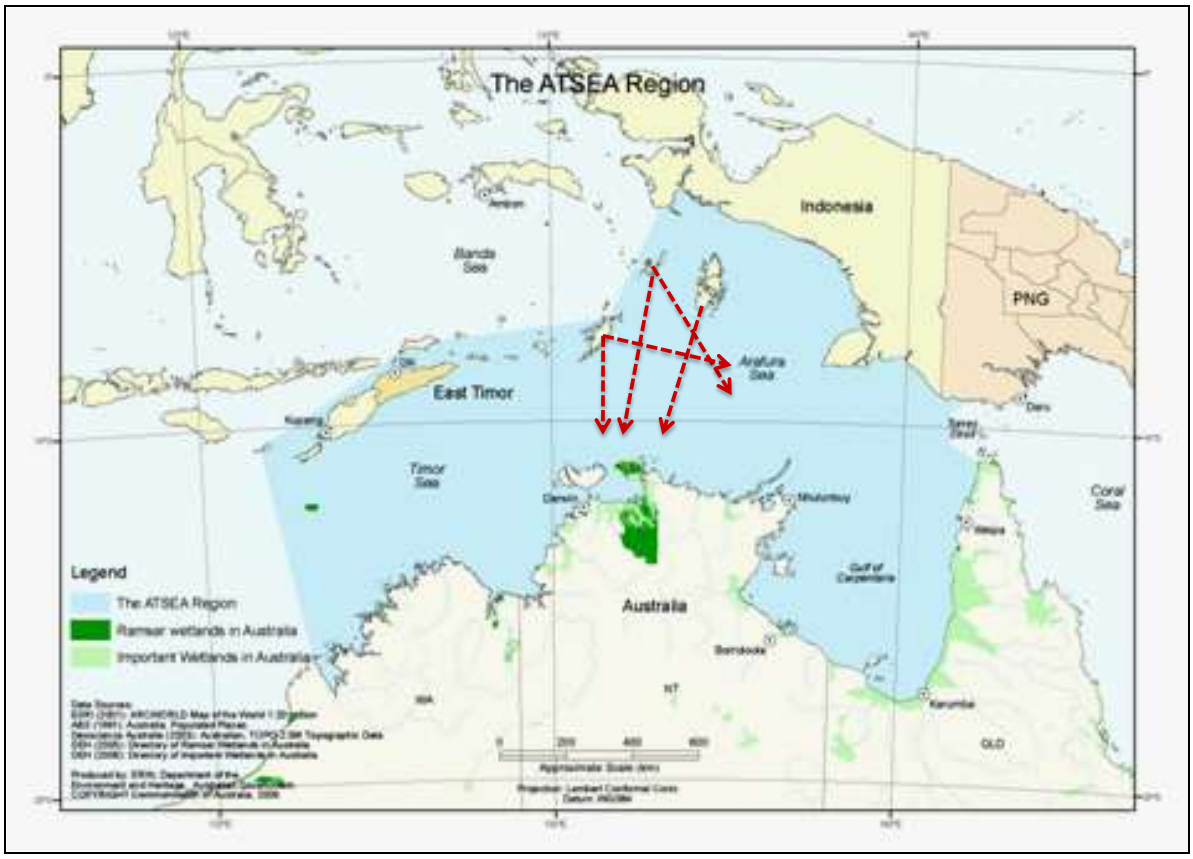

Figure 2-9. Fishing Ground of Shark Fishing Engaged by Fishers of Maluku Province

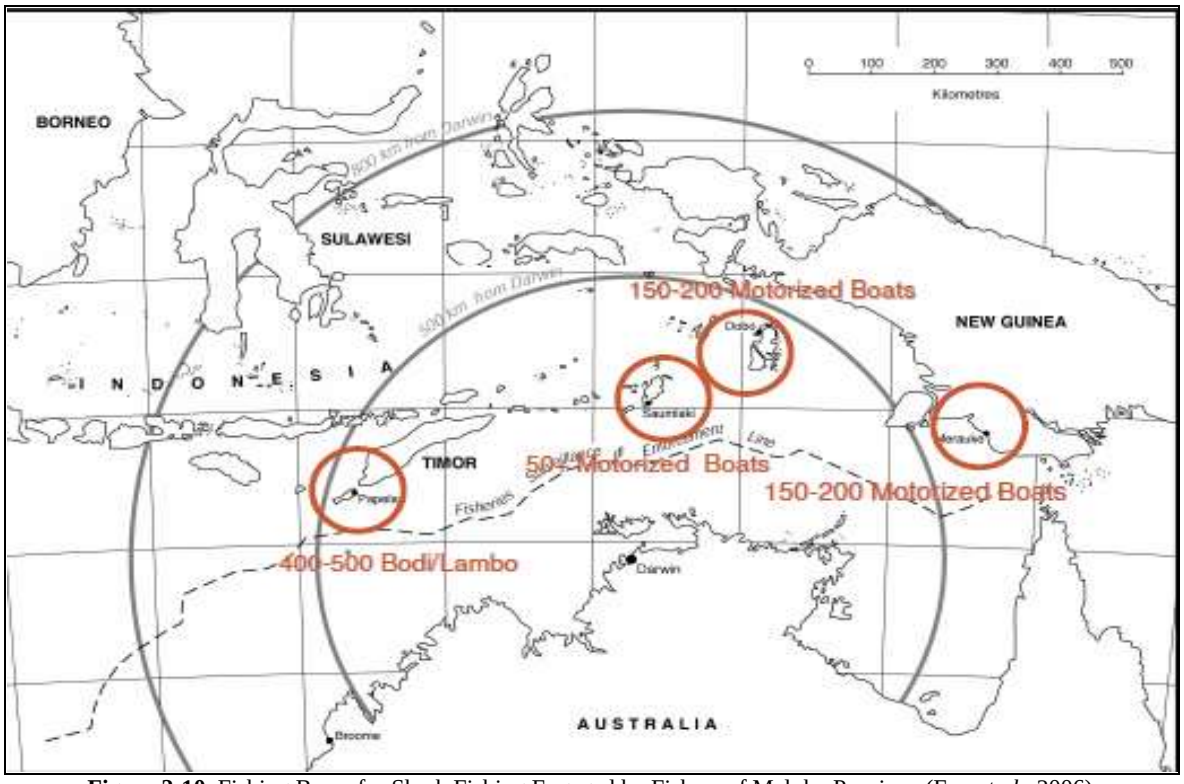

Figure 2-10. Fishing Bases for Shark Fishing Engaged by Fishers of Maluku Province (Fox *et al*., 2006)

C. Papua Region

Typical fisheries in Papua ATS region, for example in Merauke District are similar with other type of fisheries in other ATS regions. It is dominated by small-scale and traditional fisheries as observed by the official local fisheries agency. In 2003, non-powered fishing vessels numbered 1,906 units followed by 286 out-board vessels. In the case of inboard fishing vessel, it is dominated by fishing vessels with more than 200 GT of size (195 unit), followed by 100-200 GT vessel (165 unit) and 30-50 GT (157 unit).

In terms of fishing gear, fishers of Merauke are predominantly using floating gill-nets and fixed-gill-nets. In 2003, these fishing gears are reported to be 5,492 units and 6,219 units respectively. The main products of fisheries from Merauke such as fish-skin (*kulit ikan*), fish-fin-and-bones (*sirip dan tulang ikan*), fresh-fish, and fish-buble (*gelembung ikan*), were marketed to other islands as well exported to other countries such as Hongkong and Japan. Table 2-10 presents situation of fisheries products marketed inter-islands from Merauke.

Table 2-10. Volume of Fisheries Products Marketed to Inter-Islands from Merauke.

No	Fisheries Product	Volume (ton)
1	Frozen shrimp	5.80
2	Bubble fish	37.17
3	Fin-fish (sharks)	28.96
4	Fish-bones (sharks)	12.44
5	Fish-skin	88.12
6	Fresh fish	48.27
7	Sea Cucumber	1.08

Source: Maanema *et al*. (2006)

Bubble-fish is one of the typical products of Merauke. It is usually taken from Chinese Barramundi or Indonesia Barramundi which are commonly caught in the Arafura Sea. A large-size bubble-fish is priced in the range of IDR 200,000-400,000 per kg. Furthermore, in terms of social aspects of local indigenous fishers in Merauke, they originate from the Marind Tribe. Other fishers such as from Bugis and Makassar of South Sulawesi live in Merauke such as in Somkai Village. In this village, Marind tribe and Bugis tribe fishers live together and maintain their own while respecting the other.

In Papua ATS not all districts have fisheries as their common livelihood. The Asmat District. In this district, fisheries are not the main livelihood of their people. This is due to its natural characteristic which is dominated by forest area. Therefore, more than 90% of the local people depending on forest resources. However, fisheries resources is indeed very potentials in this district. Crabs, shrimps and squid are examples of fisheries resources which is easily found in the waters of Asmat District but still not yet utilized by local fishers. Most of fishing activities in this area is undertaken by foreign fishers from South Sulawesi (Maanema *et al*., 2006).

In the case of Mimika District, different situation can be found in terms of fisheries. In this district, fisheries are main livelihood of local people. However, similar with other region of ATS, the fisheries in Mimika is dominated by small-scale and traditional fisheries. Table 2-11 shows that the number of non-powered boats is reported to be 1,255 units or 73% of the total number of fishing vessels in Mimika.

Table 2-11. Structure of Fishing Vessel in Mimika

No	Type of vessel	Number (unit)
1	Non-powered fishing vessel	1,255
2	Outer board fishing vessel	382
3	Inboard fishing vessel	
4	Less than 5 GT	42
5	6-10 GT	41
6	11-20 GT	-
7	21-30 GT	-
8	31-50 GT	3

Source: Maanema *et al*. (2006)

In terms of fishing gear, gill-net is very common in Mimika. This type of fishing gear dominates the structure of fishing gears in Mimika by employing more than 69.08% of total fishing gear. The other dominant fishing gear is long-line, traps and other line-type fishing gears. Production of fisheries in Mimika District is dominated by Barramundi, Crabs, Shrimps, Shark-fin-fish, and other fishes. Table 2-12 presents the production of fisheries in Mimika by type of production.

Table 2-12. Production and Value of Production of Fisheries in Mimika

No	Type of Production	Volume (ton)	Value of Production (IDR 000)
1	Shrimps	85.00	5,525.00
2	Crabs	368.50	6,264.00
3	Barramundi	1,437.50	21,562.50
4	Sharks-Fin	21.95	2,195.00
5	Other fishes	3,955.50	28,875.15

Source: Maanema *et al*. (2006)

In terms of culture-related fisheries characteristic, people of Mimika has different situation compared with other district in Papua ATS, especially in terms of fish consumption. People of Mimika have relatively high level of fish-consumption which is reported to be 37.04 kg/capita/year, higher than national level as of 25 kg/capita/year. The local tribe of Mimika is Amungme and Komoro tribes who live in the coastal area. Amungme tribe live along area of Tembagapura and Akimugah, while, Komoro tribe live in the area of eastern of Etna Bay to Otakwa River (Maanema *et al*., 2006).

In terms of beliefs, both tribes have special local beliefs that land (including coastal and ocean) is very important assets/resources for them. For Amungme people, land is believed to be mother and good, while Komoro people believe that land is the mother of life. With this beliefs, resources conservation should be a considered as most important frameworks of development in this area. Figure 2-11 shows typical of dried sea cucumber as one of important economic commodities in ATS region.

In Papua, the port town of Merauke provides a focus point for ATS fisheries, both industrial and artisanal scale where a number of settlements (e.g. Pintu Air on the periphery of Merauke, the fishing village of Lampu Satu (2 km to the east) and the boat building village of Kumbe (60 km to the Northwest) host indigenous people and fishers belonging to migrant Bajo, Bugis and Butonese who access shark and trepang in Arafura Timor Seas. Local communities engage in small scale coastal fishing, working as laborers and trading along the Eastern Arafura Coast. There are a number of local fishermen from elsewhere, dominated by the Bugis and Butonese, mostly in the Mimika District. Very few indigenous people of Papuan descent live on this coast

Figure 2-11. Type of Sea Cucumber Collected and Processed by Local Fishers (Dried Cucumber) in Amugme District

Section 3
Gaps and Challenges Relating to Capacity Development of Communities in the ATS Region

3.1. Approach

The approach used for identifying the capacity of development needs for coastal communities in the Arafura and Timor Seas (ATS) is given in Figure 3-1 below. The identification is started by participatory root cause analysis to produce strategic socio-economic (SE) issues for each region. It is then followed by common strategic issues so that action plans can be designed and planned for the inter-regional ecosystem of ATS.

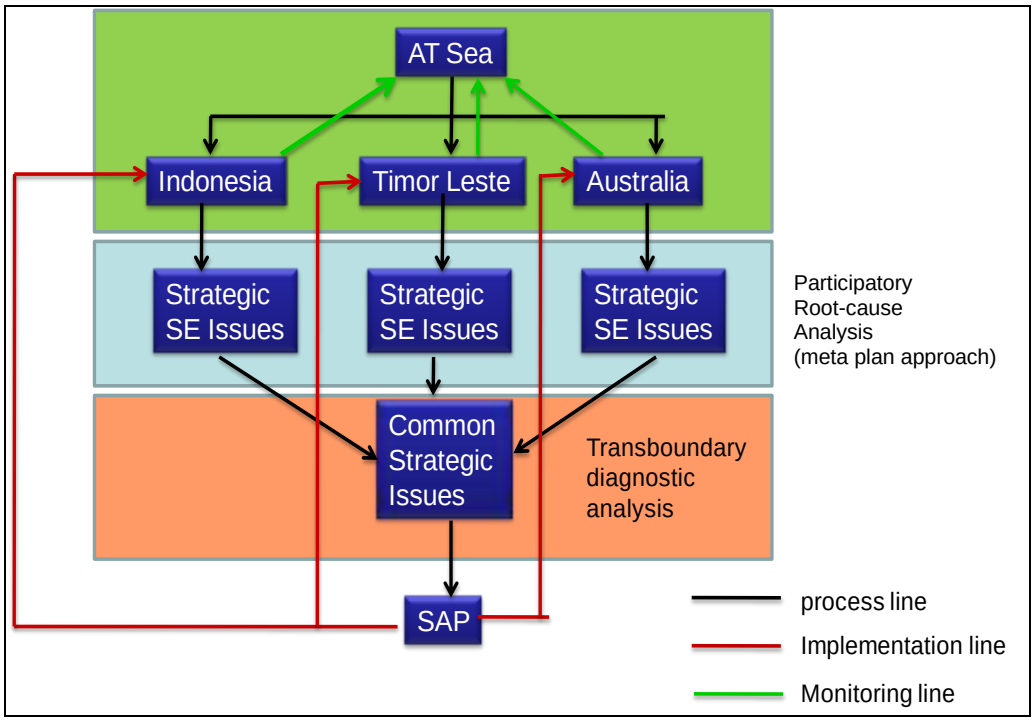

Figure 3-1. Approach for Identifying Capacity Development Needs

3.2. Gaps and Challenges for Community Development in ATS Region

According to the literature, surveys and discussions among key stakeholders of Indonesian ATS, there are a number of key gaps on socio-economic information in the coastal communities of the ATS region. Table 3-1 shows the preliminary identification of gaps in socio-economic information in the ATS.

Table 3-1. Preliminary Identification of Gaps in Socio-Economic Information of Coastal Communities in the ATS.

No	Key Socio-Economics Domain	Information Gaps
1	Community Income	Distribution of income of coastal community by type of livelihood
2	Community perception	Distribution of coastal community based on their perception on resources, resources management and governance

No	Key Socio-Economics Domain	Information Gaps
3	Structure of Livelihood	Perceived alternative livelihood of coastal community
4	Social-Ecology System	Level of Interdependency of coastal community and marine resources
5	Participation	Level of participation of coastal community on resources conservation and rehabilitation

3.2. Threats on Coastal Community Livelihood

According to the identified issues through participatory TDA conducted in Bogor, 16-17 November 2008, there are three main issues related to the ATS resources management namely (1) overfishing; (2) trans-boundary fisheries; and (3) marine pollution and resources degradation.

(1) Issues on Overfishing

In the case of overfishing, there are two priority issues to be considered in managing ATS resources in sustainable ways; (1) resources management; and (2) Monitoring, Surveillance and Control (MCS). In the case of resource management issues, discussions have identified several strategic obstacles; namely lack of research conducted to understand the dynamics of resources in ATS; lack of data and information available, especially those which related to resources management; lack of human resources capacity; and lack of management capacity.

The second priority is MCS and Law Enforcement for which several problems have been addressed, such as the lack of usage of MCS infrastructure available; the lack of consistency of fisheries policy including fishing zoning policy, production and effort limitation policy, etc; the lack of optimal fisheries tribute processes especially in terms of vertical and horizontal coordination among the tributes.

From the issues of overfishing, we can identify community development needs for coastal communities in ATS as presented in Table 3-2.

Table 3-2. Preliminary Identification of Community Capacity Development Needs to Cope with Problem of Overfishing

No	Priority Issues	Community Development Needs
1	Lack of data and information related to marine resources uses	Increasing capacity to deliver local/traditional knowledge on resources
2	Lack of research related to understanding the dynamics of ATS	Increasing the participation of local community in research. In this case increasing local capacity in research is needed
3	Lack of law of enforcement related to illegal marine resources uses	Increasing participation of local fishers in law enforcement through capacity development in regulation aspects in fisheries.
4	Lack of human resources capacity related to monitoring of resources	Increasing participation of local fishers in monitoring through developing their capacity in resources monitoring

Source: Focus Group Discussions

(2) Issues on Transboundary Fisheries

Transboundary fisheries in this report are defined as the fisheries which are undertaken in the area of other provinces or districts, as well as the other countries. The transboundary activities

are mainly due to cultural and historical reasons, but in many cases are also triggered by economic reasons.

In the case of transboundary fisheries, a TDA framework has been developed as presented in Figure 3-2 below.

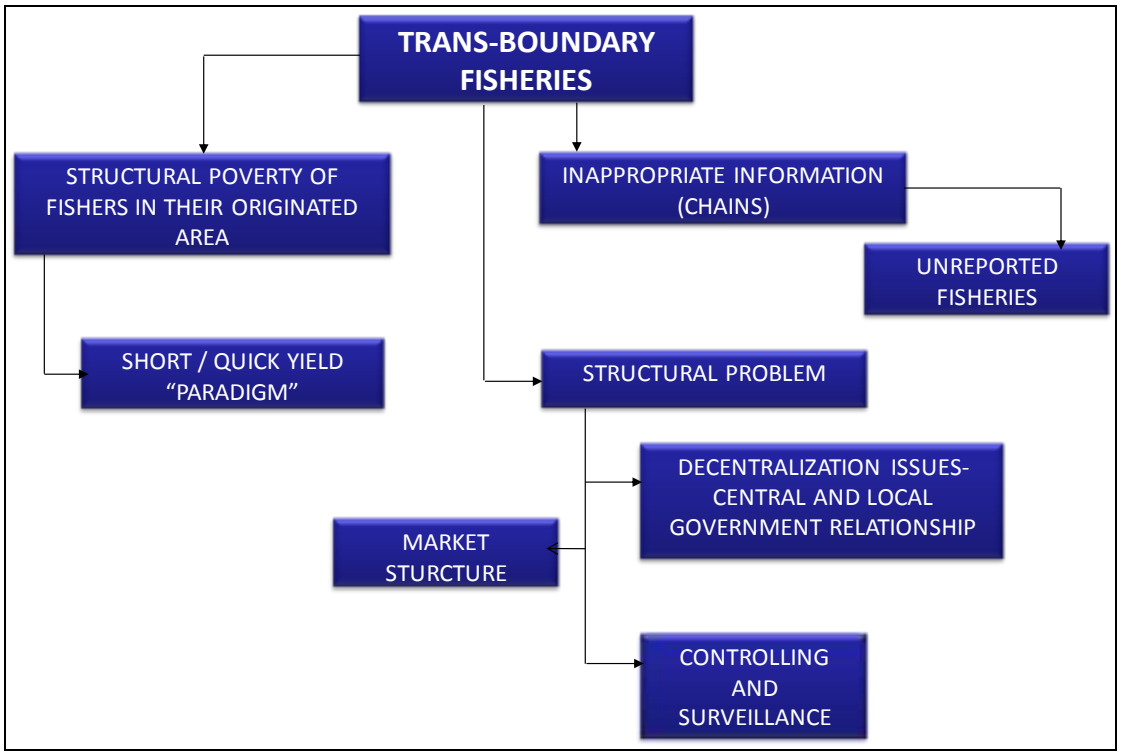

Figure 3-2. TDA Framework of Transboundary Fisheries in Indonesia ATS

As can be seen in Figure 3-2, there are three root problems in transboundary fishing; (1) structural poverty of the fishers in the originated area; (2) structural problems among local and central government especially related to management of ATS resources as well as economics and the market; and (3) the lack of information especially in terms of geographical information of national and provincial boundaries. In order to cope with this problem, some community development gaps and needs have been identified as presented in Table 3-3.

Another important challenge in addressing the livelihood needs of fishing and coastal communities in the ATS region is the migratory nature of some of these groups. Some pilot works commenced previously in NTT through the Australian National University in association with Australian government agencies and local communities in Timor and Rote, NTT have found some success in piloting alternative maritime livelihood activities with more sedentary coastal communities. This means that groups of Bajo and Butonese fishers, who comprise the majority of fishers engaged in transboundary and migratory livelihood strategies across eastern Indonesia require special consideration. For example it may be that in order to address priority environmental concerns in the ATS region, it may be necessary to implement sustainable livelihood activities in the home villages of such fishing groups, which are outside of the ATS region. This will be explored further during the full TDA for ATSEA.

Table 3-3. Preliminary Identification of Community Capacity Development Needs to Cope with Problem of Transboundary Fisheries

No	Priority Issues	Community Development Gaps and Needs
1	Structural Poverty of Fishers in the Originated Area	Developing appropriate scheme of alternative livelihood using their perspective and local knowledge
2	Structural problem both in terms of governance and market	Structure and mechanism of government intervention on market through increase capacity of fishers in economic analysis and management
3	Lack of information on geographical boundaries of national and provincial level	Facilitating and developing participatory communication system with local fishers

Another group of fishers in the ATS region who are also fishing in Australian waters (the MOU Box), are the Madurese group especially the fishers from Raas Islands, Sumenep District, Madura. As reported by Indrawasih (2008), transboundary fishing by the Raas fishers seems to be customary and has been practiced for a long time. They fish in the boundary waters between Indonesia and Australia. The Raas Islands are administratively categorized into Kecamatan (sub-district) under the Sumenep District, East Java Province. The Raas Islands consists of 14 islands with only 9 of them inhabited. The major target of the Raas fisheries is Teripang. The other type is Snapper which are only fished in areas surrounding the islands. But in the case of Teripang fishers, they travel to fishing grounds outside of the islands such as Riau Province waters, Bangka Belitung, Kalimantan, Maluku, as far as Australian waters (Ashmore Reefs Islands). They use traditional fishing vessels and according to the work of Indrawasih *et al*. (2008), there are only 16 fishers who are still undertaking transboundary fishing - 12 fishers from Tonduk Village (Tonduk Island) and 4 fishers from Ketupat Village (Raas Island).

(3) Issues on Marine Pollution and Resources Degradation

In terms of marine pollution and resources degradation, several strategic issues have been identified including the lack of knowledge and information on water circulation and ocean dynamics; the lack of capacity building and awareness, institutions, human resources related to marine pollution and resources degradation; the lack information available on geomorphology, river catchment areas and their impact on marine and coastal productivity; the lack of enforcement and information on ship based pollution, oil spills; land based pollution; and lack of coordination on an institutional level (scientific information, policy, initiative, program, etc). Some possible community development needs related to these priorities can be seen in Table 3-4 below.

Table 3-4. Preliminary Identification of Community Capacity Development Needs to Cope with Problem of Marine Pollution and Resources Degradation

No	Priority Issues	Challenges
1	Resources Degradation	Increasing community participation in resources conservation and rehabilitation
		Developing incentive based conservation system
2	Marine Pollution	Increasing community awareness on marine pollution especially those come from such type of domestic waste
		Developing communal domestic waste treatment especially for coastal community along the ATS region

(4) Issues on Illegal Unreported and Unregulated Fishing

IUU fishing is an important problem for both Indonesia and the bordering countries of the ATS region; Timor Leste and Australia. There is very limited information regarding the impact of IUU Fishing on the Indonesian fisheries. This gap should be closed in the future so that appropriate fisheries governance measures can be set up to minimize negative impacts of IUU fishing both on the resources and the community.

Section 4
Recommendation on Measures to Address Gaps and Challenges for Coastal Communities in the Indonesia ATS Region

4.1. The Approach: Sustainable Coastal Livelihood System Analysis

In order to recommend measures to address gaps and challenges for coastal communities in the ATS region, concepts of Sustainable Coastal Livelihood System Analysis (SCLSA) was used in the context of ATS resources management. In this regard, it has been revealed that natural capital and social capital is a duel system so that effort in addressing gaps and challenges for the ATS region should be based on an integrated and comprehensive approach. Theoretically, SCLSA is defined as *an analysis tool to observe and understand behavioral patterns of people and communities in complex natural and human systems in terms of elaborating vulnerability of these systems towards sustainable livelihood outcomes*

In this approach, measures to address the gaps and challenges include issues of vulnerability and resilience in the communities of the ATS region. In this case, external shocks and pressures, as have been elaborated previously, play important roles for identifying measures especially those which relate to livelihood strategies and also expected livelihood outcomes of the community. Diagrammatically, the approach of SCLSA is presented in Figure 4-1.

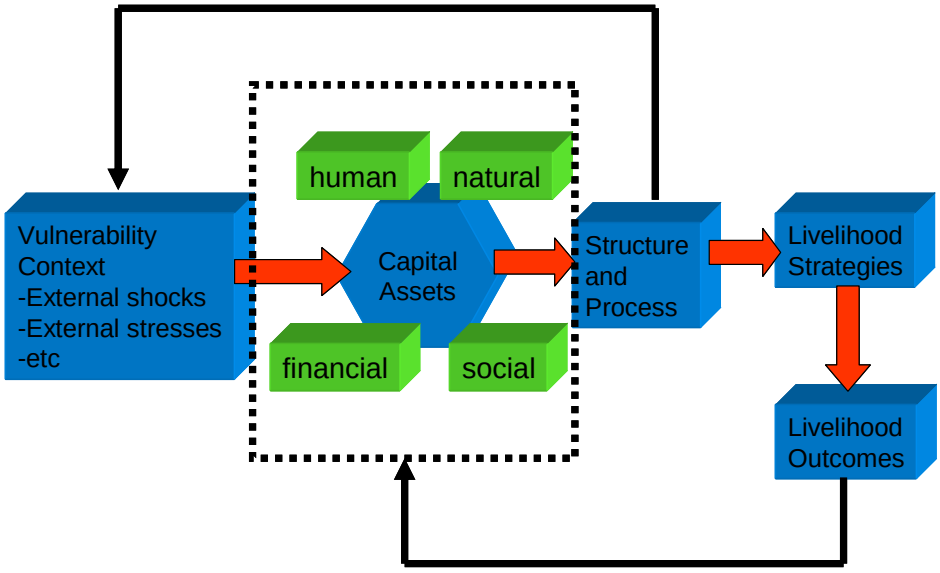

Figure 4-1. The Sustainable Coastal Livelihood System Approach Using for ATS Management Region

Furthermore, macro conceptual framework in the coastal community development in the ATS region also incorporates the approach for seeking alternative livelihood schemes as depicted in Figure 4-2 below.

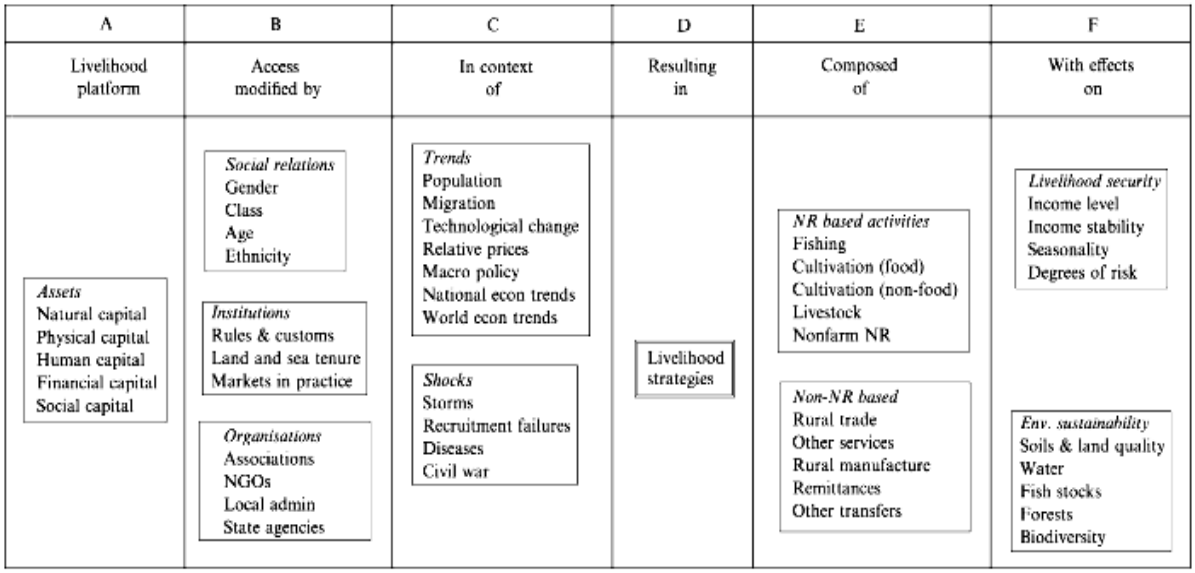

Figure 4-2. Macro Conceptual Framework for Seeking Alternative Livelihood for Community in ATS Region (Adapted from Ellison and Allis, 2001)

The process of designing and implementing economic incentives for communities in the ATS region involves a progression of logical steps and is based on a range of background information and analysis. The steps in designing measures on addressing the community gaps and challenges in the ATS region involve five stages as presented in Table 4-1 and described more detailed in Figure 4-3.

Table 4-1. Steps of Sustainable Coastal Livelihood System Analysis

No	Steps of SCLSA	Description
1	Gathering background information on community livelihood and natural systems	Describe the socio-economic and natural resources context
		Identify interactions between livelihood and the natural resources bases
2	Analysing community influences on natural resource system	Identify activities which contribute to resources degradation
		Identify underlying forces driving economic activities and resources degradation
3	Identifying needs and niches for incentive measures	Identify needs for incentive measures for resources conservation
4	Choosing economic incentives for community development related to coastal resources system conservation	Identify niches for incentive measures
		Identify incentive measures
5	Implementing incentive masures	Set in place incentive measures for community development in the context of coastal resource system conservation

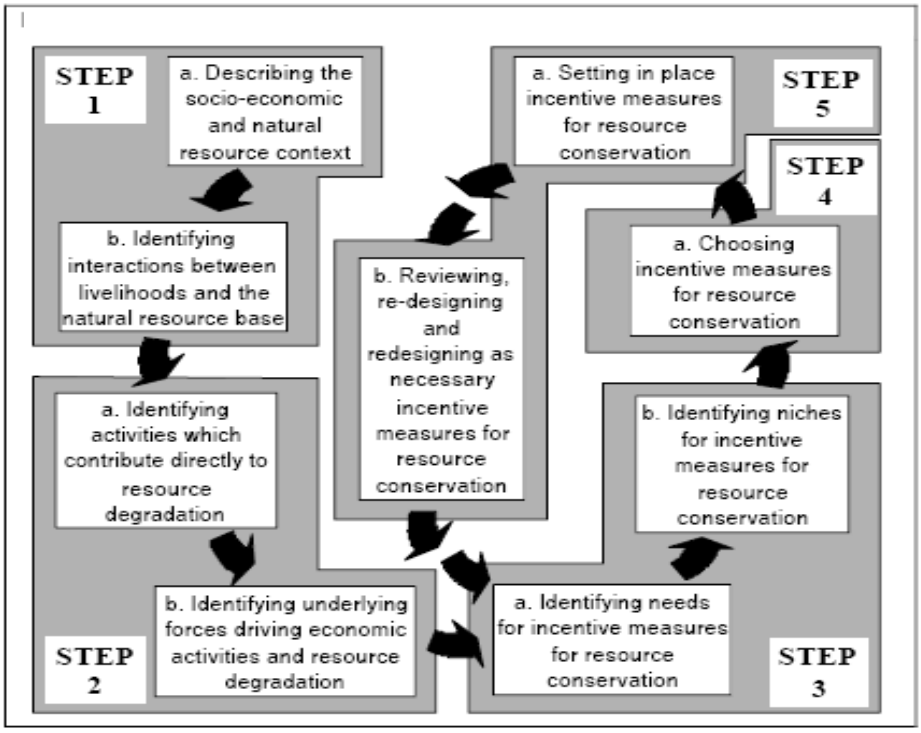

Figure 4-3. Fundamental Steps of SLCSA (adapted from Emerton, 2001)

4.2. Recommendation on Measures for Addressing the Gaps and Challenges

From the steps outlined in Figure 4-3, Table 4-2 shows the results for community development in ATS region.

Table 4-2. Matrix of SCLSA Approach in the Context of ATS Region

No	Steps of SCLSA	Description	Context of Community in ATS Region
1	Gathering background information on community livelihood and natural systems	Description of the socio-economic and natural resources context	Marine resources based livelihood, fishing activities
		Identification of interactions between livelihood and the natural resources bases	Due to high economic value of marine resources, the interaction between livelihood and natural resources is very strong
2	Analysing community influences on natural resource system	Identification of activities which contribute to resources degradation	In some places, IUU fishing activities are common. It can also be due to destructive fishing activities such as bombing
		Identification of underlying forces driving economic activities and resources degradation	In equal income and poverty in the origins

No	Steps of SCLSA	Description	Context of Community in ATS Region
3	Identifying needs and niches for incentive measures	Identification of needs for incentive measures for resources conservation	Alternative local livelihoods for fishers
		Identification of niches for incentive measures	Clear regulation in terms of coastal and marine resources uses for the community
4	Choosing economic incentives for community development related to coastal resources system conservation	Identification of incentive measures	Livelihood incentive measures such as improving efficiency, economically feasible alternative livelihood mechanism, social acceptability
5	Implementing incentive masures	Setting in place incentive measure for community development in the context of coastal resource system conservation	Resource system-based incentive

Section 5
Recommendation on Potential Demonstration Sites for Coastal Communities in the ATS Region

5.1. Potential Demonstration Sites

According to the gaps and challenges previously described, several possibilities in terms of demonstration sites for increasing the capacity of community related to ATS region is presented in Table 5-1.

Table 5-1. Issues and Appropriate Prospective Demonstration Sites in the Context of ATS Region

No	Strategic Issues	Measures	Prospective Demostration Sites
1	Poverty in the Origins	Economic Incentive for developing alternative local livelihoods: Seaweed, mud-crab-based livelihood, etc	Kei Islands, Rote Ndao, and Merauke
2	Inappropriate marine resouces governance	Strengthen the capacity of fisheries governance officers in transboundary ocean and fisheries governance; training of human resources	Rote Ndao District and Kupang, Maluku Tenggara Barat District, Maluku Tenggara District
3	Ecosystem degradation	Community-based coral rehabilitation (transplantation or reef balls approach) for tourism and fisheries	Kepulauan Aru District, Maluku Tenggara Barat District, Maluku Tenggara District

5.2. Following Up Action: ATS Strategic Plan

The prospective measures and demo sites should be followed inline with the development of a coastal and marine strategy for the ATS region. The strategy should consist of three main parts namely (1) state of the coast (SOC) of the ATS region; (2) issues and problems of the ATS Region; (3) strategy to achieve the objectives including vision and mission of the development. The overall framework of a coastal and marine strategy for ATS region is presented in Figure 5-1.

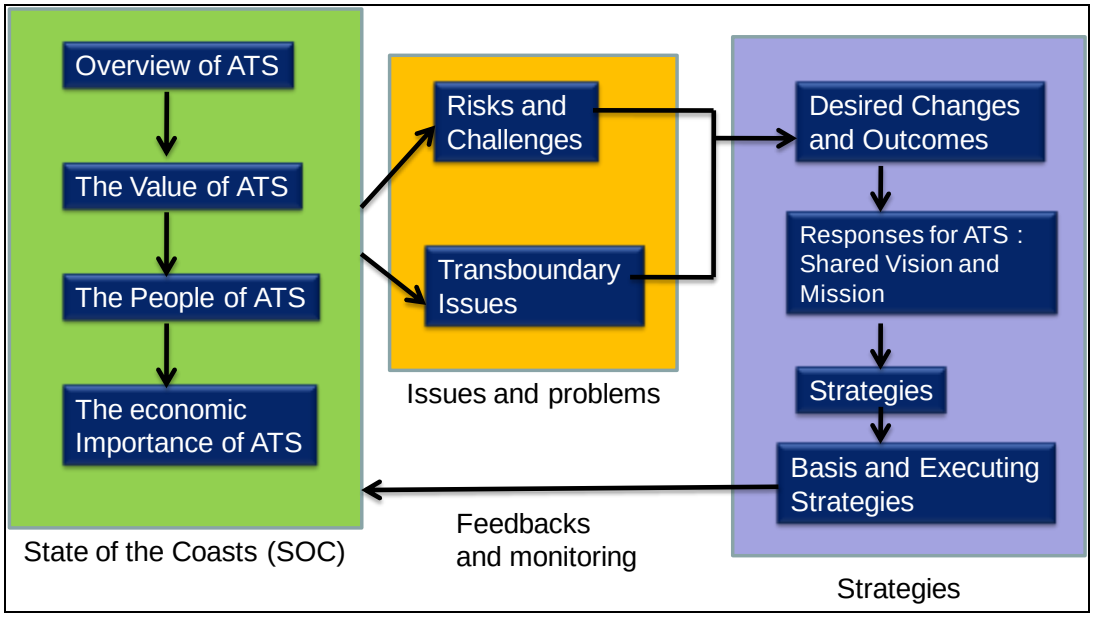

Figure 5-1. Framework of Coastal and Marine Strategy of ATS Region

It has been acknowledged that a coastal and marine resources development strategy program needs a committed, long-term effort to ensure that addressing the gaps and challenges is inclusive of a shared vision and mission among the stakeholders. PEMSEA (2008) identified some key issues related to the success of coastal and marine resources development programs. The main issue is political commitment among the decision-making groups. This issue is important due to significant affection of local government's sense of belonging to the whole program so that ATS development strategies could be embedded into their local development plan. The other issue of successful is institutional arrangement in terms of implementation of ATS management strategies, interrelate government and other institution, etc. Table 5-1 shows the success of ICM program.

Table 5-1. Success Factors of ICM Program

Key factors to ensure the success of an ATS Management Strategies	Purpose
Local government commitment	To instill a sense of ownership
Institutional arrangements	To oversee ICM development and implementation and facilitate inter-agency coordination.
Legislation	To provide legitimacy, support implementation, and provide basis for participation. To facilitate the harmonization of policies.
Availability of financial resources	To implement ATS Management Strategies programs sustainably, building on existing human and financial resources of local governments and stakeholders.
Public awareness	To ensure involvement by stakeholders, secure commitment from government, and enhance moral responsibility of the business community.
Local capacity and community facilitation	To facilitate ATS Management Strategies implementation and scaling-up.
Local ATS Management Strategies champion	To help and advocate initiation, development and implementation of ATS Management Strategies programs.
Scientific support	For sound environmental decision-making and management.

Source: Adapted from PEMSEA (2008)

The implementation of ATS management strategies also potentially raises several challenges. Table 5-2 presents the potential barriers of an ATS management strategies program.

Table 5-2. Potential Barries of ATS Development Strategy Program

Potential barriers to ATS Management Strategies programs	Causes	Action to be taken
Political interference	• Political rivalry • Changes in local leadership • Shift in political power • Personal interests of political leaders	• Unstable political climate • Take advantage of political opportunities to create a favorable political environment
Resistance from line agencies and usually is not focused	• Fear of losing legal authority and resources • Suspicious of intrusion	• Promote coordination and integration • Create a strong coordinating mechanism

Potential barriers to ATS Management Strategies programs	Causes	Action to be taken
Resistance from industries	• Fear of dealing with strict environmental management control	• Identify possible areas of resistance and interference • Identify response strategies.
Resistance from scientists	• No practical experience • Tendency to turn project into research program • Do not consider themselves capable of doing management functions	• Involve scientists
Resistance to the establishment of ATS management strategies	• Lack of understanding of the ATS management strategies	• Identify possible areas for resistance and interference • Identify response strategies

Source : Adapted from PEMSEA (2008)

Acknowledgments

I am deeply indebted to the all of stakeholders of Arafura and Timor Sea region who have involved in several group discussion related to the management of ATS region. Sharing of information, knowledge and experiences during the discussions have enriched my understanding on ATS region especially in terms of socio-economics and community development characteristics. Thanks also go to the secretariat of Arafura and Timor Sea Expert Forum (ATSEF) for giving me opportunity to involve to the discussions and also report of socio-economics of ATS region.

This report is dedicated for completing the understandings and information on ATS region, especially related to the social-economics characteristics as well as the development needs for community who depend on the ATS region. Secondary information is the main sources of this report so that further updating mechanism should be considered in the future. I am gratefully expressing my thanks also to Dr. Tonny Wagey, Dr. Natasha Stacey, Dr. Subhat Nurhakim, Dr. Sugiarta, who have never-bored effort to assist, give comments and improvement for making this report reliable. My sincere thanks also go to Ivonne Rawis and Dyah from BRKP-DKP for giving friendly-environment relationship during completion of this report.

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Appendix 1. List of Stakeholders Involved in Socio-Economics and Development Issues in ATS Region

Identification of socio-economic and development issues have been conducted through focus group discussions among the stakeholders in the ATS Region. It was undertaken using workshop methodology in Bogor and Jakarta. A list of stakeholders (by the name of institution) is listed below.

Workshop Bogor, 16-19 November 2008

1. Mr. Asep D. Muhammad, Secretary, Agency for Marine and Fisheries Research/ATSEF Indonesia
2. Ms. Anna Tengberg, Regional Technical Advisor, Land Degradation& International Waters, UNDP Regional Bangkok
3. Mr. Narciso A. de Carvalho - ATSEF Timor Leste Focal Point
4. Mr. Constancio dos Santos da Silva – ATSEF Timor Leste
5. Ms. Ilse Kiessling, ATSEF Australia Focal Point
6. Mr. Tonny Wagey – Coordinator ATSEF Regional/ATSEF Indonesia
7. Mr. Anton Sri Probiyantono, Program Officer, Environment Unit, UNDP Indonesia
8. Ms. Natasha Stacey – International TDA Consultant
9. Mr. Steve Raaymakers – International GEF Consultant
10. Mr. Subhat Nurhakim - Policy Framework and Government Institutions Specialist
11. Mr. Sugiarta Wirasantosa - Biodiversity and Oceanographic Specialist
12. Mr. Luky Ardianto – Socio Economic and Community Development Specialist
13. Ms. Wahyu Indraningsih – National Expert on Biodiversity
14. Mr. Agus Supangat – National Expert Oceanography
15. Mr. Hanung Cahyono – National Expert on Fisheries
16. Mr. Duto Nugroho – Fisheries and Marine Biodiversity Specialist
17. Mr. Wawan Oktariza – National Expert Social Economic, IPB
18. Mr. Ary Wahyono – National Expert Social Economic, LIPI
19. Ms. Helena Sahusilawane – Local Resource Person, Ambon Maluku
20. Ms. Irena Paulu Renjaan – Local Resource Person, Ambon Maluku
21. Ms. Yokamina Tahapari, Local Resource Person, Ambon Maluku
22. Mr. Bernadus Sau – Local Resource Person, Kupang NTT
23. Mr. Mohammad Khazali – Conservation International, Indonesia
24. Mr. Yohanes Subaryanto – The Nature Conservancy, Indonesia
25. Ms. Purbasari Surjadi – Sustainable Fisheries Partnership (FSP), Depok
26. Ms. Sari Devi, Staff of Cooperation and Communicaton Research Unit, AMFR
27. Mr. Bambang Herunadi, Head of Programme Division, AMFR
28. Ms. Pipiet, Staff of Cooperation and Communicaton Research Unit, AMFR
29. Ms. Ivonne Rawis – Secretary, ATSEF Indonesia
30. Ms. Sitti Hamdiyah – Staff Secretariat ATSEF Indonesia
31. Mr. Wawan Ridwan - WWF Indonesia
32. Mr. Augy Syahailatua – National Expert on Biodiversity,LIPI
33. Mr. Rolando Semeru, Finance Assistant NRM, Environment Unit, UNDP Indonesia

Workshop Jakarta, 2-3 April 2009

1. Dr. Gellwynn Jusuf, Chairman - Agency for Marine and Fisheries Research (AMFR)
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Workshop Kupang, 19-20 February 2009

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POLICY FRAMEWORK AND GOVERNANCE INSTITUTIONS GOVERNING THE MANAGEMENT OF THE ARAFURA AND TIMOR SEAS OF INDONESIA

By: Subhat Nurhakim

Executive Summary

This report describes the policy framework and institutions governing the management of the Arafura and Timor Seas region of Indonesia.

The objectives of this policy framework and governance institution study are to:

1. Identify Indonesian institutions, laws and legislations related to the marine and fisheries development.
2. Identify the gaps and challenges of the Indonesian institutional and policy frameworks related to marine and fisheries sustainable development of Arafura and Timor Seas region.
3. Identify national marine and fisheries framework development and application policy framework to be integrated in the FSP framework.
4. Identify and recommend potential demonstration activities in order to achieve the objectives of this study and the institutional set up for ATSEA.

The report outlines the environmental and sector institutions, law and legislation as well as policies in several sectors such as: Biodiversity Conservation, Fisheries, Aquaculture, Marine science and research, Agriculture/Forestry, Catchments management, Mining, Offshore oil and gas, Port and shipping and Climate change.

Since the independence of the Republic of Indonesia, in 1945 laws and regulations that relate to environment and resources management have been established parallel with the development of various government institutions.

The State Ministry of Environment in the central government level has a mandate to create the national policy and its program in order to sustainably maintain the environment and improve coordination between sectors to avoid environmental degradation as a consequence of development.

There are five Environment Management Regional Centers directly under the state Ministry, namely Environment Management Regional Center of Sumatra, Bali and ***Nusa Tenggara***, Celebes, ***Moluccas*** and ***Papua***, Java, and Borneo.

In order to strengthen the coordination of environmental management at the local level, Ministerial Decree No. 240/1980 concerning "Organization and works schedule of Regional Secretariat (Province level) and Secretariat of Regional Representative House (Province level) which has a ***Bureau of demography and environment***", was issued by the Minister of Interior.

In terms of Indonesian laws, the management and maintenance of the environment is stipulated in articles 5(1), 20(1) - 1945 Constitution of the Republic of Indonesia. Generally all the laws and regulations in the Republic of Indonesia are referred to in the 1945 Constitution of the

Republic of Indonesia. These include Government Regulation, Ministerial Decree, Provision of Director General, Governor, and other related legislation.

These laws and regulations are also contained, among others in the following: guidance in establishment of environment institutions and its working mechanism, ratification of international convention, reference of environment quality standard, measures to control and manage the environment, management of hazardous material and waste, environment settlement, pollution control, etc., legislations and policies by sector issued either by central or local government levels in line with their task.

Since Indonesia's development has mainly concentrated on terrestrial regions (forest, agriculture and industry), most of the laws and regulations are dealing with ***"Land environment"*** rather than marine environment per se.

In regards to coastal and marine resources management **by sector,** the Ministry of Marine Affairs and Fisheries has been established; however to some extent several Ministries, such as Forestry, Tourism, Mining, and Transportation, still undertake functions related to marine management.

At the local level (Province and District), besides the Technical Implementing Unit as a representative of each related Ministry, there are related Sector Services in local government levels (Province and District), that administratively come under the Governor (Province level) or Regent (district level).

Several constraints and gaps concerning institutions and legislation for each sector have been described in this report. In summary these include, among others:

- For environmental management policy and regulation at central and local government levels, it seems that most of the regulations address the impact of development to terrestrial areas; with very limited regulations that relate to environmental impact from marine activities, such as fisheries and aquaculture.
- Environment institutions in Indonesia and the three Provinces in ATS region are very fragmented. For example; roles, responsibilities, and coordination mechanisms at the national and local level are not well outlined, while the availability of human resources, finances, and technology is also very limited. These pose significant obstacles to effective environmental management of the ATS region.
- Environment management at the national level is undertaken by The State Ministry of Environment; while at the local government (Province and District level) is undertaken by environmental management agencies (e.g. *the local Agency for Controlling Environment Impact/BAPEDALDA* at Province and district levels or Office of Environment Service in certain districts). However, the largest investment and policy decisions that affect the quality of environment are actually made by other agencies, such as the Ministry of Public Affairs, the Ministry of Home Affairs, the Ministry of Transportation, the Ministry of Forestry, and the Ministry of Marine Affairs and Fisheries.
- Sectoral Services at Provincial and District levels that previously were under each Ministry are now a sub-ordinate of Local Government (Governor in Province level and Bupati in District level). This ambiguity has generated an overlap and gap in duty and execution function between Central, Province and District governments.

In order to overcome the constraints and gaps, several recommendations for ATSEA are proposed:

1. Reform the resource and environmental management system.
    - Strengthen the decentralization of environmental management.
    - Optimize the role of stakeholders.
2. Revitalization of MCS Programme for fishing activities:
3. Legislation and policy review.

Some proposed demonstration pilot projects are:

1. Integrated Coastal Management
2. Arafura and Timor Seas Fisheries Management Plan
3. Legislation and Policy Review and Analysis Project

The objectives of these projects are to improve the ability of local government and other stakeholders in developing and managing the marine resources and environment in a sustainable manner, anticipating that it will improve the policy and institutional frameworks in Arafura and Timor Seas Region.

1. Introduction

Since the independence of the Republic of Indonesia on 17 August 1945, the sea territory of Indonesia has changed several times. The Dutch government created the *Territoriale Zee en Maritieme Kringen Ordonantie Staatsblad 1939* which divided Indonesia's land into separate regions where each region has its own territory until 1957. Then, on 13 December 1957, the government of the Republic of Indonesia through *The Djuanda Declaration* which considered the unity of the Republic of Indonesia declared that all Islands and the seas in between shall be assumed as one territory of the Republic of Indonesia.

The 1982 United Nations Law of the Sea Conference, recognized Indonesian Archipelagic country territory under the United Nations Convention on the Law of the Sea (UNCLOS).

This International recognition was then followed by the Indonesian Law No.17/1985 concerning ratification of the United Nations Convention on the Law of the Sea (UNCLOS) dated 31 December 1985.

In accordance with marine and fisheries resources management, there are three types of marine territory in Indonesia:

- where Indonesia has "full sovereignty" or what is called "sovereignty territory of Indonesia";
- where Indonesia has "sovereign right" to its resources and has authority in managing its resources in certain cases; and
- where Indonesia has interest, but does not have any sovereignty, sovereign right, or authority on this territory.

Hierarchically, the Indonesian government is divided into Central, Provincial and District levels, respectively. In terms of resource management and utilization, articles 17 and 18 of the Indonesian Law No.32/2004 concerning the Local Government (Autonomic law), state that Provinces which have sea territory, are given authority to manage their resources until 12 nautical miles from the coast line to the open sea and/or to archipelagic waters, with the District government having authority to manage the first 1/3 or 4 nautical miles.

In 1999 Indonesian waters were divided into nine Fisheries management areas (Agriculture Minister Decree No.995/Kpts/IK 210/9/99) which were modified recently based on bio-ecology and morphology (Marine Affair and Fisheries Minister Decree No. Per. 01/Men/2009 concerning Fisheries Management Area of the Republic of Indonesia) into 11 Fisheries Management Areas or Zones namely: (1) Malacca Straits and Andaman Sea (WPP-RI 571), (2) Indian Ocean, western part of Sumatra and Sunda straits (WPP-RI 572), (3) Indian Ocean, southern part of Java and island of Nusa Tenggara (WPP-RI 573), (4) Karimata Straits, Natuna and South China Seas (WPP-RI 711), (5) Java sea (WPP-RI 712), (6) Makasar strait, Bone bay, Flores and Bali seas (WPP-RI 713), (7) Banda sea and Tolo bay (WPP-RI 714), (8) ***Aru, Arafura and Timor seas*** *(*WPP-RI 718), (9) Moluccas and Ceram seas, Tomini and Berau Bays (WPP-RI 715), (10) Celebes and Halmahera seas (WPP-RI 716), and (11) Pacific Ocean (WPP-RI 717).

According to UNCLOS paragraph 122, the ***Arafura and Timor Seas*** are considered as a semi enclosed-sea. In paragraph 123, the convention encourages states bordering the semi-enclosed sea to work together in implementing their rights and responsibilities. Therefore, as a state that borders Arafura and Timor Seas, Indonesia has commitments to support regional efforts in integrating research and environmental interests into economic decisions and promote sustainable use of marine resources.

The commitments of the Indonesia government in managing the Arafura and Timor seas is reflected through the active involvement of Indonesia in the Arafura and Timor Seas Experts Forum (ATSEF), a non binding forum participated in by Indonesia, Australia and Timor Leste (and Papua New Guinea), to promote sustainable development in the Arafura and Timor Seas.

The ATSEF has established 5 programme priorities:

1. To support the development of National and Regional Action Plan in combating IUU Fishing and its implementation.
2. To support the efforts of conserving Arafura and Timor Seas ecosystem and biodiversity to use the resources in accordance with sustainable principles.
3. To support the development of alternative livelihoods for coastal communities through the development of aquaculture and its post-harvest industrious activities.
4. To support the studies on systems of dynamic oceans in Arafura and Timor Seas in improving the understanding of Arafura and Timor Seas conditions.
5. To support the development of Arafura and Timor Seas data center at national and regional levels.

The ATSEF Indonesia Secretariat, based in the Agency for Marine and Fisheries Research (AMFR/MMAF), has been working together with the United Nations Development Programme (UNDP) to develop an Action Plan for ATSEF Indonesia and capacity development programmes. As the outputs of the activities, the project delivered (a) Arafura and Timor Seas Action Plan for

sustainable development in Arafura and Timor Seas for 2006-2015, and (b) Capacity development programmes.

Other efforts have also been undertaken by the Indonesian government together with several countries surrounding the Arafura and Timor seas that include initiating the Regional Plan of Action to combat Illegal, Unreported and Unregulated Fishing.

At the national and local level, policies which address the management and maintenance of the environment and resources, as well as mitigate its degradation, are established by related institutions.

This report describes and elaborates on the Indonesian Policy Framework and Government Institutions related to the sustainable management of the Arafura and Timor Seas.

The objectives of the policy framework and governance institution study are to:

1. Identify Indonesian institutions and their laws and legislations related to marine sector, marine biodiversity and fisheries.
2. Identify the gaps and challenges of the Indonesian institutional and policy frameworks related to marine biodiversity and fisheries of Arafura and Timor Seas region.
3. Identify national marine and fisheries framework development and application of policy framework to be integrated in the FSP framework.
4. Identification and recommendations for institutional arrangements for ATSEA in Indonesia.

It provides coverage of international, national, regional/district and local level sectors, and also outlines relevant NGO policies and activities. Discussion on the gaps in policies and frameworks for managing the ATS region are provided along with recommendations on measures to address gaps and challenges and on potential demonstration sites for activities under ATSEA.

Methodology

This report summarizes a wide range of government documents, policies and legislation, reports and published information relevant to the governance of the ATS region. The review of these materials was undertaken during October 2008 - April 2009. The information was summarised and analysed to identify key characterisations and issues related to the objectives of the study. Analysis of the available information also identifies information gaps and deficiencies in some aspects related to the governance of management of the marine and costal resources of the ATS region.

This report is structured into 5 sections such as follows:

Section 1 : Introduction which considers the background and history of the marine and fisheries regime in Indonesia.

Section 2 : considers the Governance (Legal, Institution and Policy) framework for the Management of the Arafura and Timor Sea, which cover Environment and sector institutions, laws and policy.

Section 3 : discusses the governance gaps and challenges related to sustainable of ATS region.

Section 4 : considers recommendations on measures to address gaps and challenges

Section 5 : considers recommendations on potential demonstration sites.

2. Governance (legal, policy and institutional) framework for the management of the Arafura and Timor Seas

The National Agency for Planning and Development (BAPPENAS) is the highest level of bureaucracy, which defines the general policy direction of the development of the Republic of Indonesia, in terms of **"environment"** and **"sector"**.

The target of the National Policy is to address and repair improper management and utilization of natural resources in line with economic development and sustainability.

As a guide-line for achieving the goal and objectives of the Republic of Indonesia, BAPPENAS established a 20 year national policy called "Long-term National Development Plan" (RPJPN), 2005-2025. (*Law No.17/2007*). The "Vision" of that Long-term National Development Plan is for an "*Indonesia that is self-supporting, Go onward, Fair, Secure and Prosperous".*

There are eight "missions" with three missions that have relevance to the Arafura Timor Seas Ecosystem Action program i.e.:

1. To establish Indonesia as a competitive nation:

    1. Increase the quality of human resources, including the role of women in development;
    2. Establish a strong economic structure based on competitive superiority in various regions of Indonesia. The agricultural sector should become a fundamental economic activity that is managed efficiently and produces a good quality and competitive commodity;
    3. Achieve good and sustainable economic growth
    4. Establish infrastructure, information, and telecommunications networks, as well as implementation of water resources conservation;
    5. Increase professionalism of center and local government officers that have the ability to support national development.

2. To establish Indonesia as beautiful and everlasting:

    1. Strengthen marine resources through a multi-sector approach, with integrative, comprehensive, and integral policies that manage the relationship between land and marine sector.
    2. Manage the natural resources diversity in every region, by improving society participation, establishing sustainability as an important concern, and stabilizing the land use planning as guidance for optimal and sustainable natural resources utilization.
    3. Control pollution and environmental damage, caused by uncontrolled management, in order to improve environment quality that could support sustainable development

3. To establish Indonesia as a self-supporting, progressive, archipelagic country, with a strong basis on national needs:

    1. Grow the maritime vision for society and government in order to make Indonesia more maritime oriented;
    2. Improve human resource capacities in terms of maritime vision;
    3. Manage the Indonesian National waters in order to keep sovereignty and prosperity; and
    4. Develop the integrated maritime economy (sea transportation, maritime industry, fishery, marine tourism, energy and minerals, sea building, and marine services), by optimizing the utilization of marine resources in a sustainable manner.

The "Long-term National Development Plan" (RPJPN), is broken-down into a five year *Midterm National Development Plan (RPJM).* The main agenda of the first (2005-2010) 5 years RPJM is:

1. Establish Indonesia as a safe and peaceful country: Improve safety and orderliness, and reduce crime. *The Policy Directions are*: Protect sea territorial waters to prevent, deter and combat illegal infringements on marine resources, through central and state policies.

2. Improve prosperity of the nation: (a). Revitalization of agriculture, including fisheries and forestry. The policy directions are: Improve the ability of farmers/fishers and other agriculture/fisheries stakeholders & improve productivity, production, competitive ability, and added value of agricultural products and fisheries. (b). Improve the natural resources management and maintain/sustain the function of the environment. The policy directions are: (i) Management and utilization of potential marine, coastal areas, and small island resources in a sustainable manner based on community concern. (ii). Develop control and surveillance systems in the management of marine resources and coastal areas accompanied by strengthening of law enforcement. (iii). Improve the efforts of marine, coastal areas, small island conservation and rehabilitate the damage of ecosystems, such as: coral reefs, mangroves, and sea grasses. (iv). Control pollution and environment degradation in marine, coastal areas, and inland waters as well as small Islands. (v). Improve regional and international cooperation to end sea boundary issues with neighboring states. (vi). Strengthen the supporting instrument for development capacities that cover knowledge and technology, human resources, institutions as well as law and regulation. (vii). Improve research and development of marine technology. (vii). Develop efforts on marine and coastal area environment mitigation, improve safety works, and minimize the risk of marine natural disasters to coastal area and small island societies. (viii). Strengthen the partnership program to improve the role of society and private sector in marine, coastal area, and small island resources management.

For the second five year National Mid-term Development Plan (RPJMN) 2010-2014, there are three main policies that have been prepared by the National Agency for Planning and Development (BAPPENAS) relevant to ATS region:

- To increase efforts maintaining national security and natural resources, including marine regions;
- To increase integrated marine development, including development of marine technology and knowledge;
- Development of marine industry that covers sea transportation, maritime industry, fishery, marine tourism, energy and mineral resources in a synergetic manner that is optimal and sustainable.

These general policies are then translated into **environment** and **sector** *policies* that are more specifically addressed by the Ministry, Directorate General and Local government level, inline with their mandate.

In summary, BAPPENAS does not have any legislative responsibility for any environment / marine areas in Indonesia. However, it is an important player in policy settings that influences actions across other areas of government at both central and local levels.

2.1. Environmental institutions, laws, and policies

2.1.1. The Ministry of Environment

The government of Indonesia has established institutions that have responsibility in maintaining and managing the environment (land, coastal and marine) and its resources in a sustainable manner, at central, provincial and district levels.

The structure of the government institution that has responsibility for environmental management is stipulated in The Law of the Republic of Indonesia No. 4 /1982 concerning Provisions of Environment Management, Chapter V, Article 18, as follows:

1. Management of the environment at the national level is performed by the integrated device institution led by a minister and regulated by the laws and regulations.
2. Management of the environment, in connection with the implementation of national policies on environmental management, the sectoral is conducted by the department/ non departments in accordance with the duties and their responsibilities.
3. Management of the environment, in connection with the implementation of national policies on environmental management, in the region is conducted by the Regional Government in accordance with the laws and regulations.

Further, Article 19 states that, NGOs play a role as a supporter for environmental management.

The first environment department in Indonesia was the Office of State Minister of Surveillance for Development and Environment (Kantor Menteri Negara Pengawasan Pembangunan dan Lingkungan Hidup/PPLH) which was established in ***1978*** based on Presidential Decree No.28/1978 junco Presidential Decree No.35/1978. Its main task was to coordinate different institutions at central and local levels.

In 1983, through ***Presidential Decree No. 25/1983***, the State Ministry of Surveillance for Development and Environment was changed to become *The Office of State Minister of Demography and Environment* (Kantor Menteri Negara Kependudukan dan Lingkungan Hidup/KLH where its main function has been altered, particularly in incorporating human environmental aspects into development.

Due to the increased rapid development over the last two decades and the negative impact to the environment the ***Agency for Controlling Environment Impact*** (Badan Pengendalian Dampak Lingkungan/BAPEDAL) was established in ***1990*** to assist the State Ministry based on President Decree (No.23/1990). Its main task is to undertake monitoring and to control development activities which potentially have a negative impact on the environment.

In ***1993 the Office of State Minister of Environment*** (Kantor Menteri Negara Lingkungan Hidup) was established, specifically to focus on the environment where demography was excluded from the mandate and task of this State Ministry.

Then in 2001 The Agency for Controlling Environment Impact (Badan Pengendalian Dampak Lingkungan/BAPEDAL) and ***the Office of State Minister of Environment*** (Kantor Menteri Negara Lingkungan Hidup) were joined to become ***The State Ministry of Environment*** (Kementerian Negara Lingkungan Hidup).

The Organizational Structure of ***The State Ministry of Environment*** (Kementerian Negara Lingkungan Hidup) is described in appendix 1. The Minister is assisted by five Advisors to the State Minister, Secretary to the State Minister, Inspector General, and seven different Deputies where each Deputy has four or five different Assistant Deputies.

There are five Environment Management Regional Centers directly under the state Ministry, namely the centers of Sumatra, Bali and ***Nusa Tenggara***, Celebes, ***Moluccas*** and ***Papua***, Java, and Borneo. Thus the ATS region is relevant to three of these Centres.

In order to strengthen the coordination on environmental management at the local level, Ministerial Decree No. 240/1980 concerning "Organization and works schedule of Regional Secretariat (Province level) and Secretariat of Regional Representative House (Province level)" has a ***Bureau of Demography and Environment***".

Recent decentralization - local autonomy policy has changed the mechanism for managing the environment in Indonesia. District and city governments have more responsibility and perhaps more competence compared with the national and provincial level. The Central government is no longer an implementing institution but rather it focuses on macro-policy and standardisation, as well as formulating criteria and procedures for environmental management. In order to anticipate the implication of implementation of the local autonomy policy in the environment and resources management, the state Ministry of Environment undertakes consultation with sector, local government and other environmental stakeholders for synergizing their competencies, strengthening the local environment institution capacity, and developing several strategic programs.

2.1.2. The Environment Laws and Policies

The quality and sustainability of the environment has become a global concern. At the Stockholm meeting in 1972, it was agreed on the urgent need to answer problems concerning the deterioration of the environment. Twenty years later in 1992 in Rio de Janeiro, the United Nations Conference on Environment and Development, declared that world governments agree that environment protection and socio-economic development is a basis for sustainable development. In order to achieve the objectives of sustainable development, the meeting adopted a Global Plan of Action for Sustainability which was known as Agenda 21, and the Rio declaration concerning Development and the Environment.

The World Summit Conference concerning Sustainable Development in Johannesburg in 2002, developed new approaches to implement sustainable development by considering links between poverty, changing consumption and production pattern as well as natural resources management for social and economy development as a target and need required just for sustainable development.

At World Summit Conference on September 2002, 189 member states of UN agreed to adopt Millennium Declaration. The target of the Millennium Development is to: (1). Overcome poverties and hunger; (2). Reach basic education for all; (3). Pushing gender equivalent and increase the role of the woman; (4). Decrease mortality of children; (5) Improve mother health; (6). Fight HIV/AIDS, malaria, and contagious diseases etc; and (7). Ascertain sustainability of environment.

In the 2nd ministerial APEC meeting related to oceanic issues in Bali on the 13-17 Septembers 2005, the Ministers re-strengthened their commitment to continue the 2002 Seoul Ocean Declarations to balance Sustainable Management of Marine Resources and Environment with Economic growth in accordance with existing resources and capability. The APEC Ministers agreed to execute Bali Plan of Action for 2006-2009 for:

- Sustainable management of marine environment and its resources;
- Obtaining sustainable economic advantage from the sea; and
- Sustainable development for coastal communities.

International Conventions

In order to support policies on maintaining the quality of global environment, there are several International Conventions that relate to environmental management of biodiversity protection that have already been ratified by Indonesia:

- The Geneva Convention 1958 concerning the Law of the Sea. Ratified by *Indonesian Law No. 19/1961*
- UN convention on Biological Diversity. Ratified by *Indonesian Law No. 5/1994*
- UN Framework Convention on Climate Change. Ratified by *Indonesian Law No. 6/1994*:
- Treaty on the Southeast Asia Nuclear Weapon Free Zone. Ratified by *Indonesian Law No. 9/1997*
- ILO Convention No. 81 concerning Labour Inspection in Industry and Commerce. Ratified by *Indonesian Law No. 21/2003*
- Convention on International Trade in Endangered Species of Wild Fauna and Flora. Ratified by *Presidential Decree No. 43/1978*:
- UNCLOS 1982. Ratified by Indonesian Law No. 17/1985
- Convention on the Physical Protection of Nuclear Material. Ratified by *Presidential Decree No. 49/1986*
- Amendment of International Trade in Endangered Species of Wild Fauna and Flora. Ratified by *Presidential Decree No. 1/1987*
- Convention on Wetlands of International Importance especially waterfowl habitat. Ratified by *Presidential Decree No. 48/1991*
- Vienna Convention for the Protection of the Ozone layer and Montreal Protocol on substance that deplete the Ozone layer as adjusted and amended by the second

Meeting of the Parties. London, 27 – 29 June 1990. Ratified by *Presidential Decree No. 23/1992*

- Convention on early Notification of a Nuclear Accident. Ratified by *Presidential Decree No. 81/1993*:
- Convention on assistance in the case of a nuclear accident or Radiological Emergency. Ratified by *Presidential Decree No. 82/1993*:
- Montreal Protocol on substance that deplete the ozone layer, Copenhagen, 1992. Ratified by *Presidential Decree No. 92/1998*
- Protocol of 1992 amendment the International Convention on civil Liability for oil pollution damage, 1969. Ratified by *Presidential Decree No. 52/1999*
- Convention on Nuclear safety. Ratified by *Presidential Decree No. 106/2001*

More specifically, in relation to marine protection, Chapter XII UNCLOS provides a comprehensive law framework for marine protection at the national, regional and global level. This chapter has identified various pollution sources, for example sources from land (Section 207), activity at the bottom of the sea under national and international jurisdiction (Article 208), dumping and pollution from ships, (Article 212). Chapter XII also discusses the protection and sustainability of marine environments at the national, regional and global scale. Although it comprises of comprehensive law framework for the protection of marine environments at national, regional and global levels, law enforcement at the national level is still very weak. Other Chapters (for example Chapter V Article 61) state the obligation of coastal state to conduct marine resources conservation, while article 62 is also concerned with marine resources utilization, including obligation of the coastal state to publish such related regulations.

In order to follow up these obligations, the Government of the Republic of Indonesia has ratified several conventions such as:

(i) International Convention on preventing pollution from vessels (MARPOL); ***ratified by Presidential Decree No .46/1986***

(ii) BASEL Convention, to control transboundary transportation from poisoning and dangerous material; ***ratified by Presidential Decree No. 61/1993***

(iii) Regulation from Agency for International Atomic Energy concerning "transportation safety" from radio-active material; ***ratified by Presidential Decree No. 106/2001***

The Indonesian Constitution

Indonesian laws, such as Articles 5(1), 20(1) of the 1945 Constitution of the Republic of Indonesia relate to the environment stating that ***"The ability necessary to conserve the environment harmoniously and balanced to support the sustainable development policy implemented by the integrated and holistic approach and consider the needs of current and future generations"***. While Article 33(3) with regards to resource management states that ***"All natural resources contained within the ground and bodies of waters shall be utilized for the utmost prosperity of the people"***.

Laws and regulations which address the environment and resources conservation and management are derived based on the 1945 Constitution and international convention, such as Laws, Government Act, or decrees of the President, Ministers, Governors, and Regents, by the

related Government institution, the policies then make reference to those Law and regulations as basic law.

The State Ministry of Environment has a mandate to create national policy and programs in order to maintain the environment in good order, and undertake such coordination between sectors to avoid damage to the environment as a consequence of development.

Historically, the Laws and regulations dealing with environment management are described as follows.

One of the important legal developments during the working period of The Office of State Minister of Surveillance for Development and Environment (1978 – 1983) is **Law No. 4/1982** concerning **"Provisions of Environment Management"**. This Law is a basis for different provisions and regulations concerning environmental management such as protection, conservation and utilization of natural resources and environment, environment impact analysis/assessment, standard of environment condition, etc.

Within the working periods of the Office of State Minister of Demography and Environment (1983 – 1993), **Government Regulation No. 29/1986** concerning **Environment Impact Analysis/Assessment** (Analisa Mengenai Dampak Lingkungan/AMDAL) acts as a basic guide in implementing development projects before activities or development projects start. The other important law concerning the environment are Government regulation No. 20/1990 concerning standard quality of the environment (Baku Mutu Lingkungan) and Ministerial Decree No. 03/1991 concerning standard quality of liquid waste (Baku mutu limbah cair).

Since September 1997 the Law of the Republic of Indonesia No. 4/1982 concerning Provisions of Environment Management was ***replaced*** by the **Law of the Republic of Indonesia No. 23/1997** concerning **Environment Management**, which included new provisions such as: (1) Right, obligation and the role of community, (2) Competence of environment management, (3) Conservation and environment protection, (4) Requirement on environment used, (5) Environment dispute solutions, (6) Investigation, and (7) Provisions of environment criminal law.

In fact, with regard to the Indonesian Laws and Regulations concerning the environment, resources management and conservation, there are:

- 62 Indonesian laws (Undang Undang),
- 90 Government regulations (Peraturan Pemerintah),
- 53 Presidential decrees (Keputusan Presiden),
- 3 Instructions of the President (Instruksi Presiden),
- 15 Ministerial decrees (Peraturan Menteri),
- 161 Provisions of the Ministers (Keputusan Menteri),
- 4 Instructions of the Ministers (Instruksi Menteri),
- 4 Provisions of Director General (Keputusan Direktur Jenderal),
- 5 Circular letters of the Minister (Edaran Menteri),
- 29 Provisions of the Chairman of The Agency for Controlling Environment Impact (Keputusan Kepala BAPEDAL), etc.

These laws and regulations contain: guidance in establishing environmental institutions and their working mechanisms, ratification of international conventions, reference of environmental

quality standards, measures to control and manage the environment, management of hazardous material and waste, environment settlement, pollution control, etc.

As Indonesia's development is mainly concentrated inland (forest, agriculture and industry), most of those laws and regulations deal with ***"land environment"***.

In regards to preventing the marine environment from pollution and habitat degradation, some laws and regulations that relate to "***marine environment"*** quality have been issued, among others:

1. Indonesian Law No. 19 Year 1961, the Agreement of The Geneva Convention 1958 concerning the Law of the Sea.
2. Indonesian Law No. 1 Year 1973 concerning Indonesia Continental Shelf.
3. Indonesian Law No. 5 Year 1983 concerning Indonesia Exclusive Economic Zone
4. Agriculture Ministerial Decree No. 473a Year 1985 concerning Total Allowable Catch in Indonesia Exclusive Economic Zone.
5. Indonesian Law No. 17, Year 1985, concerning the ratification of United Nations Convention on the Law of the Sea 1982.
6. Presidential Decree No. 46 Year 1986**,** concerning the ratification of International Convention For The Prevention Of Pollution From Ships 1973,
7. Government Act No. 17, Year 1974, concerning Inspection on Implementation of Oil and Gas off shore Exploration and Exploitation.
8. Government act No. 15, Year 1984, concerning Living Resources Management in Indonesian Exclusive Economic Zone.
9. Transportation Ministerial Decree No. 215 Year 1987, concerning Providing Reception Facility for Waste From Vessels.
10. Transportation Ministerial Decree No. 86 Year 1990, concerning Oil Pollution Prevention From Vessel.
11. Government Act No. 19, Year 1999, concerning Marine Pollution and/or Destructions Control.
12. Environment Ministerial Decree No. 51 Year 2004, concerning Sea Water Standard Quality.

Coastal areas have become an important but critical zone to maintain in terms of its environmental quality. Several regulations have been issued to prevent ***coastal environments*** from habitat degradation, among others:

1. Presidential Decree No. 48, Year 1991 concerning the ratification of the Convention On Wetlands Of International Importance Especially As Waterfowl Habitat
2. Provisions of the Environment State Ministry No. 45 Year 1996 concerning Sustainable Coastal Program.
3. Provisions of the Environment State Ministry No. 4 Year 2001 concerning the Standard Criterion for Coral Reef Damage.
4. Provision of the Chairman of The Agency for Controlling Environment Impact No. 47 Year 2001 concerning Guidance to Measure Coral Reef Condition.
5. Provisions of the Environment State Ministry No. 200 Year 2004 concerning Standard Criterion for Damage and Guidance to Measure the Status of Sea Grasses.
6. Provisions of the Environment State Ministry No. 201 Year 2004 concerning Standard Criterion and Guidance to Measure the Damage of Mangrove Forest.

The policies of environment management in Indonesia have been developed on the needs of political and global concern. The year 1998 /1999 was the "Reformation era", and the goal of environment development according to The State Ministry of Environment was addressed in order to:

1. Increase the knowledge of current condition on quantity and quality of the natural resources as well as environment services,
2. Maintain conservation areas,
3. Improve environment management systems,
4. Control pollution, mainly in dense populations and development areas,
5. Control coastal destruction, and
6. Increase critical land rehabilitation effort.

Referring to the objectives mentioned above, ***the policies on environment*** then were addressed to

1. Inventory and evaluation of natural resources and environment,
2. Safety of forest, land and water,
3. Environment improvement and management development of environment,
4. Controlling environment pollution,
5. Rehabilitation of critical land, and
6. Establishment of proper coastal area management.

The five years strategic plan of the State Ministry of Environment 2004-2009 has been made through the Regulation of the State Minister of Environment No. 04/2005.

The VISION of the State Ministry of Environment is realizing the improvement improve of the quality of the environment, through the State Ministry of Environment as an institution that is reliable and proactive in achieving sustainable development through the application of the principles of good environmental governance, to improve the welfare of the people of Indonesia.

There are three MISSIONS that should be undertaken in order to achieve this VISION:

1. Develop a policy on the Environment and Natural Resources to support the achievement of sustainable development;
2. Build stakeholder coordination and partnerships in the management and utilization of natural resources and the environment and in efficient, equitable and sustainable development;
3. Realize damage prevention and control of pollution of natural resources and environmental conservation in the context of the environment.

Goals and objectives that should be achieved during five years as well as policy strategy are specified as shown in Appendix 2.

STRATEGIC PROGRAMS AND ACTIVITIES

In order to achieve the goals and objectives of the five years strategic plan of the State Ministry of Environment such programs and activities should be undertaken using the following **ten strategic programs** and activities which will be implemented:

1. ENVIRONMENT SETTLEMENT: that focuses on protection programs and the conservation of natural resources through the operation of planning, execution and observation of exploiting of space including activities in the form: (i) neighborhoods function study, (ii) expansion of planning peripheral and study which in the form of criterion, standard and guidance, (iii) compilation of law and regulation substance in settlement area of space.

2. CONTAMINATION CONTROL: It is a part of the strategy to recover the quality of the environment functions which consists of several activities: (i) PROKASIH (Clean River Program) which controls water contamination, the activities in the regions done by provincial and district/Kota Governments. Besides decreasing industrial pollution the program increases river water quality. The State Ministry of Environment cooperates with the provincial governments (district/city) to execute the SUPERKASIH program. (ii) ADIPURA (name in full) aim to implement Good Governance principles (transparency, participation and accountability) at the local government and public levels. It is a dynamic program, meaning that continuous improvement is one of the program's base principles. (iii) LANGIT BIRU (The Blue Sky) is a State Ministry of Environment program aimed at improving air quality standards. In this program the State Ministry of Environment develops regulations on air pollution, especially from peripatetic source emissions.

3. CONSERVATION OF NATURAL RESOURCES AND ENVIRONMENT DEGRADATION CONTROL: This program is based on providing incentives and disincentives to increase income generation for the public. This policy is aimed at decreasing environment degradation including water resources, forest and land, biodiversity, energy, atmosphere, coastal area ecosystem and sea. The program promotes protection and conservation through the following activities, (a) towards a green Indonesia, (b) management of biodiversity, (c) control of climate change impact, (d) conservation of water resources and (e) Sustainable coastal and sea areas.

4. MANAGEMENT OF HAZARDOUS MATERIALS AND HAZARDOUS WASTE: with appropriate concepts and operations in place, the management of toxic agents and dangerous wastes can be mitigated, resulting in successful contamination control. Therefore, this program aims to establish operational control of both contamination procedures and the management of toxic agents and dangerous wastes. The activities for this program concentrate on the management of toxic agents and dangerous wastes while minimising the extent of contamination

5. LAW ENFORCEMENT: Enforcing environmental laws on environmental pollutants and pests is necessary to maintain the sustainability of the environment. Therefore, increasing environmental impact assessment compliance in development protocols is a priority. Programs in environmental law development include & cover: control of contamination and environmental damage and management of capacity expansion in natural resources and the environment. Strengthening Waste management law and administration is also an activity.

6. ENVIRONMENT COMMUNICATIONS AND COMMUNITY EMPOWERMENT: In order to establish good environmental governance, mainstreaming of environmental principles is required in management of natural resources at national level and also region/city is required. Therefore, community empowerment in environment management needs to be improved through the expansion of its capacities. In this case intensive communications with state institutes & government, public institutions (social, political economical, professional, etc.) by using various mass Media is one activity in environment communications.

There are several activities covered by this program, among others: *(a) Kalpataru:* which has an objective to push and increases the role of the public in environmental management. *(b) Adiwiyata:* is a State Ministry of Environment program which promotes the creation of knowledge and awareness in schools in the effort to conserve the environment. *(c) Tree Bank*: the State Ministry of Environment formed an institute called Tree Bank as a means to connect tree seed donors to the public. (*d) Civil society*: Public involvement needs to be increased in various activities which can assist people in solving problems in their area. *(e) Indonesia environment week*: Relates to commemoration of Environmental Day (5 June). State Ministry of Environment invites stakeholders to publicise their various efforts during Indonesia Environment Week. *(f) Publication and Public service:* Environment information is shared with the public using various forms of media such as, magazines, posters, leaflets, and articles. Currently, the State Ministry of Environment develop environmental information portal addressed: www.menlh.go.id. Its website specializes on environment information management in Indonesia and other links to related environment information source.

7. TECHNICAL SUPPORT FACILITIES AND CAPACITY IMPROVEMENT: This program is aimed at improving the availability of technical facilities and the improvement of professional capacity. it also aims to increase the availability of laboratories in regions, and perform out-of-laboratory services to support environmental operations and assist in measuring the impact of expansion of activities and basic facilities on the environment.

8. PROGRAM EXPANSION AND OVERSEAS TECHNICAL COOPERATION: As the allocation of regional (local government) funds for environmental management is very limited, environmental program expansion will be established through "Special Allocation Funds" of Environment policy. Special Allocation Funds of Environment policy are aimed at protecting water resources, prevention of water pollution and water pollution recovery, especially related to river water. Further, in order to improve its capacity, the State Ministry of Environment is very active in building international and bilateral cooperation.

9. PERFORMANCE ACCOUNTABILITY: To create a conducive and reliable work of environment in the public service, poor management of budgets and properties of state must be prevented. Good environmental governance will be reached if administrative performance and capacities are increased. Expert advice from government officers to the activity organizers increases the level of professionalism. Observations based on these principles shows that the State Ministry of Environment is striving towards performance accountability and good environmental governance.

10. CENTERS OF REGIONAL COORDINATION: Execution of regional environmental policy covers all strategic programs of the Sate Ministry of Environment, but many are based on operation and coordination issues. Thus, programs and activities in an area are more technical in nature like: (i) mapping area problems, (ii) development of infrastructure and supporting facilities, (iii) synchronization activity with province, sub-province, related town and sector in area, (iv) strategic communications and partnership with various institutes and public levels, and making of strategic program models of operations in the field. This includes all regions of The Republic of Indonesia, related to public heterogeneity and administrative territory; hence steps are being taken to regionalize environmental management in regional Sumatra, regional Kalimantan, regional Java, regional Bali and Nusa Tenggara, and regional Sulawesi- Maluku-Papua.

2.2. Sector institutions, laws, and policies

Although the Ministry of Marine Affairs and Fisheries has been established; to some extent several Ministries, such as Forestry, Tourism, Mining, and Transportation, still undertake functions which relate to marine affairs management.

2.2.1. Biodiversity conservation

Indonesia is a center of genetic diversity; although it only covers 1. 3% of the earth surface, Indonesia has 10% of species of world flora, 12% species of world mammals, 16% the world's reptile and amphibious, 17% of bird species and 25% of fresh and salt water species. According to the World Atlas of Coral Reefs (2001), Indonesia has the widest coral reef cover in the world, spanning 51.020 km^2. Indonesian mangrove ecosystems are the richest in the world containing 45 out of 70 known mangrove species. Indonesia has the highest number of mangrove forests, spreading 80.971 kilometers along the coast and Main Island, especially in East coast of Sumatra, coast of Kalimantan and Papua coast.

The Convention on Biological Diversity (CBD) was implemented on 29 December, 1993. It considers that bio-diversity is an important resource for socio-economic development and Indonesian culture. In 1994 by **Law No. 5/1994, Indonesia ratifies UN Convention on Biological Diversity**.

Several laws and regulations which relate directly or indirectly to the management of Biological Diversity have been issued by the government of Indonesia

- Indonesian Law No. 5/1990 concerning The Conservation of Natural Resources and Environment.
- Indonesian Law No. 24/1992 concerning Spatial Plan
- Indonesian Law No. 23/1997 concerning Environment
- Indonesian Law No. 16/1992 concerning Animal Quarantine, Fish and plant
- Indonesian Law No. 29/2000 concerning Plant Variety Protection
- Government Regulation No. 15/1984 concerning Indonesia Exclusive Management of Natural Resources in the Indonesian Exclusive Economic Zone.
- Government Regulation No. 28/1985 concerning Forest Protection
- Government Regulation No. 13/1994 concerning Animal Hunting
- Government Regulation No. 18/1994 concerning the Nature of Tourism Zone Utilization National Park, Great Forest Park (Taman Hutan Raya), and Nature Tourism Park
- Government Regulation No. 6/1995 concerning Crop Protection
- Government Regulation No. 47/1997 concerning National Land Planning
- Government Regulation No. 68/1998 concerning Nature Reserve Area and Nature Conservation Area
- Government Regulation No. 7/1999 concerning Type of Plant and Animal Conservation
- President Decree No. 32/1990 concerning Management of Protected Area
- President Decree No. 33/1990 concerning The use of Land For Industrial Development Area
- Minister of Agriculture Decree No. 214/Kpts/Um/5/1973 concerning Export Restrictions of Certain Fishes from the Republic of Indonesia.

- Minister of Agriculture Decree No. 819 / 1980 concerning Fish Importation into the Region of the Republic of Indonesia
- Minister of Agriculture Decree No. 179/1982 concerning Import Restrictions on Type of Dangerous Fish from Foreign Affairs
- Forestry Minister Decree No. 26/1994 concerning Utilization Type of Kera Ekor Panjang (*Macaca Fascilularis*), Beruk (*Macaca Nemesterina*) And Fish Arowana (*Sceleropages Formasus*) For Necessity Export
- Forestry and Plantation Minister Decree No. 55/2000 concerning Ikan Raja Laut Conservation (*Latimeria Menadoensis*) as Protected Animal

It seems that most of these regulations were addressed for terrestrial biological diversity management; however, as flora and fauna are considered a wild organism, the Ministry of Forestry dominantly implement these laws and regulations.

In relation to marine and coastal zones, several critical issues that could influence the biological diversity recorded in Indonesia are:

- Continuous coastal resource degradation (coral reefs degradation, mangrove deforestation, erosion, marine pollution, IUU fishing, etc).
- Marginalization of coastal communities
- Users and jurisdictional conflicts
- Open access and the 'tragedy of the commons'
- Coastal hazards and disasters

In order to answer and solve those issues, in 1999 The Directorate General of Marine, Coastal and Small Islands – Ministry of Marine Affairs and Fisheries was established, and received the mandate to develop the management of marine policy, and management systems of coastal areas and Small Islands in Indonesia by involving all stakeholders.

The Directorate General of Marine, Coastal and Small Island is supported by five Directorates:

1. Directorate of Spatial Planning for Marine, Coast and Small Island
2. Directorate of Conservation and Marine National Park
3. Directorate of Costal Community Empowerment
4. Directorate of Small Island Empowerment
5. Directorate of Coastal and Marine Affairs

At the local level the program of DG of Coastal and Small Island is implemented by the Province or District Marine and Fisheries Services, and in certain regions there are Technical Implementing Units as representatives of DG of Coastal and Small Island.

To run its mandate, the Directorate General of Marine, Coastal and Small Island have established the Vision and Mission as follows:

Vision: Management of the Marine, Coastal and Small Islands in a sustainable manner for the Welfare of Society.

Mission:

1. Facilitate the development of spatial plans for the interests and the legal certainty of sustainable development in the regions of Marine, Coastal and Small Islands.

2. Improve coastal and ocean management systems to create a balance between conservation and utilization of resources and the environment.
3. Encourage the growth of community based investment development in small islands
4. Develop fish resources conservation efforts through the protection, conservation and sustainable utilization of ecosystems, and fish species.
5. Improve welfare and community coastal independence in the Small Islands.

Purpose: Improve the quality of the environment, economic growth and prosperity of coastal communities and small islands in a sustainable way.

Several programs were launched in order to realize the mission and the vision, such as:

1. COREMAP (*Coral Reef Rehabilitation and Management Program*), where the objective is to " Manage coral reef ecosystems based on a balance between conservation and utilization, designed and implemented in an integrated and synergistic manner by the central government and regional governments, civil society private sector, higher education institutions, and non government organizations".

The COREMAP program began in 1997, and is divided into three phases: 1. Initiation phase (3 years); 2. Acceleration phase (6 years); 3. Institutionalization phase (6 years).

This program is jointly run through the Local and Central governments as well as international agencies such as ADB and IBRD. There was a partnership management between Ministry of Marine Affair and Fisheries (DKP), Indonesia Institute of Sciences (LIPI) and Local Government, supported by funds from ADB, IBRD, and a grant from Japan's Fund for Poverty Reduction (JFPR) and the Global Environment Facility (GEF)

Initiation Phase or Coremap I, was managed by LIPI and has been executed in some places such as Kepulauan Riau, Salayar, and Biak districts since 1997/98 and Kabupaten Sikka in 2000/2001.

Acceleration Phase or COREMAP II, in 2003-2009 was executed in several locations with the DG of Marine, Coast and Small Island-Ministry of Marine Affair and Fisheries (DKP) as executing agency assisted by Indonesia Institute of Sciences (LIPI) and DG of Forest Protection and Nature Conservation-Ministry of Forestry. Their locations include the Provinces of: North Sumatera, West Sumatra, Riau, South Sulawesi, South East Sulawesi, Papua, and East Nusa Tenggara.

Objectives: 1) to improve the efforts of coral reef sustainability in Indonesia; 2) push the role and participation of local government and community in order to rehabilitate and conserve coral reefs; 3) improve all parties' awareness of coral reef sustainability.

Goals: 1) to increase the quality and ecosystem condition of coral reef by 2% per-year , 2) to increase the local population earnings by 2% per-year living in the location where coral reefs are managed, and 3) realize the improvement of all parties awareness in coral reef sustainable management.

In its execution, several approaches were taken: 1) Policy; 2) Information centre component and training; 3) Community Based Management; 4) Public Awareness; 5) Strengthening of law and regulation.

2. MCRMP (*Marine and Coastal Resources Management Project*) (2001-2006) is a project funded through ADB. This loan is used to improve Local Government's responsibility of natural resources management, where, according to the laws No. 22 jo. Law No. 32 in 2004 and No. 25 in 1999 Provinsi and Kabupaten/City have a right to exploit and manage sea and land resources in their territory of jurisdiction.

The objectives of MCRMP are sustainable management and development of marine and coastal resources as well as biological diversity, and environment protection.

MCRMP has four fundamental components that are:

- Planning and management of marine and coastal resources
- Management of spatial data and information.
- Legislation review and law enforcement
- Small scale natural resources management

Goals:

- To strengthen Local Government ability in planning and management of coastal and marine resources in a sustainable manner.
- To improve data access and information of biodiversity and geospatial information;
- To improve legislation and regulation of marine and coastal resources management and monitor its execution;
- To improve utilization of planning documents of Integrated Coastal Zone Planning and Management in indentifying alternative livelihoods and other activity that could produce earnings for coastal societies;
- To improve socioeconomic conditions and environments on selected priority coastal area.

3. Maritime Partnership Program (Program Mitra Bahari/PMB): This is a partnership program between the Ministry of Marine Affair and Fisheries, NGO, Private sectors and other institutions to promote the acceleration of marine and fisheries development. PMB are expected to become a main partnership vehicle between stakeholders to accelerate marine and fisheries development in coastal and small island regions in a sustainable manner in order to improve social prosperity.

Mission:

- Develop strong partnerships between marine and fisheries development stakeholders to support the optimal management of oceanic resources and fisheries in coastal regions in order to improve social prosperity and environmental quality; Improve the capacities of coastal and small island management stakeholders based on science and technology; Carry out programs of counseling, education/training, applied research and policy analysis in the marine and fisheries sector.

- Overcome weaknesses in human resources and institutional capacity in managing regional marine, coastal area and small island resources; progress, operationalisation and optimalisation in coastal development in small island regions; harmonize bureaucrat-technocrat relationship/link; transfer of science and technology to society, in order to manage resources in coastal and small island regions, and become a prime contributor to Indonesia's economy in a sustainable manner.

This program was launched in 2003 and was originally executed in 5 regions (regional centers), before increasing to 11 regions in 2004, 19 in 2005 and 26 in 2006.

4. Community Empowerment based Environment Management Program (Program Pengelolaan Lingkungan Berbasis Pemberdayaan Masyarakat /PPLBPM): Coastal regions as a transitional area between land and sea tend to come under pressure from development sometimes exceeding capacity. Activity on spatial utilization is poorly controlled, generating conflict and causing environmental degradation to mangroves, coral reefs and other fishery habitats, and contributing to coastal erosion and pollution.

Vision: Optimal Management of marine, coastal, and Small Island in sustainable manner.

Mission:

- To facilitate the realization of legislated spatial planning in developing marine, coastal and small island regions.
- Improvement of marine and coastal management systems for balancing the utilization and sustainability of resources and environment.
- Increase sustainable investments in small islands based on community empowerment.
- Develop the conservation of fish resources by means of protection, and sustainable utilization at the economic, type and genetic level.
- Improve the prosperity and independency of coastal and small island communities.

Target: Improve environment quality, economic growth and prosperity of coastal area societies and small islands.

To accelerate marine and coastal development, the *Coastal Zone and Small Island Management Act No.27/2007* has been issued by the Government of Indonesia, which consists of:

1. Planning
    - Norm, standard and manual for ICM
    - Integration spatial planning
2. Utilization
    - Territorial sea use rights
    - Ecosystem based management
    - Small island management protocol
    - Coastal marine conservation
    - Mitigation of coastal hazards
3. Surveillance and control
    - Surveillance and patrol
    - Accreditation
4. Capacity building
    - Training, extension and education
    - Research and development
5. Community empowerment
    - Rights, obligations and community participation
    - Community empowerment
6. Law enforcement
    - Conflict resolution & class action

- Investigation
- Sanction

The Indonesia Coastal Zone and Small Island Management (CZSIM) Act 27/2007 has had the following implications:

1. CZSIM ACT No. 27/2007 has triggered legislative reforms for managing coastal and small islands resources.
2. The law, regional government regulations and village ordinances were developed in parallel and they are complementing each other to enhance coastal governance.
3. Greater attention has been given to manage small/micro islands, especially in the outer islands of Indonesia.
4. National, provincial and/or district government agencies have increased their budget, facilities and trained officers to implement ICM.
5. Bank and micro finance institutions promote loans and savings for coastal communities, to some extent without collateral.
6. The provisions of CZSIM Act 27/2007 have enhanced the law enforcement efforts to cope with coastal intruders.
7. Enlarged coastal-marine conservation areas to more than 3 million ha.

In relation to Biodiversity management and conservation, there are three main NGOs in Indonesia that actively support government programs surrounding ATSEF region, for instance:

(1). ***CI Indonesia*** has been very actively participating in reforming the national marine policy by working with other non-governmental organizations and the government through the *National Committee on Marine Conservation Policies (Komnas Kolaut).* CI's approach to marine conservation is through the seascapes initiative, a large-scale and multipurpose ocean management plan to secure the goals of ecosystem-based marine conservation and human well-being through partnerships between governments, local communities, non-government and private organizations. Two out of three CI's seascape initiatives are located within Indonesian waters, *the Bird's Head* in Papua and *Sulu Sulawesi Seascapes*.

(2). ***WWF-Indonesia*** has a number of Field Offices in Indonesia. Two of these Field Offices, are coordinating a number of site conservation activities and programs. The Jayapura Field Office coordinates all WWF-Indonesia activities in the two provinces of Papua and West Irian Jaya. The Mataram Field Office coordinates all of WWF-Indonesia's work in Nusa Tenggara. In total WWF-Indonesia has 24 Field Offices in Indonesia carrying out local conservation work, within local government boundaries, such as practical field projects, scientific research, advising local governments on environmental policy, promoting environmental education, empowering communities, and raising awareness on environmental issues.

WWF-Indonesia is committed to establishing the expansion of the MPA, as The Indonesian Ministry for Fisheries and Marine Affairs established a target to expand the Marine Protected Area to 10 million hectares by 2010, and 20 million hectares by 2020.

In terms of biodiversity management and conservation, the WWF Marine program strategies aim at specific targets such as:

- Marine Protected Areas; Establishing at least three new Indonesian Marine Conservation Areas, with at least one in each marine Eco-region, adding at least 750,000 ha (in Jamursbamedi beach Papua, Derawan Islands-East Kalimantan, and Alor-Solor region)
- Endangered species; Indonesian waters hold enormous economic potential through its richness in fisheries and tourism, as well as providing a home to a variety of endangered marine species such as turtles, marine mammals, sharks, coral reefs, reef fishes and other marine biota.
- Campaign; WWF works with various partners to run public campaigns through a variety of events and publications. The campaigns aim to promote sustainable consumption of resources and to inform the public and policy makers of best natural resource governance.

The major achievements of WWF in Indonesian marine conservation include:

- In 1993 Cendrawasih Bay became a national marine park based on WWF work in the bay.
- In 1999 official regulations for banning exploitation of sea turtles was endorsed and further strengthened by governor legislation for all of Bali that forbids any harvest and slaughtering of sea turtles. WWF with partners were instrumental in establishing this legislation through effective political lobbying.
- In 2001 WWF became the Indonesian coordinator of the Reef Check Program and since then more than 900 volunteers have been trained in 21 locations throughout Indonesia to conduct regular reef monitoring activities.
- Also in 2001 a private sector network Friends of the Reef was established in Bali that facilitates the application of best practices in marine tourism and provides a forum for conservation discussions based on WWF work in West Bali National Park.
- In 2002 the Ministries of Fisheries and Marine Affairs and of Forestry and Conservation adopted the approach of collaborative management for marine and coastal resource management based on WWF work with partnering NGOs and other natural resource management projects.
- In 2003 the Ministry of Fisheries and Marine Affairs agreed to host and fund the Indonesian secretariat for SSME conservation and management based on WWF work with WWF Malaysia and WWF Philippines.

(3). **The Nature Conservancy (TNC)**; the TNC mission is to preserve the plants, animals and natural communities that represent the diversity of life on Earth by protecting the lands and waters they need to survive.

> Approach*: TNC have developed a strategic, science-based planning process, called Conservation by Design, which helps to identify the highest-priority places—landscapes and seascapes that, if conserved, promise to ensure biodiversity over the long term.*
>
> Conservation Initiatives*: The Nature Conservancy has seven priority conservation initiatives to address the principal threats to conservation at the sites where we work, focusing on* fire, climate change, freshwater, marine, invasive species, protected areas *and* forests.

Recently the TNC undertook the program of Marine Area Conservation planning network in Lesser Sunda. Data collection has been conducted in six sub areas namely Bali, NTB, Solor-Lembata, Alor, Sawu-Timor dan Sumba for undertaking Marine Conservation Area network planning and its implementation.

Together with the Ministry of Marine Affairs and Fisheries, Marine and Fisheries Service NTT Province, Tim PP-KKL Solar, WWF and Federal Ministry for the Environment Nature Conservation and Nuclear Safety, The Nature Conservancy succeeded in establishing The Savu Marine Protected Area which consists of Savu area 1: 566 686 ha; Savu area 2: 1 637 254 ha, and Savu area 3: 2 763 899 ha.

2.2.2. Fisheries

In regards to fisheries, the Ministry of Marine Affairs and Fisheries (MMAF) has a responsibility to develop marine and inland fisheries in a sustainable manner. There are at least two Directorates General sections related to fisheries management, **DG of Capture Fisheries** and **DG of Surveillance and Control of Marine and Fisheries Resources**.

Fisheries Law (No. 9 of 1985), has not accommodated all aspects of management of fishery resources and failed to anticipate the growing needs for laws and regulation, as well as technological development in the management of fishery resources, and must therefore, be superseded by **Law No. 31 of 2004 regarding Fisheries**, which consists of Chapters related to: Fishery management; Fishery business; Fisheries information and statistical data systems; Fisheries fees and levies; Research and development of Fisheries; Education, training and fisheries extension; Empowerment of small scale fishermen and fish farmer; Fisheries surveillance; Fisheries tribunal; The investigation, indictment, and trial before a fisheries tribunal; and Criminal provisions, where in total there are 17 Chapters and 110 articles.

The *Vision* of MMAF is the: "Management of marine resources and marine fisheries in a sustainable and responsible manner for the welfare of the nation, while its *Mission* is to:

- Improve the welfare of the fishing community, fish farmers and other coastal communities.
- Increase the role of Marine and Fisheries sector as a source for economic growth. Maintain the capacity and improve the environmental quality of marine, freshwater, coastal, and small islands.
- Improve intelligence and health of the nation through increased consumption of fish. Enhance the role of the sea as a national unifier.
- Enhance maritime culture as a characteristic of the nation

Development objectives of marine and fisheries in the medium-term development plan are:

- Realizing the welfare of the people of Indonesia through increasing the incomes of fishermen, fish farmers, businesses and marine fisheries and others.
- Increase the role of maritime affairs and fisheries sector in the national economy.
- Establish optimal condition of the environment and marine fisheries resources.

The targets of marine and fisheries development are to:

- Increase business and the quality of Human Resources target group
- Increase contribution of fisheries and maritime sectors to the national economy
- Decrease the level of damage and violation of marine resources and fisheries.

2.2.2.1. Directorate General of Capture Fisheries

The Vision and Mission of MMAF, the *vision* of DG of Capture fisheries is: To make the Indonesia capture fisheries business strong, self-supporting and sustainable in 2020, then the *Mission* is:

(i). Responsible management of fish resources;
(ii). Provide infra-structure and structural facilities at the fishing ports;
(iii). Strengthen national fishing fleet;
(iv). Develop capture fisheries business; and
(v). Improve earnings and prosperity of fisherman.

In order to achieve the Vision and implement the mission properly, the DG of Capture Fisheries is supported by five Directorates:

1. Directorate of Fish Resources Management
2. Directorate of Fishing Port
3. Directorate of Fisheries Business Development
4. Directorate of Fisheries Business Services
5. Directorate of Fishing Vessel and Gear development

The Technical Implementing Units as a representative of DG of Capture fisheries are established in certain Provinces and Districts, for instance: Fishing port technical implementing unit, Fishing Technology Development Institute, etc.

There are also Fisheries Services at the local government level (Province and District), that administrate under the Governor (at Province level) or Regent (at District level), so that there is not a direct "command line" between Directorate General of Fisheries and Local government Fisheries Services. In some Provinces and Districts, Fisheries are under Agriculture Services.

Concerning Fishery management, based on article 2 Fisheries Law No.31 of 2004 the fishery management is carried out under the principles of: benefit, equality, partnership, equal distribution, integration, transparency, efficiency, and sustainable conservation.

Further, in respect to support of the Fishery Management policies for capture fisheries, based on article 7 Fisheries Law No.31 of 2004, the Minister of MMAF shall establish among others:

- Fisheries management plan
- Potential and allocation of fisheries resources in Fishery Management Areas of Indonesia
- Total Allowable Catch (TAC) in Fisheries Management Area of Indonesia
- Type, number and size of fishing gears
- Type, number, size and placing of auxiliary gear
- Areas, cones, period or seasons of fishing
- Requirements or standard operational procedure for fishing
- Monitoring systems for fishing vessel
- Types of fish and restocking areas and fishing activity based on aquaculture
- Prevention of pollution and destruction of fisheries resources and environment
- Rehabilitation of fisheries resources and environment
- Size or minimum weight of allowable catch of fish
- Fisheries conservation
- Types of fish that are protected and conserved and also forbidden for trade

In the case of utilization of fish resources, Monitoring and Controlling is undertaken by DG of Capture Fisheries in order to secure and protect the resources.

Monitoring: executed through data collecting and analysis to measure the development rate of fisheries effort and amount of resources exploited, this activity is executed by the Directorate General of Capture Fisheries. In the case of fisheries data monitoring, effort to improve data collecting methods, type of data and information that should be collected and training to improve ability of field staff and data analysis has been executed. Annual meetings are conducted at province level by the Directorate of Fish Resources to validate the data and information obtained. Data collecting for monitoring purposes is undertaken in fishing ports and other landing-places selected that could represent the total extraction of the fish resources from Arafura and Timor seas.

Control: executed through licensing systems and a set of regulations concerning the measures of proper and responsible fish resources exploitation to avoid over exploitation.

Improvement of licensing systems covers:

1. Re-assessment of fish resources potential yield and evaluation of capture fisheries.
2. Completion of licensee basic data,
3. Re-registration of Fishing Vessels and research of ownership status and "flag" ship,
4. Improvement of Licensing System.
5. Computerization of license service facility,
6. Improvement of employee capability through education and training,
7. Improvement of Fisheries Law, Regulations and Ministerial Decrees.

There are some regulations that relate to fisheries management in order to support sustainable development, either positive law or local wisdom, and such guidance of responsible resources utilization such as the Fisheries Management Plan in the Arafura Sea. Other activities are the bilateral and multilateral meetings at regional level, for sharing the experience and determination to eliminate IUU fishing in the Arafura Sea.

In respect to **International Conventions**, those principles and the provisions stipulated in Law No.31 of 2004 are referring to and are in line with the message mentioned in international conventions, for instance:

UNCLOS 1982: Relates to utilization of fisheries resources, Chapter V article 61 consists of the principal obligation of coastal states to conduct marine resources conservation, whereas chapter 62 relates to utilization of marine living resources, including the obligation of coastal states to prepare and implement the regulations that relate to:

- Fishing licenses for fisherman, fishing vessels and fishing gear;
- Determining the species that may be caught and its quota within certain periods;
- Arrangement of fishing seasons and zones, type and number of fishing gear and fishing vessel as well;
- Determining fish age and size that can be caught;
- Notifiable information which should be reported by fishing vessels such as catch, effort and fishing location.
- Involving observers from other coastal states in the fishing vessel practices;

All provisions mentioned above have been stipulated in Law No.31 of 2004.

Code of conduct for Responsible Fisheries (CCRF): CCRF states the action of fisheries principles in a responsible manner (responsible fisheries) as *voluntary*. The government cooperates with fisheries industries and fishing societies to responsibly implement the CCRF. The effective implementation of CCRF depends upon the inclusion of CCRF principles and targets national policies and fishery regulations. The government also must push the fishery society to develop best practice fisheries resources exploitation that is consistent and supportive of the objectives and the targets of CCRF. The potential implementation of CCRF can be seen in the several programs activities mentioned below.

United Nations Fish Stock Agreement (UNFSA): The UN Fish Stocks Agreement is an arrangement that is separated from the implementation of the UN Convention on the Law of the Sea (UNCLOS). The UN Fish Stocks Agreement is related to conservation and management of straddling and highly migratory fish stocks.

The main elements of UN Fish Stocks are the precautionary approach, transparency, conservation and fisheries management principles by non-member, and regulations that arrange international conservation regime similar with arrangements in the Code of Conduct.

Although Indonesia is currently in the process of ratifying this agreement, it has been a full member of IOTC and CCSBT, meaning that those principles of the UN agreement have been implemented by Indonesia indirectly.

Related to conservation and management of straddling and highly migratory fish stocks, under the Australia Indonesia Ministerial Forum, **Indonesia** and **Australia** agreed to consider **cooperative approaches to manage the possible shared and adjacent stocks**, reflecting the need to support Indonesian fisheries management and research capacity.

As a legal instrument, the Fisheries Law has been translated into lower level regulation such as Government regulation, Ministerial decree and Director General Provisions, in order to implement the fisheries program.

Based on its law and regulation, the DG of Capture fisheries undertakes the policies/programs that relate to fisheries management as follows:

1. *Coordinating forum of Fisheries management, which has objectives to:*
    1. Evaluate the level of utilization and its relation to management of fisheries resources.
    2. Generate a concept of management and utilization development plan of fisheries resources in accordance with Code of Conduct for Responsible Fisheries.
    3. Find solutions to the problems occurring in fisheries resources management.

2. *Co-Management in Fisheries*
    - Fisheries Management in the Fisheries Zone Managed by Central Government
        - The Government established a Coordinating Forum of Fisheries Management at the national level and in each fisheries management zone, involving representatives of fishing industries, national government, provincial governments, researchers and scientists. The forum discussed management policies, strategies and measures; *(Input control is implemented in controlling fishing capacity).*

- Fisheries Management in the Water bodies Managed by Local Communities
  - In some locations, local fish stocks were fully conserved and managed by local communities long before Indonesian independence. *(closed season is implemented to conserve fish stocks)*

3. Central and regional authority

- Vessel size (GT) > 30: the license for fishing issued by Central Government.
- Vessel size 10 < (GT) < 30: the license for fishing issued by Provincial Government.
- Vessel size 5 < (GT) < 10: the license for fishing issued by District Government.

4. Control fishing capacity.

- *Licensing System,* preventative instrument to control exploitation through allocation of sustainable fisheries potential in order that exploitation rate does not exceed the availability.
- *Fisheries Resources,* Coordinating Forum of Fisheries Management, established to specifically handle fisheries resources utilization through collaboratively managing these resources.
- *Fleets Relocation,* policy is implemented to reduce fishing pressure on fisheries management areas that are considered over exploited.

In regards to **Bilateral Arrangements**, there is a Memorandum of Understanding (MoU) between the Government of Australia and the Government of the Republic of Indonesia regarding the operations of Indonesian traditional fishermen in areas of the Australian Exclusive Fishing Zone and Continental Shelf (7 November 1974) and its amendments in 1989.

Under the Australia Indonesia Ministerial Forum (AIMF), Indonesia and Australia committed to manage and conserve the resources in the MoU Box area, in the last meeting of AIMF in Canberra 10 – 12 November 2008. The agreed outcomes of the MoU Box Sub-Working Group are:

- Indonesia and Australia noted the need to increase joint efforts to address issues relating to the MoU Box, among others through continuing joint research and developing alternative livelihoods for Indonesian traditional fishing communities. In light of recent work and with the view to further improve outcomes, Indonesia underscored the need to develop jointly agreed terms of reference for research in the MoU Box.
- Indonesia proposed that the 1974 MoU in the so-called MoU Box be revisited, especially with regard to the definition of traditional fishing rights of Indonesian fishermen, in accordance with international law.
- Indonesia and Australia noted the need to develop innovative ways to progress all aspects of management in the MoU Box, taking into account *inter alia* the use of technology and the need to ensure that the fisheries are sustainable.
- Indonesia and Australia agreed to conduct joint surveys as well as other research activity to assess *inter alia* the status of fish stocks in the area, and to refocus efforts to develop alternative livelihoods for traditional fishing communities with an historic link to fishing in the MoU Box, and to use its findings as a basis for developing acceptable measures for both sides.

Following the Canberra meeting, the 6th Annual Meeting of the Working Group on Marine Affairs and Fisheries was convened on the 19-20 March 2009 in Bali. The agreed outcomes and actions of the Sub working Group on the MoU Box are:

1. Australia and Indonesia acknowledged the valuable work done to date on the MoU Box and the need to agree on a new, reinvigorated approach that will address issues comprehensively. The working group noted that Ministers had acknowledged the interests of traditional fishers and the importance of sustainability of resources.

2. Australia proposed a Road Map of MoU Box Cooperative Management as a new approach, acknowledging the importance of sustainable management of the MoU Box and the interests of Indonesian traditional fishers. The key components for progressing this are :
   - Research terms of reference and research program;
   - Management measures and options;
   - Socio economics and alternative livelihood aspects;
   - Training and capacity building needs; and
   - Consultative processes with stakeholders and consultations with traditional fishers, taking into account their concerns including the use of technology for fishing practices.

   Indonesia and Australia agreed to establish a small working group to further discuss elements of the Roadmap of MoU Box Cooperative Management. The first meeting of the working group was held in Jakarta in April 2009.

3. Australia acknowledged Indonesia's concerns in relation to the safety of traditional fishers and their access to technology for fishing in the area.

At the **regional level**, Indonesia is a member of Southeast Asian Fisheries Development Center (**SEAFDEC**), which has been recognized as an organization that promotes sustainable fisheries development. Indonesia actively participated in SEAFDEC programs such as the:

- Introduction of Thai Turtle Excluder Device (TTED), and Juvenile and Trash Excluder Device (JTED).
- Resources research survey using MV SEAFDEC; the results were published as scientific material to support fisheries planning and management.
- Implementation of resources enhancement program and promotion on rights based fisheries management concept to local fishers.
- Conservation of shark and marine turtles, and seed production under international concern for stock enhancement purposes.

At the **local level** of sector governance and policy frameworks, the marine and fishery policies have been formulated by each province and district of the Arafura and Timor seas region (there are 3 provinces that cover 10 districts) in the form of a strategic plan for marine affairs and fisheries. These plans are based on the vision and mission of the Ministry of Marine Affairs and Fisheries, however there are some additions and modifications in line with the need of each province and district; they are in place for a period of 5 years.

The marine and fisheries policies of each province and district are similarly concerned with:

- Increasing production and added value of the fisheries product.
- Resource and environment management for sustainable utilization

- Development of human resources
- Increasing prosperity of the fishers
- Market development
- Open employment
- Improvement of domestic original income (Pendapatan Asli Daerah/PAD)
- Improving fisheries business
- Partnerships among institutions

Problems frequently occur in implementing these policies, when the local government values increased production and domestic income over the sustainable use of natural resources and environmental management.

In regard to sustainable fisheries, the government of Indonesia also works cooperatively with **NGOs**. The following are some activities undertaken by WWF Indonesia:

- Establish certification for early adopters in the ornamental fish trade and identify the feasibility of certification for wild caught grouper and lobster fisheries and for farmed grouper.
- Establish fisheries management schemes that include 'No-Take Zones' for replenishment purposes, within seven sites (Bunaken, Wakatobi, Cendrawsasih, Karimunjawa, Riung, West Bali and Ujung Kulon) and establish national policy strategies on no-take-zones for all MPAs.
- Determine WWF-Indonesia Marine Program contributions to global targets of reducing Illegal, Unregulated, and Unreported (IUU) fishing through working with relevant regional fisheries bodies (APEC/ASEAN/ATSEF) and national fisheries bodies (GAPPINDO/HNSI).

Certification of fisheries has been initiated, as it can be an option to transform unsustainable fisheries through market-incentives. Fisheries products that are certified can be identified by consumers as having been produced by environmentally well-managed fisheries.

2.2.2.2. Directorate General of Surveillance and Control of Marine and Fisheries Resources

At global, regional and national levels, issues associated with IUU fishing activities currently constitute a major world-wide threat to fisheries stocks.

Surveillance and law enforcement are executed in order to control and maintain resource users and regulate fishing activities. S*urveillance* functions such as law enforcement is a mandate of Directorate General of Surveillance and Control of Marine resources and Fisheries – Ministry of Marine Affair and Fisheries.

In undertaking this task the DG of Surveillance and Control Marine and Fisheries Resources specify its Vision and Mission as follows:

Vision:

To realize responsible and well regulated marine and fisheries resources management and utilization.

Mission:

- Increase quality of marine and fisheries resources surveillance and controlling systematically and with integrity, in order to support proper management for sustainable utilization of the resources.
- Increase appreciation and participation of stakeholders and society in marine and fisheries resources surveillance.

In achieving and implementing the Vision and Mission, the DG of Surveillance and Control Marine and Fisheries Resources are supported by five Directorates as shown in Figure 1.

The Marine Resources and Fisheries Surveillance Technical Implementing Units as representatives of the DG of Surveillance and Control of Marine and Fisheries Resources have been established in selected Provinces and Districts including bases in Bitung (North Celebes) and Jakarta, and stations in Belawan (North Sumatra), Pontianak (West Kalimantan) and Tual (Arafura)

The Fisheries Service at the local government level (Province and District), as mentioned earlier, also undertakes the task of policy development on marine and fisheries control and surveillance activities, in order to support the implementation of central government policy.

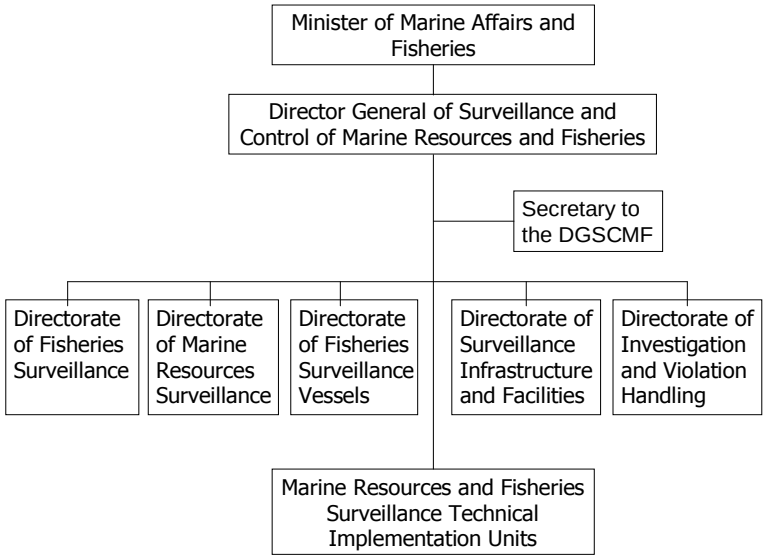

Figure. 1. Organization structure of DG of Surveillance and Control Marine and Fisheries Resources

In Indonesia the regions most at risk from IUU fishing activities are the South China Sea, the waters around North Sulawesi and the Arafura Sea. Each of these regions experience specific problems at various levels of severity. However, there are a number of similarities, including a very high level of illegal fishing in each of these three areas. In addition, the level of surveillance by the relevant forces of law and order is still very low.

Surveillance has a strategic position in the management of marine and fisheries resources. Thus a surveillance program that recognizes a Monitoring, Control and Surveillance system (MCS) has been developed. An MCS that consist of sub system Monitoring, Control and Surveillance is supported by several components such as VMS (Vessel Monitoring System), Communication device, CDB (Computerized Data Base), community based surveillance systems (System Pengawasan Berbasis Masyarakat), Patrol boats, Fishing Log Books etc. Targets to be reached are:

(i) Decrease infringements in improper utilization of marine and fishery resources; (ii) Decrease the damage of marine ecosystems; and (iii) Forming of active community groups to participate in community based surveillance systems (SISWASMAS).

Arafura Sea is the main fisheries area, especially for demersal and pelagic fish and prawns. However, marine fisheries development in Arafura and Timor Seas are free from IUU Fishing problems. In Indonesian waters the Arafura Sea is one of priority areas for infringement crisis zone fisheries.

Programs are developed in order to overcome IUU Fishing executed in the Arafura Sea and South China Sea and are a basic principal in the execution of capture fishery development in 2004-2009. This Program covers: (i) Improvement of integrated operations to prevent, deter and eliminate illegal fishing especially in the South China and Arafura seas; (ii) Development programs of surveillance and control facilities of utilization of the Marine and Fisheries resources MCS/VMS; (iii) Development of a Community based surveillance system (SISWASMAS) (iv) Development of an Incentive System in implementing a Code of Conduct For Responsible Fisheries (CCRF).

The development of a Surveillance and Law Enforcement Capability by DG of Surveillance and Control, Marine and Fisheries Resources Ministry of Marine Affairs and Fisheries will:

- Increase surveillance activities at ports and sea, including observer programs, and joint sea surveillance with the navy and marine police, and joint air surveillance with the air-force.
- Develop a Vessel Monitoring System (VMS) and utilise this system to observe the compliance of fishing vessels and fish carrier vessels.
- Develop a community-based fisheries surveillance system involving communities in the observation of activities at sea and on land, who report to surveillance officers when illegal fishing activities are sighted.
- Establish Technical Implementation Units for Fisheries Surveillance in strategic locations taking into account a high possibility of fisheries law violation.
- Develop Fisheries surveillance facilities and infrastructure
- Establish fisheries courts in five locations close to the areas with high frequency of fisheries law violation.
- Establish a national coordinating forum involving relevant government institutions to increase the effectiveness of fisheries law enforcement.
- Increase the number and capability of Fisheries Surveillance Officers and Fisheries Investigators.
- Increase efforts to Combat Illegal Fishing by improving:
    - Monitoring components
    - Control components:
        - Re-registration of Fishing Vessels
        - Improvement of Licensing System
        - Improvement of Fisheries Law, Regulations and Ministerial Decrees
    - Surveillance and Enforcement components

As illegal fishing is an international and regional concern, Indonesia and Australia under Australia – Indonesia Ministerial Forum (AIMF) agreed to combat IUU fishing. The agreed outcomes of Sub Working Group of IUU fishing in the last Working Group Marine and Fisheries Meeting in Bali (2009) include:

1. Indonesia and Australia recognized the significant decrease of the illegal activities by fishing vessels in Indonesia-Australia waters during the period of increased bilateral cooperation.

2. Indonesia and Australia noted the success of the Public Information Campaign (PIC). For the future, the visits to fishing communities will be suspended and PIC activities will engage Indonesian fisheries extension officers, both provincial and district fisheries officials, through a series of workshops, with the aim that the extension officers disseminate information to the community. The PIC message will change from assertive to informative and persuasive. The meeting members agreed to hold future discussions on the PIC in the Sub-Working Group on partnership and cooperation. Indonesia presented a new map to be distributed for future PIC activities. Australia provided initial suggestions and will provide further comments.

3. Indonesia and Australia noted the progress of the fisheries surveillance forum, covering cooperations in:
    - Coordinated fisheries patrols,
    - Exchanging information,
    - Reciprocal port visits by Indonesian Fisheries and Australian Customs patrol vessels,
    - Capacity building through training and development opportunities, and
    - Provision of technical support.

4. Australia and Indonesia underscored the need to continue and expand the cooperation, including through increased exchange of surveillance data and real time information and coordinated patrols, and to develop arrangements to formalize cooperation within the existing framework of fisheries cooperation and the plan of action for the implementation of the Lombok Treaty.

5. Indonesia and Australia discussed the practice of Hot Pursuit and Australia agreed to provide further information on its practices with other countries.

6. Indonesia advised its intention to highlight the transnational organized crime linkages of illegal fishing through the United Nations Transnational Organized Crime Convention (UNTOC) in order to complement the food security approach of the FAO.

7. Indonesia and Australia agreed on the need to progress the objectives of the Regional Plan of Action to Promote Responsible Fisheries including Combating IUU Fishing (RPOA), through enhanced coordination between the two countries and by encouraging RPOA members to fulfill their commitments.

8. Indonesia and Australia recognized the increasing problem of mother ships on the Australia-Indonesia border, which are used to support illegal fishing operations. Both countries also noted the potential for the problem to increase as a result of the global financial crisis. Both countries agreed to discuss ways to work cooperatively to address this issue.

9. Indonesia and Australia agreed to a way forward for finalizing the "Joint Australian-Indonesian Study on Illegal Foreign Fishing in Waters of Mutual Interest between Australia and Indonesia".

10. Australia provided clarification in response to an Indonesian request regarding compensation issues linked to the apprehension of nine vessels in 2008. Compensation was paid for all nine vessels. Compensation was not paid for three other vessels as the masters of these vessels were convicted of fisheries offences. Australia will provide further information in relation to these vessels.

In terms of **regional cooperation**, Indonesia and Australia agreed to continue cooperating to encourage commitment from member countries to implement the priority actions of The Regional Plan of Action to Promote Responsible Fishing Practices Including Combating Illegal, Unreported and Unregulated Fishing in the Region (RPOA), that also involve Papua New Guinea and Timor Leste.

Programs and activities to overcome IUU fishing activities are also a priority for **local government level,** for instance:

East Nusa Tenggara Province (Nusa Tenggara Timur/NTT): Some issues of IUU Fishing that are already identified in East Nusa Tenggara Province include the illegal entry of foreign fishing vessels, the usage of fishing gear that is not selective (destructive fishing) in territorial waters and in the EEZ; fishing with dynamite and cyanide and illegal entry of national commercial fishing vessels. In order to overcome these IUU fishing problems several actions are undertaken such as: (i) Community surveillance systems; and (ii) Development of alternative livelihoods. Lack of facilities for effective surveillance is the main constraint being faced.

Western Southeast Molucas District: Arrangements of fishery businesses in Molucas Western Southeast district relies on Molucas Western Southeast district regulation No. 20, Year 2003 concerning Fisheries businesses in Molucas Western Southeast district. Fisheries violations that often happen in Molucas Western Southeast district waters concern fishing by using dynamite, poaching fish and non-fish marine resources. Dynamite and the usage of poison in catching coral fishes are caused by a high demand from foreign countries for exotic fish. Turtles are also in high demand, either for the domestic or foreign market. Generally the domestic buyer is Balinese buying turtles for ceremonial purposes and lobster for general trading. Penyu sisik (*Eretmochelys imbricata*) and green turtle (*Celonia mydas*) are often found in this area.

Fisheries resources surveillance mechanisms undertaken by Marine Affairs and Fisheries service of Molucas Western Southeast district rely on reports from local communities. At this time the Marine affairs and Fisheries service of Molucas Western Southeast district operate a Kalwedokidabela patrol boat. In case of fishery violation, the actions undertaken by Marine Affairs and Fisheries service of Molucas South-East West district will prosecute fishers for using incorrect fishing gear, The constraints faced by fisheries surveillance are: (i). Minimal resources for surveillance of such a large area; (ii). Lack of surveillance personnel, either in terms of quality or quantity; (iii). Surveillance activities depend on the season; (iv). The programs Community Surveillance System (Siswasmas) and Community Surveillance Group (Pokwasmas) have not yet been fully adopted by the community; (v). Lack of communication facilities; and (vi). Limitation of fuel stocks for patrol boats.

Papua Province: As almost half of the Papua coastal zone is on the Arafura Sea it faces a serious problem of IUU Fishing either at a national or regional scale. Consequently, the government has tried to undertake several activities in order to prevent, deter and eliminate IUU Fishing, such as: (i). limitation of fish catch within optimum level, processing and marketing, implementation of Code of Conduct for Responsible Fisheries (CCRF); improvement of control and licensing service; and (ii). Improvement of surveillance on marine and fisheries resources utilization: providing the facilities and infrastructure;

surveillance of IUU Fishing, development of Community Surveillance System (SISWASMAS); development of surveillance station; and coordination among sectors.

Mimika District: One of the programs in the strategic plan (2006-2010) of the Mimika district is the improvement of marine affairs and fisheries resources surveillance. The main activities are: (i). Fishing port development to facilitate the surveillance of IUU fishing activity; (ii). Improvement of surveillance facilities, for instance, patrol boats; and (iii). Improvement of monitoring systems for IUU Fishing. In order to realize these programs, the local government of Mimika district has issued such regulations concerning Integrated Surveillance Teams that consist of the Marine Affairs and Fisheries Service, Navy and Marine Police. Technical guidance on surveillance concerning prevention, deterrence and elimination of IUU fishing is published as a reference for the team in executing their task.

Merauke district: At this time IUU fishing activities are a serious issue in Merauke district. This is substantiated by the existence of various fisheries violations in territorial waters off Merauke district, for example: (i). Transshipment from catcher to carrier vessel; (ii). no licensing document; (iii). Fishing zone violation; (iv). Violation by foreign vessel and Indonesia industrial fishing vessel in territorial waters 0-4 miles, especially by fish and shrimp trawlers; and (v). Violation on fishing method. In an effort to eliminate these violations the local government undertakes: (a). export activities surveillance every month; (b). inspection of fishing vessels (checklist) every month; and (c). periodical licensing surveillance. However in its implementation the Merauke district government faces several constraints such as the quick change of weather and sea conditions in the Arafura Sea, and not enough patrol boats to survey the area.

2.2.3. Aquaculture

Development of aquaculture for the purposes of contributing to economic growth was realized through a competitive, sustainable and equitable aquaculture system. Various activities to reinforce mari culture (aquaculture) developments in the last five years (2001-2005) have proven beneficial in increasing overall mari culture area and mari culture production. Within this period the overall mari culture area increased in average from 676.185 ha in 2001 to 736.298 ha in 2005. Meanwhile, mari culture production in the same period has doubled in four years, from 1 million tons in 2001, to 2.2 million tons in 2005.

At the national level, policies in aquaculture development (either marine or fresh water) are directed by the Directorate General of Aquaculture, as a sub ordinate of the Ministry of Marine Affairs and Fisheries.

In undertaking the task the DG of Aquaculture specified its Vision and Mission as follows:

Vision: The establishment of competitive and sustainable aquaculture as a mainstay of economic growth

Mission:

1. To produce high quality fish efficiently
2. To develop responsible and environmentally friendly aquaculture
3. To create business opportunities and provide employment

The DG of Aquaculture is supported by five Directorates, namely:

1. Directorate of Aquaculture Production Development
2. Directorate of Seed Development
3. Directorate of Aquaculture Infrastructure
4. Directorate of Fish Health and Environment
5. Directorate of Aquaculture Business Development

In order to support the development of aquaculture at the local level, the Aquaculture Technical Implementing Unit as a representative of central government was established in certain Provinces and Districts. Among 11 Aquaculture Technical Implementing Units distributed in Indonesia, there is none located in ATS region and the only mari culture institute located near the ATS region is the mari culture institute in Ambon.

The Fisheries Service at local government level (Province and District), as mentioned earlier, also implements policies on aquaculture activities, in order to support the implementation of central government policy. By issuing the law No. 32 of 2004 concerning Local Government (UU No. 32/2004 concerning local autonomy), the local government has more power in specifying policies and activities related to aquaculture.

There are two aquaculture programs which were launched by the Directorate General of Aquaculture in order to stimulate the development of aquaculture in line with its Vision and Mission:

1. **The Aquaculture main program**, which consists of three sub programs namely (a) Increasing mari culture product for export (PROPEKAN), (b) increasing the aquaculture production for the improvement of community fish consumption (PROKSIMAS) and (c) protection and rehabilitation of aquaculture resources (PROLINDA).
2. **The Aquaculture supporting program** consists of six sub programs namely (a) Aquaculture infrastructure development, (b) Seed production system development, (c) Production system development (d) Development of Fish Health and Environment Management System, (e) Development of aquaculture business system and (f) Administration and institution system development.

Besides the national programs mentioned above there also exists other similar local programs. Pearls are a leading commodity in the mari-culture industry, especially in eastern Indonesian waters. In general, the pearl aquaculture business uses *Pinctada maxima* and *Pinctada margaritifera* pearls, and has been targeted by foreign investment companies, as well as domestic investment and national private enterprise. According to Government regulation No. 15/1990 and Government regulation No. 54/2002 concerning Fisheries Business Permit, permit for an aquaculture business (either foreign or domestic investment) is issued by the Coordination Agency for Investment based on a technical recommendation from the DG of aquaculture, while for national private enterprises which use foreign labor, permit is issued by DG of Aquaculture.

2.2.4. Marine Science and Research

Research and development of fisheries is stipulated in Chapter VIII, Law No. 31 of 2004 concerning fisheries, and states that:

- The government shall regulate, encourage, and/or conduct fisheries research and development and technology for the management of fisheries businesses.

- Any individuals, universities, non-governmental and/or private research and development institutions may carry out fisheries research and development.
- Any individuals, universities, non-governmental and/or private research and development institutions as referred above, may cooperate with: (a) organizers of research and development, (b) those involved in fisheries businesses, (c) fisheries associations and/or (d) foreign research and development institutions

In regards to the research and development as mentioned in Law No. 31 of 2004, more detailed provisions are stipulated in the Government Regulation No. 30/2008 concerning Undertaking of Fisheries Research and Development.

There are several institutions that undertake research on fisheries and marine science at different levels of intensity for instance: The Agency for Marine and Fisheries Research-Ministry for Marine Affairs and Fisheries (BRKP-DKP), The Research Center for Oceanology – Indonesian Institute of Sciences (Pusat Penelitian Oceanologi-Lembaga Ilmu Pengetahuan Indonesia/P2O-LIPI), The Agency for Assessment and Implementation of Technology (Badan Pengkajian dan Penerapan Teknologi/BPPT), and Universities. The BRKP-DKP and P2O-LIPI are the main research institutions dealing systematically and continually with marine and fisheries research, while those in BPPT and Universities do not focus merely on marine research.

The Agency for Marine and Fisheries Research (AMFR), as an agency under MMAF, has a role in providing the research support and scientific input in management and development of the marine and fisheries sector, and also in harmonizing to support the marine and fisheries policy.

Vision
Establishing science and technology as a key toward the self-support of sustainable and responsible marine and fisheries management and development.

Mission
1. The development of resource capacity of marine and fisheries research
2. The intensifying of marine and fisheries activities to contribute to scientific knowledge, to support marine development, and to carry out new innovations in marine and fisheries technology
3. The dissemination and public awareness of marine and fisheries research output and marine and fisheries science and technology development

Based on Ministerial Decree No. 7 of 2005 and on its vision and mission, AMFR is supported by six Research Centres whose activities are focused on Capture fisheries, Aquaculture, Product processing and Biotechnology, Socio-economics, Maritime Territories and Non living resources, and Marine Technology, where each research centre administers several institutes and installations that carry out research on the fields mentioned above.

The priority of AMFR research can be categorized into three main research categories i.e. basic research, integrated applied research and advance research. The research program of each research centre can be described as follows:

Research program on capture fisheries

There are three main research programs in capture fisheries that include:

a. Research on fishery resources and environment which can be divided into two main components: (1) Research on fishery resources, intended to provide scientific information on fisheries resources as a basis for management, it will cover research on biology, population dynamics and environment. (2) Research on stock enhancement, which aims to increase the abundance of certain depleted resources.

b. Research on fishing technology, which consists of research on fishing gear, gear material, and fishing method as well creating eco-friendly fishing gear and methods.

c. Research on fisheries policy analysis, focusing on the evaluation and study of which fisheries policies and regulations are being enforced.

Research program on aquaculture

Research program on aquaculture can be divided into four kinds of research:

a. Research on marine, brackish water, seed production and fresh water fish genetics aimed at data availability and stock potential, methodology of stock selection and integrated spawning technology
b. Research of fish growth, improvement of aquaculture productivity emphasising environmental impact, production techniques and candidate stock development.
c. Research led technology and nutrition directed towards getting the food formula, production techniques, and research about nutritional needs including type, amount, and quality of fresh food.
d. Research on fish health management and environment that covers disease surveillance and probiotics for the prevention of fish diseases.

Research program on marine technology

a. Technology development for fisheries infrastructure such as fishing ports and fishing vessels.
b. Technology development for marine and coastal conservation and rehabilitation.
c. Applied technology development to increase welfare of coastal communities.
d. Research on technology development and utilization of marine resource surveillance, including MCS system.
e. Technology development for seabed and deep sea exploration and exploitation.
f. Technology development on remote sensing technology and GIS for marine and coastal resources management.

Research program on maritime territories and non-living resources.

Research programs on *maritime territories and non-living resources* can be divided into eight components as follows:

a. Research on ocean dynamic and climate variability.
b. Research on jurisdiction of territorial sea and continental shelf which includes formulation of technical methods on mapping of local maritime boundaries.
c. Research on mineral and submarine natural gas (Methane) that includes research on utilizing mineral and gas resources and its impact on ocean and coastal environments.
d. Research on underwater archeology, such as shipwrecks.

e. Research on marine disasters, mitigation, tsunamis, geodynamic and paleo climate of Indonesian waters.
f. Research on ocean-atmosphere interaction.
g. Research on maritime history of Indonesian coastal area.
h. Research on policy of national and international marine development.

Research program on product processing and biotechnology

a. Product processing research with a scientific base for rational and responsible handling and processing of marine organisms.
b. Food security and environment research in order to assure that Indonesian fisheries products have fulfilled the national and international food security standards.
c. Biotechnology research and applied engineering research.

Research program on socio-economics of marine and fisheries.

a. Research on the dynamics of marine and fisheries management
b. Research on social, anthropological and institutional
c. Research on trade and entrepreneurship of marine and fisheries.

In order to improve the ability of the scientists and develop institutional capacity, research partnerships have been formalized by AMFRs, either with local research institutions or regional/international research institutions.

In implementing the programs, AMFR is supported by skilled and professional scientists; however the research facilities such as laboratories, research vessels and experimental ponds are generally in poor condition.

2.2.5. Forestry

In relation to the Arafura and Timor Seas region, there are around 638 000 hectares of mangrove forest along the Arafura coast and 19 600 hectares along the coast of Timor Indonesia.

Existing forest area (including mangrove forest along the coast) is still under pressure from several interests that threaten its existence. This pressure comes from various levels of society for instance: claims from traditional societies, lack of clarity on the boundary of forest area, and conversion of forest area to other sectors.

Institution and Regulation.

At the level of central government the Minister is supported by the Secretary General, Inspector General, Advisor for the Minister and five Directors as shown in Figure 2.

The Ministry of Forestry has several Technical Implementing Units, namely: River Flow Area Management Institute (31 units); Stabilized Forest Area Institute (11 units); Natural Resources Conservation Institute (32 units), National Park Institute (33 units), Institute of Certifications of Forest Product Examination (17 units), Research and Development Institute of River Flow Area Technology (2 units), Research and Development Institute of Forest Plantation (2 units), Research and Development Institute of Forestry (8 units), Institute of Natural Silk (1 unit), Seeding Production Technology Institute (1 unit), Forestry training and extension Institute (7 units), Seed Production and Forest Plantation Institute (6 units).

There are Forestry Services at Province and District level that were previously under the Ministry of Forestry; however they are now a sub-ordinate of Local Government (Governor in Province level and Bupati in District level).

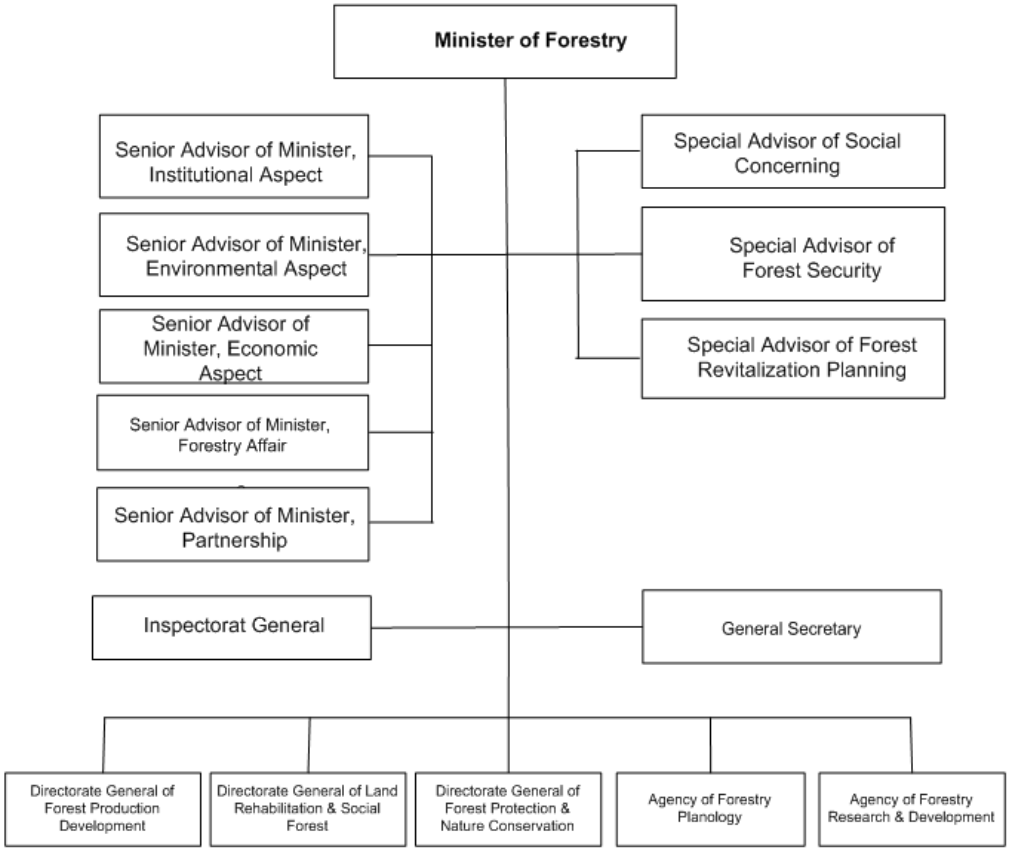

Fig. 2. The Organizational structure of the Forestry Ministry.

In the case of regulations supporting the execution of forest development, the forestry sector, through the Ministry of Forestry, is protected by law and regulations as follows as well as various other supporting regulations including forest resources management instruments:

1. Law No. 41/1999 concerning Forestry (that is completion Law No. 5/1967),
2. Law No. 22/1999 concerning Local Government.
3. Law No. 25/1999 concerning Finance Counter Balance, Central and Local,
4. Law No. 12/1992 concerning Plantation Culture System.
5. Law No. 24/1992 concerning Forest Space Planning,
6. Law No. 5/1990 concerning Living Natural Resources Conservation and its Environment,

The Ministry of Forestry has published some regulations as the formulation of Law No. 41/1999. For example:

1. Government Regulation. No. 34/2002 concerning Forest Arrangement and Preparation of Forest Management Planning, Forest Utilization, and Exploitation of Forest Area
2. Government Regulation No. 35/2002 concerning Re-forestations Fee,
3. Government Regulation No. 63/2002 concerning Urban Forest.

A Forestry Ministerial Decree to support the execution of Government regulations has been published. The Government is currently in the process of developing other Draft Government Regulations for example: Draft of Government Regulations concerning Forestry Planning. Draft of Government Regulations concerning Customary Forest, Draft of Government Regulations concerning Forest Rehabilitations.

In terms of regulation implementation, law enforcement has been undertaken through control and surveillance that is conducted on a regular basis; nevertheless the results are not yet satisfactory.

In addition to law and regulation, the support of forestry planning needs to be synchronized with the execution of development activities. So far, the process of preparation of forestry planning is yet to accomplish this.

Vision and Mission

Vision: Sustainable forests for the improvement of community prosperity.

Mission: In order to achieve this vision, the mission is specified as follows:

1. Guarantee the existence of forests. This Mission has objectives to realize the certainty of the law/status of forest area and maintain the forest in accordance with its functions (conservation, protection, production). The existence of the forest area will support the management of forest areas for attainment of forest sustainability.

2. Optimizing the benefit of the forest. This Mission has objectives to: 1) Rehabilitate the forest condition that has been damaged, 2) Improve forest social benefit, 3) Improve the effort for forest resources conservation, and 4) Optimize the benefit of forest products (wood, non wood, tourism, environment service etc) for conservation, protected forest and production forest areas and the forests that exists outside these areas. It is expected that sustainable forest management that has positive effects on forests and communities is achievable in the future. Additionally, this mission expects to integrate and synergize development activity during the period of rehabilitation and conservation.

3. Strengthen the forestry institution. This Mission has objectives to strengthen the basis of, and provide support for, the achievement of the previous mission. This Reinforcement covers, among others: organization, professionalism and human resources, science and technology, planning and forestry, law and regulation, partnership and cooperation, preparation of data/information, surveillance and control.

Policy, Strategy and Programs.

Policy

Based on the existing situation the Ministry of Forestry has specified five priority policies (according to the Decree of the Minister of Forestry No. 7501/Kpts-II/2002). Each Policy is supported by a number of strategies. Each policy and strategy is listed below.

a. Illegal logging eradication:
   - Applying a social forestry principle in regions of illegal logging.
   - To improve and strengthen forestry law enforcement.

- Development of forest security institutions.

b. Prevent and control forest fire:
- Applying a social forestry principle at regions of forest fire.
- To improve and strengthen the forestry law enforcement.

c. Restructure of forestry sector:
- Paradigm that will be used in forestry development is "resources based management".
- Application of “soft landing" to give the forest opportunity to repair.
- Restructuring of forestry industry.
- Harmonizing the supply and demand of logs for achieving sustainable production.
- Improvement of non-timber forest production use.
- Improvement of eco-tourism and environment services etc.
- Forestry management (conservation, protection and production) must be approached by "social forestry” principles.

d. Rehabilitation and conservation of forestry resources:
- Future development should include area rehabilitation and conservation
- Development of collaboration in managing national parks
- Development and effort to improve the rehabilitation of forests and land and conservation of forestry resources.
- “Social forestry” approach must be used in the effort to rehabilitate and conserve.

e. Decentralization of forestry sector:
- Improvement of policy transparency through the involvement of multi stakeholders in decision making processes.
- Facilitate the decentralization process for responsible forest management.

There are supporting policies in order to achieve the five priority policies for example: Application of social forestry as the basis of the five priority policies; Preparation of pre-condition reports ; The forest use must be concerned with its function and carrying capacity; Improve the role of communities in forest management; and strengthen forestry institutions.

In order to support this policy, there are two strategies below:
- Integrative approach achieves success in the five priority policies.
- Improve the use of research and development in the policy making process.

Programs.

The Ministry of Forestry has five main programs, as follows:

1. Development of sustainable social forestry area program.
2. Forest protection and security program.
3. Forest and land rehabilitation and forest resources conservation program.
4. Development of sustainable forest management program.

   This program is constituted by a "social forestry" policy, balance of supply and demand through soft landing, restructuring of forestry industry, forest utilization according to function (conservation, protection and production) and carrying capacity and community involvement.
5. Development of forestry institution program.

   The target of this program is to achieve the objectives of the mission “forestry institution strengthening". The existence of a strong forestry institution could support the achievement of the other two mission objectives.

In summary, the Ministry of Forestry has an important role and responsibility in managing: (a) mangrove forest along the coast of Arafura and Timor seas, (b) "river flow area" management and (c) conservation of marine organisms currently under the management of the Ministry of Forestry. Better collaboration and cooperation in managing coastal area is needed between the Ministry of Forestry and Ministry of Marine Affairs and Fisheries.

2.2.6 Catchment management

There are 79 watersheds (Daerah Aliran Sungai/DAS) in Papua, the widest being "Membramo watershed" that cover 10 districts (Kabupaten) while the second one is "watershed area Eiladen" that covers eight districts.

The total coverage of watersheds in Papua is 6.5 million hectares that have been divided into 4 statuses according to their condition:

a. Very critical area: 48 thousand hectares
b. Critical area: 3 million hectares
c. Nearly critical area: 1.7 million hectares
d. Potential critical area: 1.3 million hectares

In central government watersheds, (DAS) are the responsibility of the Ministry of Forestry regarding forest conservation and management along the river, and Ministry of Public Works regarding protecting the river channel from degradation.

Watershed management institutes (Balai Pengelolaan Daerah Aliran Sungai) are the Technical Implementing Unit at the local level under the Ministry of Forestry, for instance The Membramo watershed Management Institute (Balai Pengelola Daerah Aliran Sungai Membramo) was established based on Ministerial Decree No. 665/Kpts-ii/2002.

The Membramo watershed is sparsely populated and abundant in rich and exotic biodiversity. The vast and highly inaccessible Mamberamo Basin in Indonesia's West Papua contains some of the world's most pristine rainforests. The region's 7,000 people and their communities are spread over 7.7 million hectares of low-swamp, vast forests and high mountains.

The main task of Membramo "watershed management institutes" is to undertake institutional development plans and the evaluation of watershed management.

Function:

- Prepare "watershed" management planning.
- Prepare and present the "watershed" information.
- Development of "watershed" management modeling.
- Development of "watershed" institution and partnership.
- Monitoring and evaluation of "watershed" management.
- Implementation of administration and logistics of the institution.

Vision: To realize The Membramo watershed Management Institute as a qualified central authority of information in supporting watershed management.

Mission:

- Preparing “watershed” management planning in accordance with local specifications.
- Improvement of quality and accuracy of the “watershed” data.
- Improvement of monitoring and evaluation.
- Develop and strengthen partnerships among stakeholders.

Other institutions that must be involved in catchment management are the Ministry of Interior and local governments (Province and District).

2.2.7 Mining

The existence of mineral and energy resources in Papua Province has had international recognition since before World War II.

Directorate General of Mineral, Coal and Geothermal (Direktorat Jenderal Mineral, Batubara dan Panas Bumi/DJMBP) is one DG under the Ministry of Energy and Mineral resources that have responsibility of mining in Indonesia which consists of four Directorates as follows:

- Directorate of Mineral, Coal and Geothermal Program development
- Directorate of Mineral and Coal business development
- Directorate of Geothermal and Ground water utilization and management
- Directorate technique and environment of Mineral, Coal and Geothermal

Law No. 11/1967, concerning Ordinance of Mining Articles, foreign investment in general mining was developed through the working contract system, e.g. the agreement between governments and investors. The agreement specifically gives sole rights to investors to prospect for mineral resources contained in the area of the working contract, and then to mine, process and market the minerals. The sole rights are given as a guarantee that the investor will continue to fulfill obligations to pay taxes and other charges as stipulated in the agreement even if no mineral is found.

In 2009, the Government of Indonesia changed Law No. 11 of 1967 concerning Main Provision on Mining to Indonesian Law No.4 of 2009 concerning Mineral and Coal Mining. The new Law is more complete and comprehensive and sustainable development is one of the basic principles of this Law. There are several conditions in order to support sustainable development; among others is public/stakeholder participation. Therefore, this new Law accommodates the provisions concerning public/stakeholder participations in regards to exploitation, monitoring as well as utilization. In regards to good mining practices, the importance of social, economic and environmental sustainability should be considered before the project begins, until the end of the project.

There are at least 22 articles that need to be followed up as a Government Regulation. There are four Government regulations as a derivative of Law No. 4/2009 which are being prepared that are expected to be completed in late 2009.

Directorate General Mineral, Coal and Geothermal have a duty to formulate and execute policy and technical standardization in regard to mineral, coal and geothermal activities.

Vision:

To realize the management of mineral resources, coal, geothermal properties, and ground water in a sustainable and environmentally sound manner and as well to give maximum benefit for community prosperity.

Mission:

- Execute development utilization of mineral, coal, geothermal, and ground water in order to facilitate optimal benefits and added value.
- Realize professional human resources which are highly competitive, and follow international best practice
- Improve personnel management quality, financing, infrastructure, and documents.
- Realize good governance.

Activities to progress the achievement of the Mission and the Vision on Restructuring of Sector Policy include:

- Develop National Coal Policy and General Mining Road Map.
- Prepare Blue Print and development of Geothermal Road Map.
- Agreed to change the Perpu No. 1/2004 as revision to Law No. 41/1999 and have been ratified to become Law.
- Law No. 27/2003 concerning Geothermal and Draft of Government Regulation (RPP) concerning geothermal development.
- Law No. 7/2004 concerning Water Resources that Arrange Ground Water Management.
- Finalization of Draft of Law and Government Regulation of General Mining.
- Government Regulation 75/2001 concerning Main Provision of Mining.
- Finalization of Draft of Government Regulation concerning General Mining.
- Finalization of Draft of Government Regulation concerning Ground Water is in process.
- Finalization of Draft of President Decree concerning Closing of Mining.
- Finalization of Minister Decree concerning Geology and Mining Guidance.

In trying to promote investment growth in mining businesses generally, the government had to streamline the information service of mineral resources in Papua. Licenses in general mining are given according to Governor Instruction No. 104/2002 concerning The Process of Giving Temporary Legal Mining Access in Papua Province.

In order to support local autonomy in mining, the following program and activities were undertaken:

- Improvement of local government officers in mining surveillance.
- Assistance in the mining information system as well as geology and mineral resources database.
- Improvement of local government officers in stocktaking and ground water management as well as mitigation of geological disasters and volcanoes.

To individual/private groups operating in mining group C (sands and rocks) and gold materials that have traditional land rights, the government provides tools such as separator/sluice box to help separate and wash the gold substance and tray, block-made machines and mild stone crushers that are easy to move to different places.

2.2.8 Offshore oil and gas

The Directorate General Oil and Gas is one of the DGs under the Ministry of Energy and Mineral Resources that has duties to formulate and implement the technical standardization and

policy in the Oil and Gas sector. In running its tasks and functions the DG of Oil and Gas are supported by four directorates, namely:

1. Directorate of oil and gas program development.
2. Directorate of oil and gas up stream business development.
3. Directorate of oil and gas down stream business development.
4. Directorate of oil and gas Technical and Environment.

The Directorate General of Oil and Gas has the following functions:

1. Preparation of policy formula for the Departments in the oil and gas sector.
2. Implementation of policy in the oil and gas sector.
3. Compilation of standards, norms, guidance, criterion, and procedures in the oil and gas sector.
4. Providing technical advice and evaluation.
5. Implementation of administration of the Directorate General Oil and Gas.

The Vision of this DG is to be a policy and regulation creator which is competent and also to provide good services in the industrial oil and gas area.

The mission in order to achieve the Vision is to:

1. Improve interest, human resource integrity and professionalism.
2. Improve coordination and integration.
3. Create a conducive environment and positive image.
4. Produce policy and regulation appropriately and precisely and provide good services in the industrial Oil & Gas area

Indonesian Law No. 22 of 2001 concerning Oil and Gas is the legal basis for exploiting oil and gas, and consists of 14 chapters that cover 67 articles, the important provisions stipulated in this Law include:

1. General Provisions
2. Principle and Purpose
3. Control and Business Operation
4. Upstream Business Activities
5. Downstream Business Activities
6. State Revenues
7. The Relationship between Oil And Gas Business And Land Titles
8. Development and Supervision
9. Implementing Body and Regulatory Body
10. Investigation
11. Criminal Provisions

Indonesian Law No. 22 of 2001 concerning Oil and Gas, the Government Regulation No. 35 of 2004 concerning oil and gas upstream business activity consists of 14 Chapters and 105 articles, which cover several provisions as follows:

1. Operational Area
2. General Survey And Oil And Gas Data
3. Implementation of Upstream Business Activities
4. Use of Oil And Gas To Supply Domestic Needs
5. State Revenue

6. Proprietary Land and State-Owned Land Use Settlement Procedure
7. Industrial Safety and Health and Environmental Management and Development of Local Community
8. Use Of Domestic Goods, Service, Technology and Engineering and Design Skills
9. Manpower
10. Development and Supervision of Upstream Business Activities

Additionally, the Government Regulation No. 36 of 2004 concerning oil and gas downstream business activity consists of 19 Chapters and 100 articles, which cover several provisions as follows:

1. Downstream Business Activities Execution
2. Business License
3. Processing
4. Transportation
5. Storage
6. Trading
7. Crude Oil Strategic Reserve Stock
8. National Petroleum Fuel Reserve Stock
9. Standard and Quality
10. Supply and Distribution of Certain Types of Petroleum Fuel
11. Petroleum Fuel and Natural Gas Prices
12. Distribution of Petroleum Fuel at Remote Areas
13. Industrial Safety and Health and Environmental Management and
14. Local Community Development
15. Utilization of Domestic Goods, Service, Engineering and Design Skills and Manpower Employment
16. Development and Supervision
17. Sanction

Currently there are three off shore oil drilling areas in the Arafura Sea, Indonesia:

1. Offshore South east Tual;
2. South palung Aru; and
3. East palung Aru.

2.2.9 Port and shipping

In regards to port and shipping business, the Republic of Indonesia gives a mandate to the Directorate General of Sea Transportation that runs under the direction of the Ministry of Transportation.

Based on Presidential decree No. 165/2000 which is followed up by the Provision of the Ministry of Transportation No. KM 24/2001, the Directorate General of Sea Transportation is supported by five Directorates, namely:

1. Directorate of Traffics and Sea Transportations
2. Directorate of Port and Dredging
3. Directorate of Shipping and Seamanship
4. Directorate of Navigation
5. Directorate of Sea and Coast Guard

The Directorate General of Sea Transportation specifies its Vision and Mission as follows:

Vision: To realize the management of national sea transportation as effective and efficient backbone of the nation and the state.

The Mission is:

1. To provide reliable and high capability of national sea transportation services in order to fulfill national and international standards; Improve national competitive ability of sea transportation industry in the global market that can generate value for national economic growth;
2. To execute consolidation of the role of community, business enterprise and government through restructuring and reform of the regulations and institutions of sea transportation;
3. To improve the role of sea transportation in order to speed up the national development growth rate;
4. To improve the accessibility of the community in sea transportation activities services.

Law No. 21 year 1992 concerning Sea Transportation was issued by the government of the Republic of Indonesia, then was recently replaced by Law No. 17/2008 concerning Sea Transportation.

In order to manage the development of ports and harbors, The Government Regulation of Republic of Indonesia No. 69/2001 concerning Port Business was issued which consist of 16 Chapters and 81 articles as follows:

Chapter I	: General Provision.
Chapter II	: National Port Autonomy Structure/Organization.
Chapter III	: Location, Master Plan, Working Area and Interest Area of the Port.
Chapter IV	: Development and Operational of the Port Autonomy.
Chapter V	: Execution of activities in Port Autonomy.
Chapter VI	: Port Autonomy Services.
Chapter VII	: Port Autonomy Supporting Business Activities.
Chapter VIII	: The Land Port Autonomy.
Chapter IX	: Cooperation.
Chapter X	: Port Authority Services Fee.
Chapter XI	: Special Port.
Chapter XII	: Port Which Open for Foreign Trade.
Chapter XIII	: Waste Reception facility.
Chapter XIV	: Indemnity.
Chapter XV	: Other Provisions.
Chapter XVI	: Final Provisions.

In order to guarantee the safety of sea transportation, the government of the Republic of Indonesia issued The Government Regulation No. 81/2000 concerning navigation affairs that cover 7 Chapters and 51 articles as follows:

Chapter I	: General Provision.
Chapter II	: Navigation Supporting Facilities and Telecommunication.
	Section 1: General.
	Section 2: Execution

Section 3: Distress news, Meteorology and Time Standard Broadcast Services.
Section 4: Damage and Obstruction.

Chapter III : Line and routes of sailing.
Section 1: Sailing Lane
Section 2: Route System and Traffics Procedures
Section 3: Building or Installation

Chapter IV : Piloting
Section 1: Piloting Management
Section 2: Piloting Requirement
Section 3: Piloting Responsibility

Chapter V : Vessel frame, Salvage, and Under Water Works.

Chapter VI : Transition Provisions.

Chapter VII : Final Provisions.

Other Government regulations and ministerial decrees that relate to sea transportation management include:

1. Government Regulation No. 82/1999 concerning Sea, Lake and River Transportation.
2. Government Regulation No. 51/2002 concerning Naval Architecture.
3. Government Regulation No. 12/2000 concerning Search and Rescue.
4. Government Regulation No. 7/2000 concerning Seamanship.
5. Government Regulation No. 1/1998 concerning Vessel Accident Inspection.
6. Ministerial Decree No. 1/2008 concerning Organization and Working Mechanism of Ministry of Transportation.
7. Ministerial Decree No. 20/2006 concerning obligation for Indonesian Flagged Vessel to Register in Indonesian Classification Bureau.
8. Ministerial Decree No. 41/1990 concerning Measurement of Indonesian Vessels.

2.2.10 Climate change

Indonesia signed the ***United Nations Framework Convention on Climate Change*** (UNFCCC) agreement in June 1992 and ratified it in August 1994 by Law of the Republic of Indonesia No. 6/1994.

The climate change policy coordination falls under the State Ministry of Environment, while mitigation and adaptation activities are being designed and implemented by different sectors at national and local levels. Indonesia has a National Action Plan for Climate Change and a list of priority projects that provide guidance for the climate change mitigation and adaptation effort.

In order to effectively manage climate change policy and programs, a new climate change institution "The Indonesian National Council for Climate Change" has been recently created through President Regulation No. 46/2008, concerning the National Council on Climate Change.

The National Council on Climate Change is chaired by the President of the Republic of Indonesia. Its Executive chair is the State Minister of Environment.

In implementing its decisions, the Council has two organisations. The first is the Working Group that serves as the think tank to prepare drafts of new or revised climate change policy. There are seven Working Groups: Mitigation, Adaptation, Technology transfer, Land Use, Land Use Change and Forestry (LULUCF), Financial Mechanism, Post 2012, and Scientific Basis and Green House Gases (GHGs). The second organisation is the Secretariat of the council that serves as the supporting unit for the Council. The Secretariat delivers monitoring, international cooperation, public awareness campaigns, promoting CDM projects, capacity building, research grant facilitation and legal assistance.

The Indonesian National Council on Climate Change is tasked to deliver:

1. Formulation of national policies, strategy, program and activities on climate change.
2. Coordination of climate change activities that include adaptation, mitigation, technology transfer and financing.
3. Formulation of national policies, mechanisms and procedures on carbon trade.
4. Monitoring and evaluation of policy implementation on climate change management and control.
5. Support on UNFCCC negotiations and compiling Indonesia's position for each international meeting

As mentioned in the National Action Plan to anticipate climate change, the priority programs are as follows:

Mitigation priorities:

- Energy; diversification, conservation of clean sources of energy, including energy efficiency program.
- Transportation; developing mass rapid transportation, fuel conversion and non motorized transports.
- Industry; Implementation of energy saving and clean technology in industries with the potential to emit substantial greenhouse gases, such as cement industry, pulp and paper, cooking oil and sugar cane.
- Forestry; combating illegal logging, rehabilitation of degraded forest to increase carbon absorption capacity, conservation of primary forest and peat land, empowering local community to adapt to climate change.
- Mitigation incentive programs; Toward Green Indonesia (Menuju Indonesia Hijau/MIH) program as an initiative to encourage local government to maintain protected forests.
- Marine and fishery sector; planting mangroves, coral reef rehabilitation and Marine Protected Areas.

Adaptation priorities:

Indonesia is located on the equator and is vulnerable to climate change induced disasters such as flood, tropical storms and drought. These natural disasters threaten the availability of food, energy and clean water for local communities. Priorities include:

- Disaster risk reduction, reforestation in critical forests and rehabilitation of degraded lands, rivers and estuaries.
- Dissemination of climate change information to vulnerable communities to increase preparedness for climate induced disasters, strengthening capacities to conduct scientific research and monitoring climate change at local and regional levels, including the development of climate change projection models.

- Mainstreaming adaptation into infrastructure planning and designs, also developing designs for climate emergency needs.
- Agriculture, developing agriculture infrastructure that can accommodate extreme climates, searching for suitable seeds for climate change vulnerable agriculture areas.
- Health, awareness on health and climate change issues, strengthen disease surveillance and control on disease vectors, increase preparedness for higher frequency of outbreaks of climate change induced diseases.
- Water management, rehabilitate primary water resources, expand water reservoirs and ponds, increase water saving campaign and land conservation along the rivers.

Transfer of technology

The needs assessment for climate change technology will be the basis for selecting the technology transfer potential. Climate change technologies for Indonesia include clean energy, energy saving and low emission power plants, industries and transportation, forest fire monitoring and agricultural technology (seeds and irrigation) and weather prediction technology for the benefit of fishers and farmers.

Funding mechanism.

Sources of financing include; emission tax, tax exemption for energy saving and low emission technology. Also funding from Debt Swap, CDM, Adaptation fund, SCCF, GEF, Climate Change Trust Fund, Bilateral Fund, etc. The government of Indonesia is preparing Indonesia Climate Change Trust Fund for bilateral and multilateral support for various technical assistance and financial support, and a Low Carbon Development Fund for private and corporate support in various climate-change-friendly investments.

3. Governance gaps and challenges related to the sustainability of the ATS region

Although the Government of the Republic of Indonesia has developed institutions and regulations for managing the environment and its resources, in general, there is a long way to go. There are several gaps and constraints.

In regards to the Arafura and Timor seas region, a policy relating to a sustainable ATS region that *could influence* **"all sectors"** is described as follows.

In line with Indonesian Law No. 32/2004 concerning Local Government and Government Regulation No.25/2000 concerning Government Competency and Province Competency as an autonomous region, the central government delegated authority in managing resources and environment to local governments, so that resources and environmental management is mostly now under the care of Province or District governments.

As a consequence, currently there are several constraints faced by local governments (district or/and provincial) in managing resources and the environment, among others:

1. Overlapping of planning for resources and environmental management among sectors:
2. Lack of local government financial support and human resources and skilled people in environment issues

3. Lack of balance between economic profit and environment.
4. Weaknesses in law and regulation implementation
5. Weaknesses in surveillance and law enforcement.
6. Application of technology that is not environmentally friendly.
7. The level of community participation in resources and environmental management in Indonesia is still very low.
8. Weak framework of environment management systems in Indonesia

Challenges include efforts to:

1. Develop the institutional framework in central and local government in order to optimize the utilization of marine fisheries resources in Arafura and Timor seas.
2. Harmonize the legislation and regulation in Arafura and Timor seas region.
3. Strengthen the process of achieving sustainable development through understanding various ecological, social and biological characteristics of Arafura and Timor Seas.
4. Develop sound policies and management plans to balance economic growth and sustainability of natural resources.

There are also specific gaps in management activities for each sector in the Arafura and Timor seas region:

3.1. Environment

Gaps:

In terms of environmental policy and regulation at central and local government levels, its appears that most of the regulations address the impact of development in terrestrial areas, with very limited regulation that relates to environment impact from marine orientated development activities, such as fisheries and aquaculture.

Environmental institutions are very fragmented, for example, roles, responsibilities, and coordination mechanisms at the national and local level are not well outlined, while the availability of human resources, finance, and technology is also very limited. These pose significant obstacles to effective environmental management.

Implementation of environmental management at the national level is undertaken by The State Ministry of Environment; while at the local government (Province and District level) it is undertaken by environmental management agencies such as *The Local Agency for Controlling Environment Impact/BAPEDALDA* at province and district level or Office of Environment Service in certain districts. However, the largest investment and policy decisions that affect the quality of environment are made by the other agencies, such as the Ministry of Public Affairs, the Ministry of Home Affairs, the Ministry of Transportation, the Ministry of Forestry, and the Ministry of Marine Affairs and Fisheries.

It has been identified that, generally major causes of destruction of the environment are due to:

1. Lack of political support for sustainable development of the environment in decision making processes,
2. Insufficient penalties given to violators of environment regulations, and
3. Poverty.

In regards to Arafura and Timor seas, it seems that attention to the environment is still a low priority, due to overlapping responsibilities across sectors for environmental management and poor implementation and enforcement of laws and regulations. The knowledge of the community concerning the importance of environment for better lives is still low.

As such, environmental sustainability just becomes another slogan/motto.

Challenges include efforts to:

- Strengthen political support for sustainable development of the environment in decision making processes,
- Improve community knowledge concerning the importance of environmental sustainability.
- Develop sound policies and management plans to balance economic growth and sustainability of natural resources.

3.2. Biodiversity conservation

Gaps:

In regards to marine and coastal biodiversity conservation and management, several gaps have been identified such as:

- The majority of natural resources development is based on terrestrial resources.
- Until 2000, no local government had authority to manage its coastal water resources.
- Indonesia is the largest archipelagic country in the world, the Arafura and Timor Sea is just a small part of it.
- Development budget, facilities and officials for coastal and marine resource development and conservation is very limited.
- Lack of institutional capacity of local government agencies and non-government institutions.
- Fragmented power and authorities among government agencies to regulate coastal and marine resource uses.

In the Arafura and Timor seas region, as the coastal population is not as dense as that in western Indonesia, major damage of coastal and marine habitat is not due to coastal community activities, but more influenced by industrial activities such as industrial fisheries (trawl fishing) and mining. The bargaining power of biodiversity conservation and management is negligable compared with that of resources exploitation.

Challenges include efforts to:

- Improve the budget, facilities and officials competence for coastal and marine resource development and conservation.
- Strengthen the institutional capacity of local government agencies and non-government institutions
- Unify the power and authorities among government agencies to regulate coastal and marine resource uses

3.3. Fisheries

Gaps:

Based on scientific information, exploitation of marine fisheries resources in Arafura Sea is at the state of overexploitation which means there is no balance between effort and the availability of the resources. It is also due to the over issuing of licenses and illegal fishing.

There is no proper management, meaning that Monitoring, Controlling as well as Surveillance and law enforcement is very weak, and as a consequence the law and regulation is not implemented well.

In fact, the license for fishing (Controlling aspect), issued either by central government or local government (Province or District level) depends on the size (Gross Tonnage) of the fishing vessels. Due to the lack of coordination between central and local government the number of licenses issued for the Arafura Sea exceeds the Maximum Sustainable Yield. In the case of the Fisheries Management Plan in the Arafura Sea, stakeholders in the fisheries business have not been involved in its development process; as a consequence the Management Body can not function properly.

In line with decentralization, data collection of fishery statistics (monitoring aspects) for basic information for management has become worse, because the DG of Capture Fisheries as well as Aquaculture has no direct line of command to the Province and District Marine Affair and Fisheries Service level. At this time local government (Province and District level) give less attention to the management of fishery statistics collection. This condition is worsening due to a lack of human resources, facilities and infrastructure, and financial support.

In terms of fisheries regulation, it seems that most of the regulation tends to deal more with business practices instead of fisheries resources management.

Challenges include efforts:

- To utilize marine resources optimally in territorial seas, EEZ and in the Arafura and Timor seas.
- To strengthen regional cooperative efforts in combating IUU Fishing.
- To manage the boundary areas as the outer limit of the territorial seas, including small islands at the borders.
- To develop MCS system for marine resources in Arafura and Timor seas.
- To improve the political support and all stakeholders' support to combat IUU Fishing.

3.4. Aquaculture

Gaps:

Compared with the western part of Indonesia, the aquaculture development in eastern Indonesia (Arafura and Timor Sea region) is left behind. The new aquaculture technology is still not well-known by most of the coastal community.

There is still weak policy, law and regulation that could stimulate industrial or small scale aquaculture enterprise in the ATS region.

In local government level, aquaculture development is under Fisheries and Marine Affair Services. A lack of skillful human resources in aquaculture technology and extension mean aquaculture development in Arafura and Timor Seas region is poorly developed.

Challenges include:

- The role of aquaculture must be increased to match the development of other sectors.
- To improve the facilities and infrastructure related to development of aquaculture.
- Incentives must be given in order to support the development of aquaculture.
- To improve the capacity and capability of fisheries service officers on the knowledge of aquaculture and its technology.
- To provide appropriate resources for local level community based aquaculture.

3.5. Marine science and research

Gaps:

Marine science and research activities are mostly undertaken by research institutions at the central government level. Indonesia has large areas of oceans and seas but the budget is quite limited for science based data collection and monitoring and there are poor research facilities. As a consequence the marine science and research activities do not provide results to support management and utilization of the marine natural resources. In some cases where there is scientific information that informs the state of exploitation of the fisheries resources, it has not been utilized for resource management purposes.

There are no coordinated programs in regards to marine and fisheries research in Arafura and Timor seas region among research institutions, and in some cases there are some gaps and overlap in activities.

Challenges include:

- To strengthen coordination between programs across research agencies in regards to marine and fisheries research in the Arafura and Timor seas.
- To optimize the utilization of research results for management purposes and at the same time the research should be in line with the needs of development.

3.6. Forestry

Gaps:

The Forestry Service at Province and District level, previously under the Ministry of Forestry, are now a sub-ordinate of Local Government (Governor in Province level and Bupati in District level).

In the Arafura and Timor seas region, the ambiguity referred to above has generated the overlap and/or lack of duty and function between Central government, Province and District. For instance: dysfunction of forest planology, forest utilization and forest extension and weakness of control of forest product distribution. Also, the main task and function of the Technical Implementing Unit is similar to the Central Technical Implementing Unit which is formed by local government. As a result policy, law and regulations are not well executed.

Challenges:

Integrating working programs between central and local government in order to achieve the objectives of the national development as well as for sustainable development.

3.7. Catchment management

Gaps:

There are several sectors that are involved in catchment management activities where each sector has different interests. It always involves multiple organisations and groups, so that in order to achieve better management, negotiation always has a key role.

Although the Ministry of Forestry has technical implementing units such as River Flow Area Management Institute (Balai Pengelolaan DAS), the working mechanism with the others stakeholders (Ministry of Public Work, Local government, etc) are not clearly defined, so that some overlapping of competency often happens.

Challenges:

Undertake auditing processes that will lead Indonesia through identifying the main issues and main stakeholders in catchments or sub catchments. In the process, it will help us to explore how we can work with others to manage catchments.

3.8. Mining

Gaps:

As in other regions, mining activities in Papua (Arafura and Timor Seas region) are undertaken by legal mining companies and illegal mining by individuals. It seems that the focus of either the legal or illegal activities is on "quick yielding mining" without any consideration on sustainability for future generations.

In regards to mining development, there is a lack of coordination among the stakeholders resulting in overlapping problems in land utilization.

The new Law (Law No.4 of 2009) is more complete, comprehensive, and also considers sustainable development; however, it is still not implemented well.

Challenges:

In regards to good mining practices, the importance of social, economic and environmental sustainability should be considered from the project beginning, through implementation, until the end of the project.

Introduce and publicize the New Mining Law for improved implementation, and more attention should be put on public/stakeholder participation in regards to exploitation, monitoring and use.

3.9. Offshore oil and gas

Gaps:

In Arafura and Timor Seas region, information concerning the effect of offshore oil and gas activities to the environment is still limited.

Although several regulations concerning the protection of the environment from oil and gas activities have been issued, as oil, gas and mining have a high priority in the Indonesian national development plan, the importance of the other sectors is often not considered.

Challenges:

Monitoring on the impact of offshore oil and gas activities to the environment and sectors must be undertaken.

Comprehensive environmental impact analyses that consider long-term advantage must be implemented, and measures to prevent environmental damage as a consequence from offshore oil and gas activities should be improved.

3.10. Port and shipping

Gaps:

Most of the vessels in Arafura and Timor Seas region are fishing vessels managed by the DG of Capture fisheries not by the DG of Sea Transportation. Thus the regulations issued by both institutions do not support each other.

Challenges:

Harmonizing the regulations from related institutions (in this case DG of sea transportation and DG of capture fisheries) is necessary to make it compatible.

3.11. Climate change

Gaps:

There is no one institution that manages climate change - it involves several sectors and ministries, which are not coordinated.

Challenges:

Create a climate change institution at the ministry level that could coordinate climate change activities and programs in each ministry.

4. Recommendation on measures to address gaps and challenges

In order to solve the problems in managing the environment and its resources in the Arafura and Timor Seas region, there are several strategic measures that could be adopted as follows:

1. Reform the resources and environmental Management System

Strengthen the decentralization of environmental management

The State Ministry of Environment (KLH) should concentrate on making a framework environmental policy, lead the transfer of functions of the environment to local governments, mobilize resources to answer management challenges at the local level, and evaluate local government performance. Local governments need assistance in the ability to develop in terms of environmental management, including better supervision, implementation mechanisms, improvement of Environment Impact Assessment procedures, and provision of permits related to environmental issues, and the use of economic resources that are available.

Optimize the role of stakeholders

In addition to modernizing regulations and procedures, the State Ministry of Environment and its local governments and other relevant institutions should promote public participation, and strengthen the programs that complement the system of authority and rules that can also create the conditions that allow the role of the private sector to increase participation in the management of the environment. It includes the creation of programs that allow local communities to become partners in the supervision, to provide environmental education at the grass-roots level, and to facilitate the reception of environmental policy through a multi-party dialogue.

2. Revitalization of MCS Programme implementation in fishing activities:

Monitoring : It is necessary to improve data management systems, including data collecting, analysis and storage, including increasing human resources in terms of quality and quantity, as well as infrastructure, equipment and supplies both at national and regional levels. The log book and observer programme needs to be better organized and put in place as a matter of urgency.

Controlling : Strengthening of the system and mechanisms for licensing can support the log book and observer programmes in the Monitoring component. National and regional licensing needs to be implemented under a common policy and must be "on line".

Surveillance : Coordination between officers of the different authorities involved in surveillance needs to be greatly improved, in addition to increasing operational infrastructure, equipment and supplies and improving social security benefits for field staff. Law enforcement needs to be well and truly implemented.

Some more concrete actions which can be taken are:

- The statistics system needs to be free from data manipulation activities such as merely recording the annual production targets that have been reached.
- Fisheries regulations should be more specific in line with the data requirements of fishers and penalties should be imposed for infractions must be more severe.

- A policy of "no data, no license" should be implemented as a matter of urgency, through regulations from the ministerial level or above, such as government regulation. This would mean that companies wishing to renew their fishing license would have to append a report containing data such as a 'log book', without which their application would be refused.
- Verification of reported fisheries catch must become a key component of overall improvements to the system. Observers can play an important role in this verification.
- The vested interest of international bodies and donors in the improvement of statistical data should be taken advantage of. For example, Australia is interested in improving Indonesian fisheries statistics, especially those relating to shared fish stocks.

3. Legislation and policy review

In terms of management, laws and regulations are one of several important components for achieving the expected objectives of development. Law and regulation should be base on scientific evidence and the best laws and regulations could be implemented and adopted by all stakeholders.

In fact there are such laws and regulations related to management of the Arafura and Timor Seas region that are not well implemented due to conflict with other laws and regulations or are not supported by sufficient scientific evidence.

As capture fisheries has an important role in Arafura and Timor Seas, for the first time analysis and review could be addressed to the policy, law and regulation of capture fisheries.

5. Recommendation on potential demonstration sites

As the Arafura and Timor seas cover three Provinces in Indonesia. There is at least one district in each province which should be chosen as a demonstration site, namely Kupang District for Nusa Tenggara Timur Province, Aru Archipelago District for Molucas Province and Merauke District for Papua Province. It considers fisheries and aquaculture and tourism activities as well as other coastal activities in those three districts relatively high compared with the others districts in the Arafura and Timor seas region. Additionally, "local wisdom" still exists in these districts.

Two projects (programs) are proposed for each selected district namely "Integrated Coastal Management" and "Arafura and Timor Seas Fisheries Management Plan".

"The Integrated Coastal Management Project" could be undertaken in each selected district as mentioned above, while "The Arafura Fisheries Management Plan Project" will cover all Provinces and Districts surrounding the Arafura and Timor Seas.

The objectives of these projects is to improve the ability of local government and other stakeholders in developing and managing the marine resources and environment in a sustainable manner, hoping that it will improve the policy and institutional frameworks in Arafura and Timor Seas Region.

At the national/central level, "a Legislation and policy Review and Analysis Project" for several "key sectors" especially for fisheries is suggested. The objectives of this project are to identify the weakness in the legislation, description of overlaps, conflicts and gaps and recommendations to be addressed.

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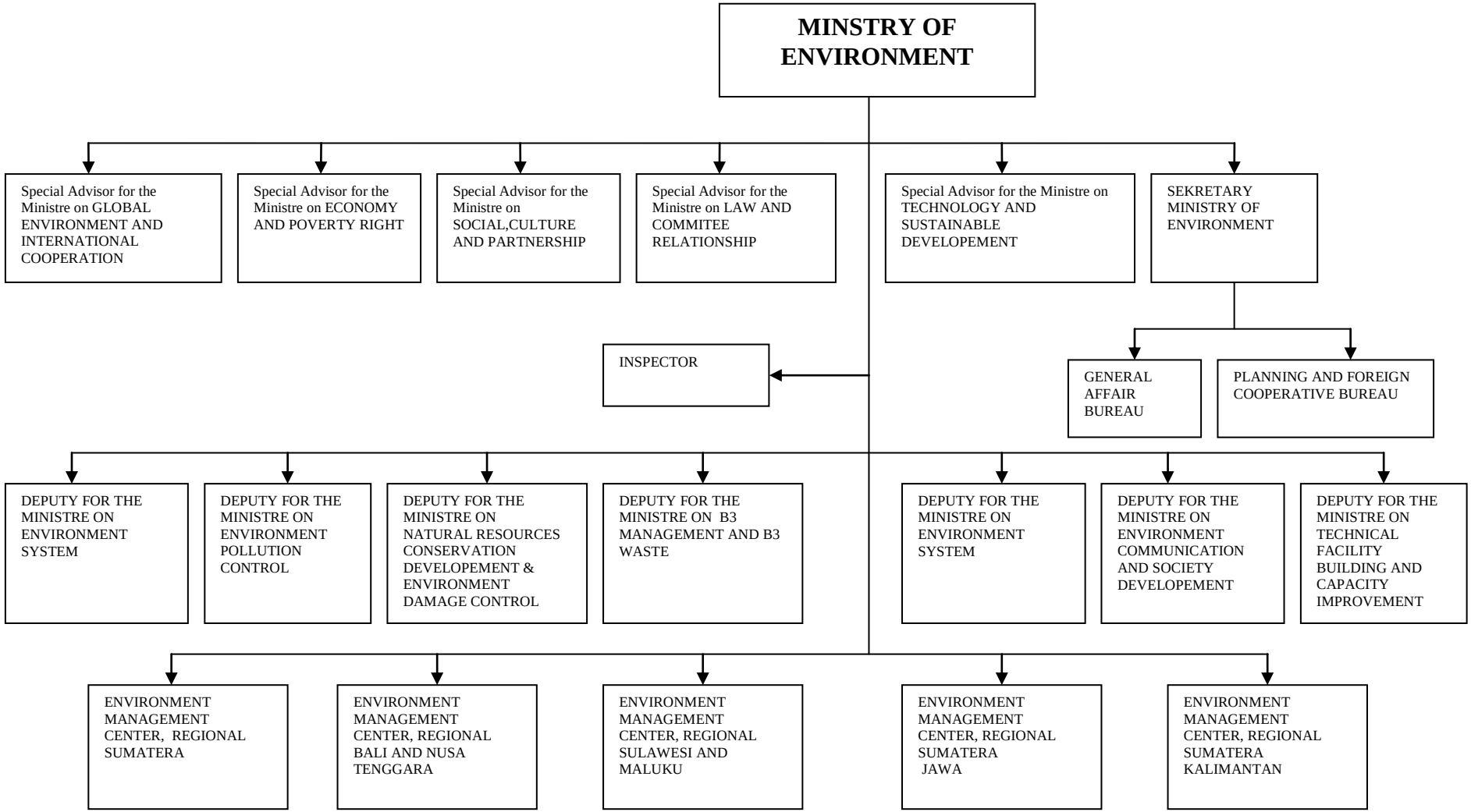
Appendix 1: Organization structure of the State Ministry of Environment.



Appendix 2. Goal, Objectives and Policy Strategy of the five years strategic plan of the State Ministry of Environment 2004-2009.

GOALS AND OBJECTIVES

1. To realize the improvement of environmental quality function
   Target:
   a. Decrease the burden of environmental pollution include water, air, atmosphere, ocean, and land, rate of environmental degradation, which include water resources, forest and land, biodiversity, energy, atmosphere, ocean and coastal ecosystems
   b. Integrated action should be the consideration of conservation and environmental functions in the planning and implementation of development and utilization of the space environment and
   c. Increasing adherence to development to maintain the quality of the environment

2. Ensuring good governance in the field of environmental management *(Good Environmental Governance)*
   Target:
   - The materialization of the principles of governance in the management of natural resources and environment in the central and local

Increasing the capacity of the State Ministry of Environment a reliable and proactive in the management of natural resources and environment

Target:

- The State Ministry of Environment realizing an increase in the carrying capacity of the main duties and functions

POLICY STRATEGY

A. The strategy refinement achievement of the goal to realize the quality of the environment
Target:
1. Decrease the burden of environmental pollution include water, air, atmosphere, ocean, land and
2. Decrease the rate of damage to the environment (water resources, forest and land, biodiversity, energy, atmosphere, and coastal and marine ecosystems)
3. Integrated action and consideration on the preservation of the environment in development planning and implementation and supervision of the utilization of space and environment should be implemented.
4. Increasing adherence to development to maintain the quality of environment.

B. Strategy to realize the achievement of the goals of good governance in the field of environmental management *(of good environmental governance)*
Target: The materialization of the principles of governance in the management of natural resources and environment in the central and local

Strategies to improve the capacity of the achievement of the goals the State Ministry of Environment a reliable and proactive in the management of natural resources and environment *Target:* The State Ministry of Environment realizing an increase in the carrying capacity of the main duties and function

GOVERNANCE INSTITUTION POLICY FRAME WORK AND SOCIO-ECONOMICS OF TIMOR-LESTE

By: Constancio dos Santos Silva

Executive Summary

One of the most significant challenges for Timor-Leste as a new nation is improving governance and capacity for marine resources. The situation is complex with existing Timorese (and customary), Indonesian and UN laws in place. The government is working towards addressing these challenges of weak legal-regulatory framework and institutional structures; lack of coordinated policy-making; weak enforcement capacities; basic technical and scientific data and information gaps; and lack of infrastructure and equipment (Anonymous, 2008). Timor-Leste although a small country by international standards has the potential through ATSEA and related programs to provide valuable high-grade protein to feed Timor-Leste, provide employment and significant income earning opportunities and foreign exchange from fisheries and sustainable fisheries management. IUU fishing has been identified as a major issue.

Background

The purpose of this report is to contribute towards the ATSEA Project Preparation activities:

- To provide background materials for the Project Brief and Project Document, illustrating the environmental context for the GEF project.
- To provide a forum for consensus-building on the environmental issues of highest priority in the ATSEA region and in particular in Timor-Leste.

The intention of this report is to provide a Timor-Leste perspective on transboundary governance and socioeconomic issues in the ATS region. The report:

- Provides a description of the region's governance, policy and socio-economic characteristics including those of global significance.
- Identifies gaps in our existing baseline knowledge of the ATS governance and socioeconomic issues.
- Provides recommendations on measures to address these information gaps.
- And provides an outline of the main transboundary threats to and impacts on biodiversity and fisheries resources in the region.

Methodology

For this study a review of a wide range of information (both published and unpublished such as government reports and statistics) was undertaken during October 2008 – May 2009. The information was summarised and analysed to identify key characterisations and issues related to the objectives of the study. Meetings were held with key stakeholders in Dili to obtain information. The main government sources of information for this status report include the Ministry of Agriculture and Fisheries (MAF) and the Ministry of Economy and Development (MED). Other relevant government sources were the State Secretariat for Energy Policy and State Secretariat for Electricity, Water and Urban Development. Non government sources of information include the UNDP, the World Bank, FAO and non government organizations such as the *Haburas Foundation.* This report typically forms part of the first element of a TDA; a meta-data stock-staking exercise.

CHAPTER I Governance Institutions and Policy Framework on Environment Management Timor-Leste

I. Introduction

Timor-Leste was recognized internationally (UNTAET) as the world's newest sovereign state on 20 May 2002, following a quarter century (1975-1999) of occupation and conflict. During the six years independence since 20 May 2002, Timor-Leste has established official government institutions in various departments.

The various institutions have a responsibility to managing the environment by maintaining its resources in a sustainable manner at the national and district level. As guidance for their work, policies which address the environment and resources conservation and management have been issued such as laws and regulations and government decrees by the related government institutions.

The Institution of Government of Timor-Leste has a mandate to develop the national policy and its program in order to maintain the environment, and undertake such coordination between multi sectors to avoid damage to the environment as a consequence of national construction and development.

II. Legal Institution and Regulatory Framework

Institutional structures in the Timor-Leste government are undergoing dynamic changes. Relevant institutional details are likely to change accordingly. This information was correct as of April – May 2009.

International Laws

The 1982 UN Convention on the Law of the Sea (UNCLOS) defines a coastal state's jurisdictional right for internationally recognized maritime zones, including inland waters, the territorial sea, the continuous zone, and the Economic Exclusive Zone (EEZ). In 2002 Timor-Leste enacted Law 7/2002 on Maritime Boundaries which is based on international law, in particular UNCLOS. Under this law, the Timor-Leste territorial sea, continuous zone, and EEZ have been set at 12 nm, 24 nm, and 200 nm, respectively. However, the definition of precise maritime boundaries with Australia and Indonesia is still pending (Timor Sea Office 2007).

Regional Agreements

As the surrounding waters of neighboring countries in the region continue to empty of fish, many countries have secured agreements to gain access to the waters of Timor-Leste. The regional agreements will help the small scale fishing concerns which will support semi-industrial fishing in the southern coast of the island as well as fish processors. Fish from the south make the supply more abundant in markets and help to keep prices more realistic as an exportable commodity. These agreements typically state the amount of fish that can be caught in any one year. They normally include a range of measures for monitoring and controlling the fishing.

A. Ministry of Agriculture and Fisheries

A.1. National Directorate of Fisheries and Aquaculture (NDFA)

The Ministry of Agriculture and Fisheries of Timor-Leste which was established in 2002 has committed to the sustainable use of natural resources. The country enshrined the management of natural resources to ensure its sustainable utilization. The following Sections of the Constitution provide general guidelines for the management and use of natural resources.

The Constitution of RDTL:

Part II, Title III, Section 61*: (1) Everyone has right to a humane, healthy, and ecologically balanced environment and the duty to protect and improve it for the benefit of the future generations.(2) The State shall recognize the need to preserve and rationalize natural resources. (3) The state should promote actions aimed at protecting the environment and safeguarding the sustainable development of the economy*

Part IV, Title I, Section 139*: (1) The resources of the soil, the subsoil, the territorial waters, the continental shelf, and the exclusive economic zone, which are essential to the economy, shall be owned by the State and shall be used in a fair and equitable manner in accordance with national interests. (2) The exploitation of the natural resources shall preserve the ecological balance and prevent destruction of ecosystems*

In addition, Section 115.1 of the Constitution mandates the creation of a legal, managerial and regulatory framework for the administration of Fisheries. In accordance with this mandate, the government issued Decree-Law No. 6/2004 on 21 April 2004 (***General Basis of the Legal Regime for Fisheries and Aquaculture Management and Regulation)*** establishing the principles and ground rules for the exploitation and regulation of fishing resources in national waters and high seas as well as that of the establishment and exercise of aquiculture.

The Decree-Law 5/2004 of 28 July 2004 provides, among others, the granting of fishing licenses, the collection of taxes, increasing the quality of the population's diet, assisting self-employment and improving the conditions for the development of the fishery sector and national fishing industry in general. The decree requires all resource users to secure a permit and license.

A.1.1. Vision and Mission of the National Directorate of Fisheries and Aquaculture (NDFA)

A.1.2. Vision:

Achieving the optimal utilization of Timor-Leste resources through responsible development and management and the provision of the highest quality of public service to Timor-Leste companies and citizens to enable them to achieve these goals.

A.1.3. Mission:

To deliver to Timor-Leste companies and citizens the best available information for the responsible development and management of fisheries and aquaculture industries.

A.1.4. Goals:

That policies and strategies place emphasis on responsible development of the fisheries and aquaculture resources of Timor-Leste. This is in line with the National Development Plan.
Five major policy objectives have been identified which are detailed below:

1) Optimal use and management of Timor-Leste living aquatic resources resulting in increased sustainable production and export of fishery products providing long term social and economic benefit.
2) Conservation, and where appropriate, rehabilitation of Timor-Leste aquatic habitat helping to sustain the productivity of Timor-Leste fisheries resources.
3) A sustainable, efficient and profitable fishing industry meeting the needs of the population for good availability of affordable, quality fish and supplying export markets mainly from offshore resources.
4) Development of a viable aquaculture industry meeting the needs of the population for good availability of affordable, quality fish and supplying export markets.
5) Development of fisheries institutions and associations staffed by capable individuals serving the needs of the fishing and aquaculture industries.

A.1.5. Role of the National Directorate of Fisheries and Aquaculture:

In the longer term, Timor-Leste Fisheries should move toward some level of self-sufficiency, developing mechanisms by which at least part of the cost of licensing, monitoring and management are recovered from licensed commercial operators. Timor-Leste aims to manage coastal fisheries on an integrated basis with coastal communities committed to managing and monitoring our resources, as outlined below.

The involvement of national fisheries in collaborative co-management schemes for coastal fisheries will be ongoing in terms of providing guidance and support to village level endeavours to conserve and manage these resources. Timor-Leste national staff will encourage and facilitate new community based fisheries management initiatives. At the village level, the office of national fisheries expects that NGOs will provide assistance as facilitators and information providers.

Strategy Aim: A cost effective fisheries monitoring, control and surveillance system helping manage national fisheries, scaled according to commercial realities and co-operating with relevant regional fisheries authority through:

- Monitoring, Controlling and Surveillance (MCS) to develop foreign licensed fishing vessels fitted with a vessel monitoring system (VMS)

- Vessel registration at national level
- Co-management of fisheries resources
- Fisheries data collection system
- Local Monitoring, Controlling and Surveillance (MCS)

A.1.6. Institutional Strengthening:

The National Directorate of Fisheries and Aquiculture (NDFA) have grown rapidly over the past eight years from having five local staff in April 2001 to 107 as of April 2009, of whom 36 are permanent staffs. Over this period its role has grown considerably from one Fisheries Management and Environment Division to its current structure of four Divisions, covering:

i. Fisheries Resource Management,
ii. Fisheries Inspection,
iii. Fisheries Industry, and
iv. Aquaculture and Sal culture.

Given this rapid growth in function and staffing, there is an urgent need to develop an appropriate organizational and staffing structure to meet the range of functions to be provided before recruiting suitable staff to fill the skill gaps in the current staff complement.

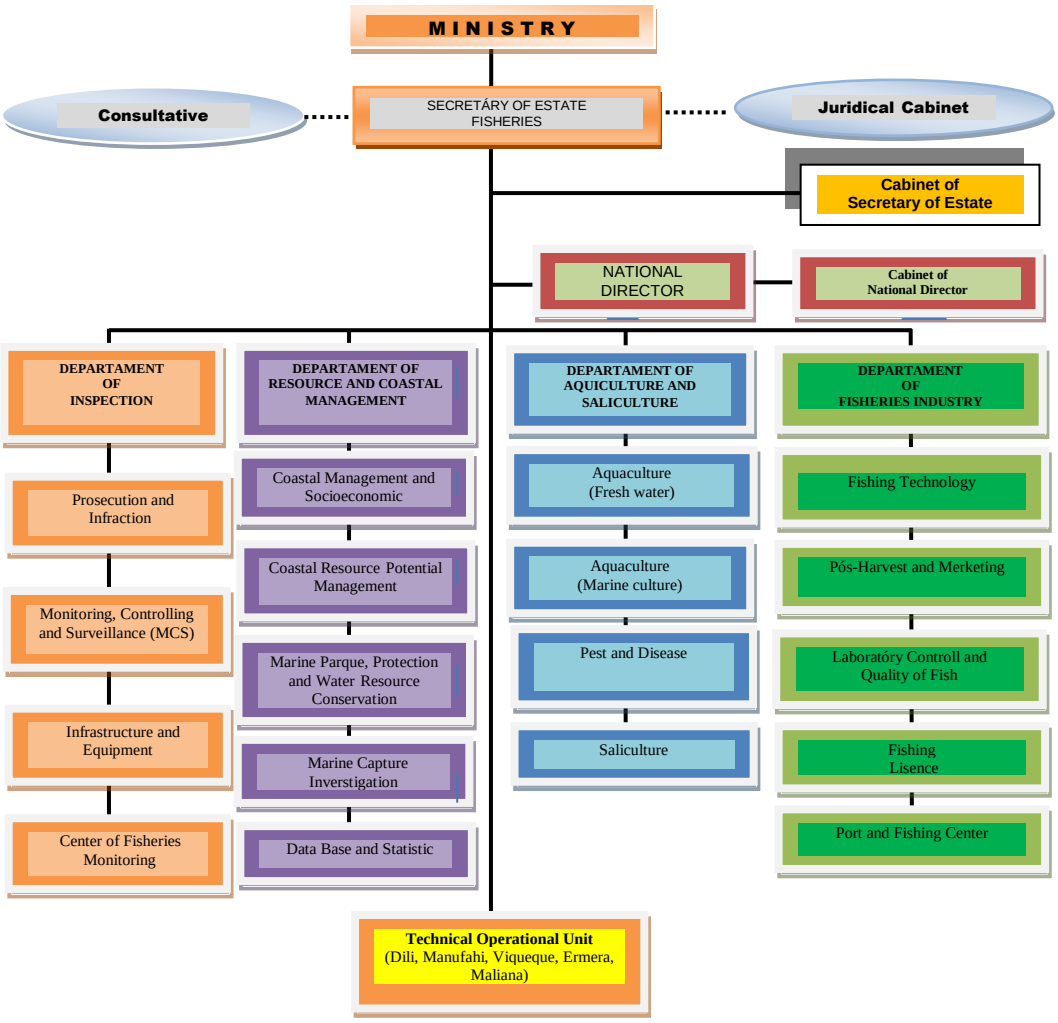


Figure 1. Organization structure of National Directorate of Fisheries and Aquaculture (NDFA)

Managing living marine resources, fisheries management and development requires taking an integrated approach. This means working closely with many other parties, government, non-government, the fishing industry and coastal communities.

a) Ministry of Fisheries and Aquaculture (Directorate of Fisheries)
   - Licensing of fishers
   - Data collection
   - Links to monitoring, control and surveillance and prosecution
   - Marketing Promotion

b) Ministry of Defence Force (Navy and Police)
   - Surveillance and enforcement
   - Legal Affairs (establish fishing zone, development of fisheries)
   - Legislation, (assist with licensing mechanism)
   - NGO,s (support for community-based fisheries management, training, access to micro finance and business training)

c) Ministry of Economic and Development (environmental impact assessment)
   - Protection of biodiversity
   - Environment watch-dog

A.1.8. Aquaculture:

Compared to many neighbouring countries, Timor-Leste has a very small aquaculture industry, but it is growing quickly. There are currently about 18 hectares of freshwater ponds with a total annual yield of 14 tonnes of:

1. Grass carp (*Cyprinus carpio*)
2. Tilapia (*Orechromis mossamblica*),
3. Milkfish (*Chanos chanos*) and
4. Seaweed (*Eucheuma denticulatum*).

The National Directorate of Fisheries and Aquaculture of Timor-Leste has a small team of staff at the national level and regional hatchery stations responsible for aquaculture research and extension support to fish farmers. There are also a small number of Non-Government Organization (NGO) projects providing financial support, training and extension services.

1. Feasibility Study (commercial and small-scale):
   A pre-feasibility study in Aquaculture will be undertaken with a few key species and locations which offer greatest promise for the development of a long term, commercially sustainable, local and export based aquaculture industry in Timor-Leste.

2. Development Approach:
   - Develop a viable and environmentally sustainable commercial aquaculture industry in fresh, brackish and marine waters to support economic development.

3. Aquaculture Action Plans - focus:
   - Fry and fingerling production
   - Survey of potential sites for aquaculture
   - Aquaculture promotion through demonstration plots
   - Training of fish farmers

4. Capacity building of fisheries staff and institutions through:
   - Overseas and in-country training
   - Provision of technical advisors and mentors
   - Assistance in drafting resource management plans
   - Given the limited resources of government, to cooperate, coordinate and collaborate with NGOs and other development agencies
   - Community based approach through consultations / generation of project proposals
   - Cooperate and coordinate with other agencies such as environment, investment and trade

5. Main program:
   - Rehabilitation of freshwater fish hatchery - Loihuno, Viqueque district
   - Re-stocking of carp breeders - Gleno, Ermera district
   - Rice-fish culture (Stocking fish in rice paddies in Manatuto district)
   - Brackish water aquaculture (Milkfish) in Maubara - Liquiça district

6. Marine Aquaculture:
   - Seaweed culture - *Eucheuma spin sum* / *cottonii* *E. spinosum* and *E. cottonii* cultured for the Timor-Leste local market and home consumption in Liquiça district

A.1.9. Existing Programs and Future Action plan Linkages of the National Directorate of Fisheries and Aquaculture-NDFA):

1. Existing National Operational Activities Plan:
   - Dissemination and enforcement of existing Laws on fisheries with particular attention given to conservation of Marine Protected Areas such as those in Atauro and Batugade
   - Monitoring, Controlling and Surveillance (conducting fisheries inspections related to commercial and non commercial fishing activities)
   - Fisheries resources protection and conservation (identification of protected species and coastal habitat)
   - Fisher-folk workshop and training (ownership of coastal fisheries resources management)
   - Fish farmer training (training on fish farming, brackish water, marine water technology)
   - National Hatchery Management (fish food and maintenance)
   - Laboratory and fisheries quality control (installation of laboratory equipment in the new building)

2. Multilateral and Bilateral:

   The National Directorate of Fisheries and Aquaculture has been involved in drawing up three regional (CTI) Triangle Coral Reef Management Programs in the Asia Pacific region. Main programs are: Coastal Management, Ecosystem Management, Marine Protected Area, Climate Change Adaptation and

Protected Marine Species. Negotiation on the implementation of the project is still an ongoing process.

- PEMSEA (Partnership in Environment Management for the Seas in East Asia) collaboration on various activities such as community based approach, marine culture, seaweed production and salt production in two districts. Short-term projects will be trialled in Manatuto and Liquiça.
- PEMSEA will establish a new branch office in Timor-Leste to help and manage various activities implemented by PEMSEA.
- JICA (Japan International Cooperation Agency) short-term fisheries capacity building.
- GTZ, long-term Fisheries capacity building.
- AUSAID, short-term Fisheries capacity building.
- World Bank, Costal Fisheries Baseline Study and Community Management.
- ADB (Asian Development Bank), Hera Fishing port rehabilitation Project.

A.2. National Directorate of Forestry

The National Development Plan (2002) assigns the Ministry of Agriculture, Fisheries and Forestry (MAFF) as a government agency having prime responsibility for forestry development. Government Resolution No. 9/2007 concerns the National Policy and Strategy Management for Forestry. In this resolution, the National Directorate of Coffee and Forestry (NDCF) has broad responsibilities for community forestry, watershed management, forest protection, plantation forestry, protected natural areas development and others aspects of forest development.

The Government of Timor-Leste is still using UNTAET Regulation No. 19/2000 designed to protect various natural areas and UNTAET Regulation No. 17/2000 which prohibits logging and timber export. Decree Laws on forestry are presently in draft form and in the process of review by the Counsellor Minister and National Parliament of Timor-Leste.

Forestry in the Ministry of Agriculture and Fisheries (MAF) has primary responsibility for policy and activities associated with the development, implementation, management, promotion and preservation of forest and watersheds in Timor-Leste. The division of Forest Protection and Resource Management is currently responsible for the establishment, development and management of a national protected areas network, including survey and management of flora and fauna within protected areas. The establishment and management of marine protected areas is currently the responsibility of the National Directorate of Fisheries and Aquaculture, through the Division of Fisheries Resource Management of MAF in collaboration with the Division of Protected Forests and Resource Management.

A.2.1. Goal: Protected Forests:

The policy objective is:

- Effective protection of the ecological integrity and biological composition of not less than 70% of the forest area by 2020. Protection of forests will facilitate sustainable forest management, preserve and maintain their ecological, social and economic value especially for sustainable livelihoods and economic development of communities, reduction of poverty, and for the benefit of the nation.

A.2.2. Strategies:

- To protect all forests from damage or loss through programmes that will empower, engage and involve the community to manage forest land, through public relation and education activities, the prevention and physical control of wildfires and reduced livestock grazing
- To authorize and provide the secure right to rural communities under the forest legislation to protect, reforest, restore, utilize and undertake such other activities that will contribute towards forest protection, sustainable forest management, the reduction of poverty, watershed and other policy objectives.
- Customary land and forest usage rights, customary land management approaches and customary village (suco) boundaries will be determined and legally recognized under Land Law 01-2003 and new forest legislation as a basis for defining forest ownership and forest management responsibilities.

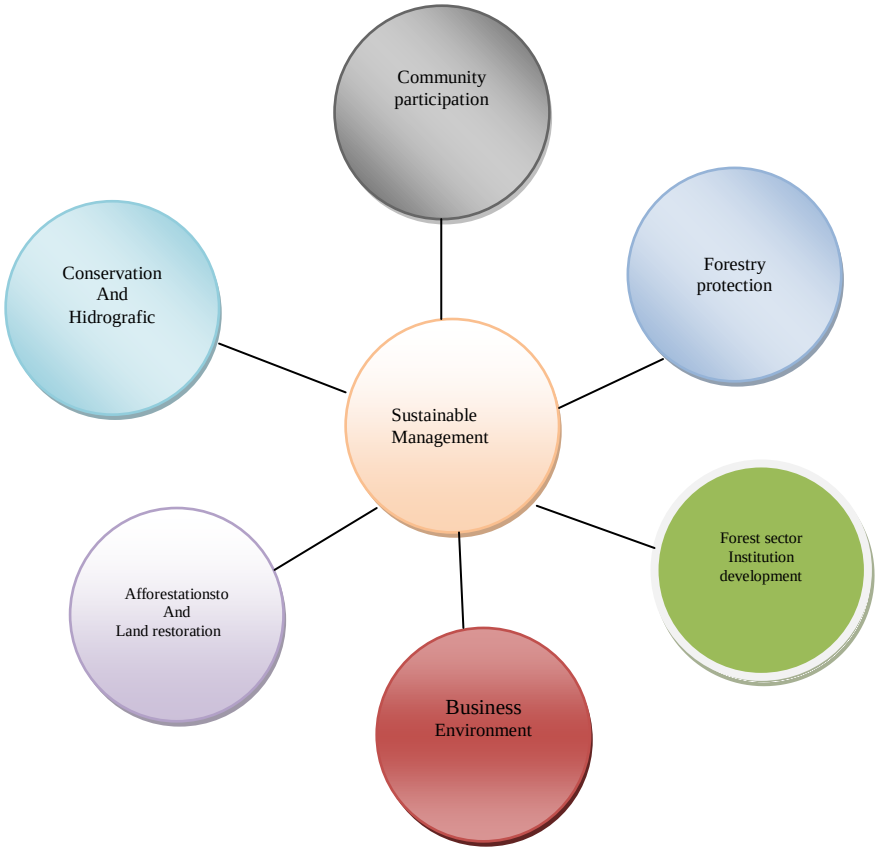


Figure 2. Relationship between the Forest Policy Goal and Objective:

A.2.3. Goal: Community and Private Participation in Forest Development:

Objective: Harmonious and affective participation of forest communities and other private sector groups and the Government by the end of 2010. Effective community participation will provide a lasting basis for forestry sector development, including the implementation of programmes for forest protection, conservation, forestation, sustainable forest management and the development of new forest enterprises and industries.

Public participation in the management of national forest use, to the greatest extent practical, the customary land and forest protection methods that are understood and to some extent respected is a wish of forest communities. A survey of rural communities that was undertaken as part of the process of formulating this forest policy has shown a preference for the use of customary land and forest management arrangements.

A.2.4. Strategies:

- To award long-term land use rights under the provisions of Land Law 01-2003 and the new forests legislation to local communities, or to individual families or other stakeholders, not later than the end of 2020, that legally recognizes customary community land and forest usage rights (*Tara Bandu*)
- To negotiate and conclude mutually agreeable arrangements of cooperation, participation and forest management by the end of 2020
- Community participation in forestry development shall be based upon the strategy of enabling communities to undertake protection, management and other forestry responsibilities rather than enforcing them to do so.

A.2.5. Goal: Watershed Conservation:

The policy objective is long-term sustainable conservation of watersheds not later than 2020 in order to maintain and enhance natural water flows, to maintain high water quality and to minimise flooding and the erosion of rock and soil.

Timor-Leste has unique dramatic and rugged topography, dominated by the Ramelau range. Slopes are short though steep; soils are shallow or nonexistent and are susceptible to erosion.

A.2.6. Strategies:

- To achieve effective management of all forest, savannah woodlands and grasslands not later than 2020 from damage or loss form wildfires, shifting cultivation, unlawful logging, settlement through a combination of actions that will include public relations.
- To promote and encourage cooperation between rural communities and government.
- To promote ecologically realistic forest restoration and mountain closure programmes.

A.2.7. Goal: Forestation and Land Restoration:

The objective is reforestation and restoration of degraded land to improve watershed and coastline protection, maintain and expand wood resources for energy production, construction, and furniture and craft manufacture.

A.2.8. Strategies:

- To promote ecologically realistic forest programmes of planting and reforestation.
- To undertake inventories of specific wood and non-wood forest resources.

- To promote cooperation between rural communities and government through the allocation of long-term land use management agreement and utilization rights for forestation.

A.2.9. Development of a Private Sector Business Environment:

The policy objective is the development and maintenance of a private sector-based business environment for profitable forest ownership and the management, production and utilization of forest products.

As a policy objective rural communities will be encouraged over time to acquire the knowledge, skill, experience and confidence to manage, utilize and market forest resources as private forest owners.

A.2.10. Strategies:

- To encourage private sector investment in forest development
- To ensure that policy considers private sector investment and trade
- To promote domestic and international trade of added-value forest products and to ensure the profitable utilization of tree species that are presently under-utilized.

A.2.11. Programs and Action Plan:

a. Forestry and Ecosystem:

Forests provide not only timber for housing and firewood for cooking, but they also produce potential market products such as candlenut (*Aleurites molucana*) and tamarind (*Tamarindus indica*), as well as staple food crops such as sago, yams, wild and beans. In addition, sandalwood (*Santalun album*) has for centuries been providing a significant share in export revenues. There are also non-timber forest products with potential for domestic and export markets such as honey, bamboo, and rattan. Forests also provide for occasional grazing for domestic animals such as buffaloes and horses, but it is primarily the natural ecosystem of wild flora and fauna that are essential components of the biodiversity.

b. Conservation Areas plans of the National Directorate for Forestry:

The National Directorate for Forestry estimate suggest that a significant area of forest land is under threat from degradation and concerted efforts have been pursued to protect and conserve the forest resources. Fifteen protected areas have been established since 2000 by the Forestry Division of MAFF, the largest of which are located in Tutuala, Lautem district. The first National Park of Timor-Leste declared on 1st August 2008 is the Nino Conis Santana National Park in Tutuala. In addition, 27 watershed areas have been identified in the country covering a total area of 110,620 hectares or about 10% of the total forest area. Among the 27 watersheds identified are: Vero, Seiçal, Laleia, Laclo, Ue Tuken and Sahe, Loes, Clere and Belulik, Mola and Tavara, Irabere and Tono. These watersheds are presently under pressure from unsustainable forest exploitation, forest fires and unsustainable upland management, including widespread collection of firewood.

c. Key Measures:

Key measures are now being undertaken to remedy these problems including reforestation of degraded areas with valuable local timber species, particularly sandalwood, and encouraging community participation in the rehabilitation of degraded forest areas. The Government and MAF are being assisted in the area of watershed management by JICA (for Laclo and Comoro) and GTZ (in Maliana and Covalima).

d. Major Issues:

Presently there are two major issues that emerge as effects from the disruption of the hydrological cycle and land degradation effecting rural and urban populations of Timor-Leste; these are;

- Water quality
  - High level of erosion resulting in high levels of sedimentation and turbidity, thus incurring an increase in water treatment coasts.
  - Urban and domestic waste is leading to biological, chemical and physical pollution of water. The availability of clean water for domestic and non-domestic use in general is a problem found in rural and urban areas.

Water access has been the focus of Government programs with assistance from many international agencies such as UNDP, CARE and AusAID. Major water supply projects have been carried out by UNDP for a district town water supply system in Dili, Liquiça, Manatuto and Lospalos and for the rehabilitation of Laclo irrigation scheme and rural water and sanitation in Aileu and Baucau.

- Land degradation:
  Investigation of causes of erosion as a major source of soil degradation and the search for ways to reduce the impacts on the social environment of Timor-Leste have been attracting attention for a long time. The issue was identified as a major problem during the later Portuguese colonial period and Indonesian administration period. Community consultations during a recent study confirm deforestation to be a major cause of serious soil erosion.

A.2.12 . Programs and action plan linkages:

- Establishment of permanent forest tree nurseries and continued annual reforestation programs.
- Creation and finalization of forestry Law: Decree Law on Forest Management and technical framework for the implementation of forest management.
- Conservation of forest resources through the national park.
- Construction of two dams in the water catchment areas (Laclo-Manatuto) and (Comoro-Dili) to conserve and collect surface water for irrigation purposes and other domestic and livestock consumption needs.

B. Ministry of Tourism, Commerce and Industry

B.1. National Directorate of Tourism:

The Tourism Department is responsible for promoting tourism in Timor-Leste, by cooperating with international and domestic tour and travel organizations and by providing information on the internet and through posters and brochures about Timor-Leste as a potential tourist destination.

Unspoilt coastal and terrestrial environments and interesting cultures are seen as the chief potential focus for tourism. Bird-watching and other sustainable eco-tourism activities will be encouraged by the department. The tourism sector is a young industry in Timor-Leste under the Department of Tourism, Trade and Industry on cabinet constitutional IV of Republic Democratic of Timor-Leste.

B.2. Vision:

- To put Timor-Leste firmly on the regional and international tourism map and develop a thriving tourist industry.

The vision statement is for a dynamic, competitive and profitable industry, which makes vital and increasing contributions to the sustainable economic, social, cultural and environmental well being of Timor-Leste.

B.3. Policy context:

The main benefits of tourism development as a key strategy for Timor-Leste are:

- Jobs, directly and indirectly, especially for women and youth
- Foreign exchange earnings as an export
- Infrastructure improvement
- Increased revenue
- Protected environment and culture
- Positive image for the country

B.4. Implementing the vision:

In order to effectively implement tourism policy once adopted, the government can request that tourism be develop through accessing the necessary technical assistance from its development partners. This will detail and coordinate each of the above elements into a comprehensive set of budgeted, time bound actions.

B.5. Strategies and Outlook:

According to the IV Constitutional Government Program 2007-2012 (RDTL, 2007b:8), the government is committed to develop structured tourism which will act towards a sustainable and responsible development of tourism, through planning, coordination and harmonization of transversal policies, taking into account the need to render compatible environmental preservation, natural resources management and land use planning. It envisions an industry that is based on the country's natural beauty. Below are some examples of natural beauty to consider and develop in future:

- Sea life, especially corals
- Coral reefs, under water caves
- The north coast is more suitable for developing the "3-S" (Sun, Sand, Sea) beach tourism due to its infrastructure and accessibility, and more suitable climate (GERTIL, 2001)

B.6. Institutional framework:

The Ministry of Tourism, Trade & Industry is in charge of developing the industry. There is currently no legislation in force that regulates the industry, but IV Constitutional Government Program 2007-2012 (RDTL, 2007) envisions the creation of specific legislation for the sector and official adaption of a National Tourism Strategy plan.

- Private sector support:
  The main private sector representative bodies for tourism are either weak or dormant. In particular the Timor-Leste Tourism Association (ATTL) is not functioning at present. It nevertheless remains as a legal entity though needs to be reformed and given a more prominent role. It can be an effective interface with government, and the industry more widely, as the lead body.

- Public sector support:
  The government leading actor for implementing policy and achieving strategic goals for the sector is the National Tourism Directorate (NDT) under Department of Tourism, Trade and Industry. Its capacity is constrained due to resource limitations.

- Infrastructure:
  Improvement of the country's basic, general infrastructure related to tourism such as hotels, guesthouses, restaurants includes:
  - Transportation
  - Communication
  - Utilities

B.7. Key tourism clusters or product grouping:

The following special interests, niche markets and even sub niches within each particular market segment are bellow:

- Diving and related marine-based activities (snorkelling, kayaking, sport fishing)
- Adventure tourism, land and marine-based
- Eco-tourism and culture tourism
- Scientific tourism
- Heritage and nostalgia tourism

B.8. International Cooperation:

The Government of Timor-Leste receives support from the WTO and UNDP with tourism policy development and the Northern Territory Government, Australia, is helping Timor-Leste to identify suitable locations for tourism development and a marine park.

C. Ministry of Economic and Development:

C.1. National Directorate of Environment:

The Directorate of Environment Services is part of the Ministry of Economic and Development of cabinet constitutional IV of Democratic Republic of Timor-Leste. The Directorate has overarching responsibility for environmental management in Timor-Leste through authority delegated to it under Decree Law 3/2005 which specifies that it will encourage environmental protection to support the Secretaries of State for Regional Coordination.

C.1.1. Mission:

- Protect and conserve natural resources including biodiversity through cooperation with relevant agencies, NGOs and community
- Increase community awareness about the importance of the environment through advocacy
- Understand the national status of biodiversity through baseline monitoring in and outside protected areas
- Develop national environment policies and regulation including Environmental Impact Assessment

The National Directorate of Environment (***direcção nacional Meio Ambiente)*** has also established a draft Strategy and Policy presently pending submission to the Counsellor Minister for discussion and to make decisions on the following:

a. Organizational structure
b. Create Law and regulation
c. Infrastructure development

The structure of the Timor-Leste institution that has responsibility for environment management is stipulated in adopted Law of the Republic of Indonesia No. 51/1997 concerning Provisions of Environment Impact Assessment (EIA) and No. 23/2004.

C.1.2. Strategies:

Conservation of biodiversity (Flora and Fauna)

- Conservation of natural waters
- Rehabilitation and protection of atmosphere (ozone)
- Sustainability Conservation for ocean and coastline

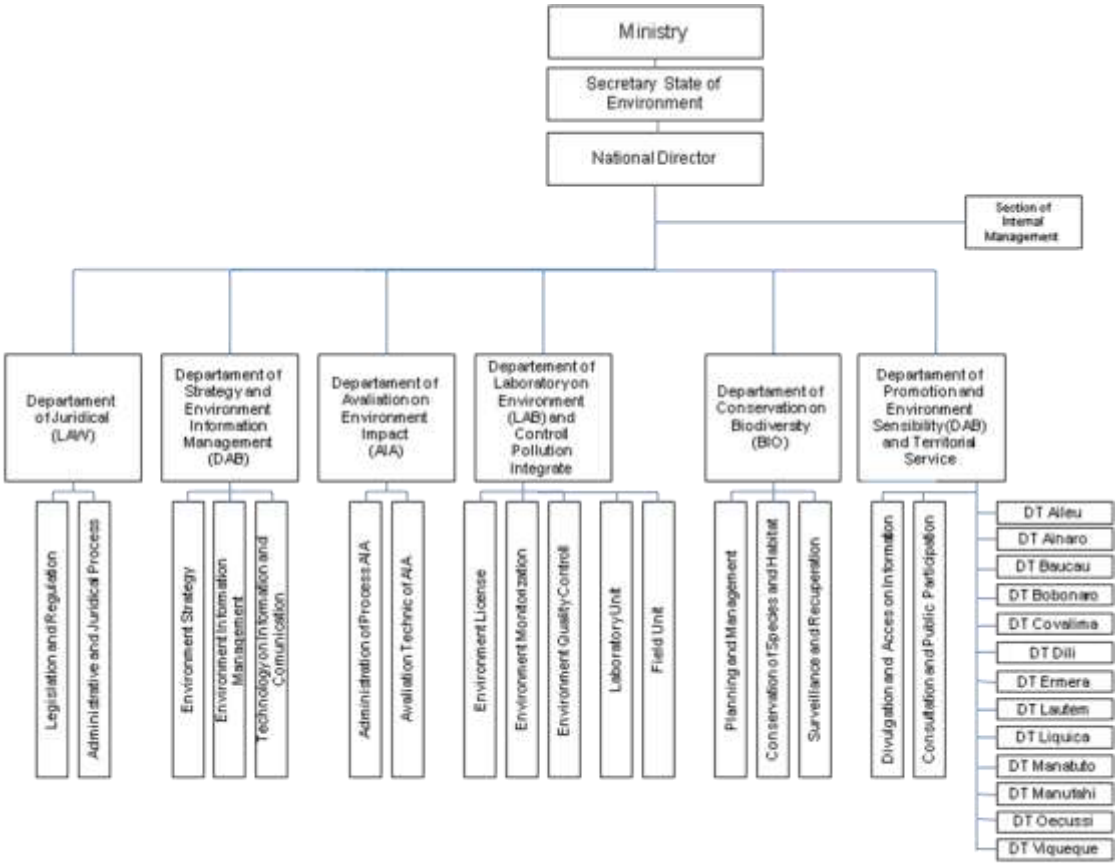


Figure 3. Structure of National Directorate of Environment Timor-Leste

C.1.3. Legal and Regulatory Framework:

Timor-Leste historical legacies have created a unique and complex set of long-term, widespread conditions. Currently the environment management framework lacks several important elements. These include:

- Proper legal framework for environmental management including land and water rights
- Environment and social impact assessment and regulatory framework for the concessions of mining, logging, etc
- Environment management plans
- Environment protection and conservation standards
- Protected areas systems and endangered species law
- Forest management policy and law
- Information and reporting systems
- Environment civil education

The RDTL Constitution, article 6.f, provides for the protection of the environment and preservation of natural resources. Articles 61 and 139 further stipulate conditions for the use and preservation of the environment and natural resources, to secure ecological equilibrium and contribute to sustainable development. Decree Law No. 7/2007 which established the fourth Constitutional Government of Timor-Leste included the State Secretariat for the Environment under the Ministry of Economy and Development (MED).

Currently, environment legislation is very limited in Timor-Leste. The Government is still using UNTAET Regulation No. 19/2000 designed to protect various natural areas and UNTAET Regulation No. 17/2000 which prohibits logging and timber exports. Laws on pollution and environmental impact assessment are presently in draft form pending submission to the National Parliament. The Government issued the Water Services Decree No. 4/2004 to provide for the management of water services delivery, including provisions for the identification of areas to supply and service user charges. In addition, the Public Sanitation Decree, promulgated in October 2005, provides the Ministry of Health with powers to direct organisations and individuals to remove any risks to public health.

C.1.4. International Conventions:

Timor-Leste has acceded to all three Rio Conventions – United Nations Convention to combat Desertification (UNCCD) in 2003, United Nations on Climate Change (UNFCCC) and the United Nations Convention on Biodiversity (UNCBD) in 2006 – effective on January 2007. The UNCBD is to help prevent and control dangerous anthropogenic activities that would otherwise leave Timor-Leste vulnerable to environmental catastrophes and irreversible biodiversity losses in the future. Being a party to these agreements is also seen as Timor-Leste's contribution to Global Environmental Protection. The National Parliament of RDTL ratified the Kyoto Protocol on the 10th of March 2008, paving the way for Timor-Leste to have access to the Clean Department Mechanism (CDM) Fund for adaption, mitigation, and technology transfer project.

C.1.5. Multilateral Environmental Agreements (MEAs):

- MEAs were established within DNSMA in 2005, and after a lengthy process, Timor-Leste National Parliament ratified three important international conventions (Rio Conventions) mentioned above. To focus its capacity for global environment management and with specific focus on the implementation of Rio Conventions, National Capacity Self Assessment (NCSA) has been carried out for Timor-Leste
- The NCSA process was implemented through the establishment of Three Thematic Working Groups (TWGs) for UNCGD, UNFCCC and UNCCD respectively. The findings of the NCSA on biological diversity suggest the following:
  - Aside from the government commitment to take part in the convention, little has been done at the national level to implement the convention
  - Timor-Leste has no law of its own on biodiversity conservation
  - There is no institution with a clear mandate to hold overall responsibility for biodiversity resources and management

C.1.6. Current Policies and Plans:

The following description is based on the Environment related policies and plans - status of the Government of Timor-Leste, The Secretary State of Environment (SEMA) especially for the National Directorate of Environment 2008-2012 Development Program :

- Environment
  - The Government has committed to developing an environmental policy. It is currently in the process of consultation
  - Establishment of environment and natural resources policies that integrate environment components in the different sector policies, based on the principles

of sustainability, mainstreaming, integration, equity and participation, enhancement of natural resources that sets agricultural and forestry development within a framework of nature conservation

- Elaboration and consolidation of environment legislation concerning existing and Potential Protected Areas, the Evaluation of Environmental Impacts and Control of Pollution
- Implementation of the Multilateral Environment Agreements signed by Timor-Leste, respectively the three Rio conventions (UNFCCC, UNCBD and UNCCD)
- Provision of adequate information on the environment and encouragement of the participation of citizens and stakeholders through campaigns and programmes of environmental education
- Elaboration and implementation of a National Surveillance Network for the quality of the environment and the implementation of a Pollution Control system through the approval of relevant legislation and implementation of a environment Licensing System
- Establishment of National Policy, Strategy or Plan to Preserve Nature and Biodiversity, reviewing and updating the UNTAET rules and regulation and approval for new legislation on Protected Areas

- Reforestation
  - The creation of tree nurseries is to be incorporated into erosion prevention systems and balanced reforestation programmes in all districts. The reforestation programme will develop trees for domestic use, trees for human and environmental rehabilitation and trees for commercial use
  - Capacity building is required for foresters and creation and protection of Forest Centres is to be supported by the creation of adequate legislation and civil education programmes

D. Civil Society Organizations:

In Timor-Leste, civil society has strong roots in resistance organizations working underground during Indonesian occupation and fighting for independence. Many of these organizations are now gradually evolving into organizations that are helping to rebuild the country. East Timor forum is functioning as an umbrella for many of these organizations.

D.1. Haburas Foundation

Based in Dili, capital of Timor-Leste, Haburas is the oldest and most active national environment group in Timor-Leste. Haburas uses a wide network of local community groups and relies on traditional Timorese culture to promote better environmental management practices that also respond to the development needs of local communities. It runs various projects throughout the country related to protection and management of coastal resources. Most activities are based in the Lautem district (Lospalos, Tutuala and Jaco Island) where the organization has its roots and where the newly established National Park is situated. Projects include mangrove replanting, ecotourism development, catchment rehabilitation, reforestation, environmental education and the strengthening of other traditional resource management regimes.

- Haburas also promote specific Timorese culture (*Tara Bandu/ritual prohibition*)

- Haburas also engage in capacity building and community education to shift from environmentally harmful practices such as destructive fishing methods, and harvesting of turtle eggs and shells to environmentally sound practices.

D.2. Perkumpulan Hak

Perkumpulan Hak has been very actively participating in environment programs, especially sustainable fisheries activities, including a survey of fisheries operation and a community workshop on safe fishing practices such as a costal community socio-economic issues survey in six districts: (1) Loes/Liquiça, (2) Dili/Atauro/Ilikmano, (3) Aitehen/Manatuto, (4) Lootasi/Suai, (5) Betano/Same and (6) Xanane/Oecuse.

☞ Programs and Action Plan of Perkumpulan Hak

- To increase the participation of fisher-folk that helped to establish fishing activities related with government planning.
- To improve capacity building for fishers related to socio-economic, culture and social structure such as forming fishing cooperative associations.
- To strength cooperation with government especially the Ministry of Agriculture and Fisheries.
- To improve the fish consumption campaign for food security in Timor-Leste.

D.3. Belun organization

In collaboration with international donors Belun has established cooperation with local fishing communities in Ainaro district to develop community conservation capacity building and fishing gear support.

☞ Program of Belun

- Promoting Aquaculture programs
- Boat building program in Vemasse-Baucau
- Agriculture and fisheries programs for Bikeli community in Atauro-Dili, Oecusse, and Liquiça

D.4. Roman Luan

Roman Luan has established fisheries co-management programs by creating two community-based Marine Protected Areas (MPAs) in Bikeli, Atauro island. The NGO is also running an eco-lodge on Vila beach and has developed a set of guidelines for eco-tourism. Other activities are concerned with sustainable fisheries and include a survey of fisheries activities and community workshops.

A partnership project between Roman Luan and, the Australian Conservation Foundation, and Marine and Coastal Community Network based in Darwin is engaged in capacity building in community-based marine management.

Chapter II Socio-Economic Characteristics of Timor-Leste in Arafura and Timor Sea

A. Introduction

A.1. Historical Background, Geography and Location

Timor comes from the Malay word for "East"; the island of Timor is part of the Malay Archipelago and is the largest and easternmost of the Lesser Sunda Islands. Timor-Leste is located in Southeastern Asia, northwest of Australia in the Lesser Sunda Islands at the eastern and of the Indonesia archipelago. Timor-Leste includes the eastern half of the island of Timor, the Oecusse region on the northwest portion of the island of Timor, and the islands of Atauro and Jaco and Timor-Leste. Geographical details are:

- Coordinates: 8 50 S, 125 55 E
- Approximate coastline: 706 km
- Marine exclusive economic zone (ZEE): 75,000 km^2
- Land boundary: 228 km
- Map references: Southeast Asia

Timor-Leste is a remarkably diverse territory in terms of environment, demography and ethno-linguistic aspects. Based mainly on factors of altitude and rainfall, Timor-Leste can be divided into six agro-climate zones – coastal lowland, mountain slope and upland zones in each of the South and North sides of the country. The coastal lowland and mountain slope zones dominate the Western and Eastern Regions while the upland zones dominate the Central Region. These agro-climatic differences are critical factors in the present pattern of livelihood strategies of the people.

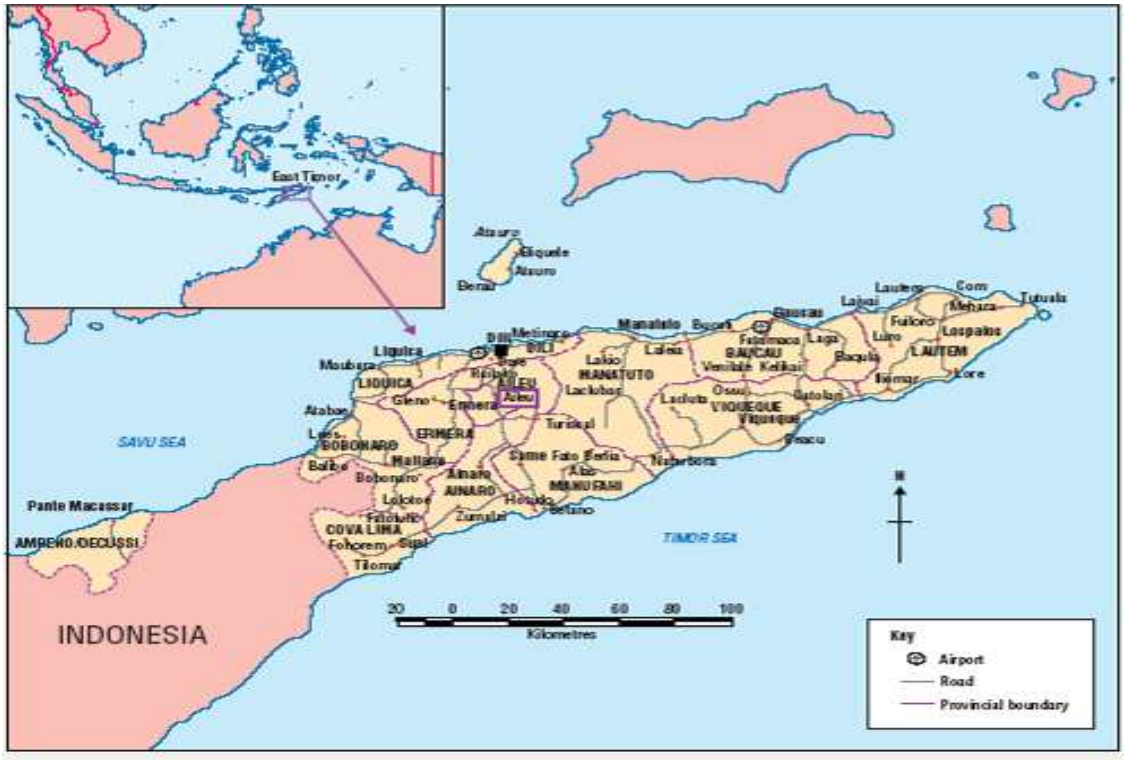


Figure 4. Map of Timor-Leste

A.2. The Population of Timor-Leste

The population of Timor-Leste is estimated to be 1.1 million as of July 2008. It is estimated to increase at an annual rate of 3% over the next 7 years. The population is reasonably balanced between males and females. However the age structure is skewed towards the young, with an estimated 62% under the age 24, and 30% under the age of 10.

Timor-Leste remains predominantly an agrarian society, with approximately 80% of the people living in rural areas and most dependent on subsistence farming. In 2001, more than two in five Timorese were below the national poverty line of $0.50 per day. Informal estimates suggest that as much as 42% of the population is now below the national poverty line. The implication is that as many as 430,000 people are below the poverty line compared with about 345,000 in 2001.

B. Profile of Fisheries

Timor-Leste has a coastline of about 706 km whilst the national marine exclusive economic zone (EEZ), over which Timor-Leste holds exclusive fishing rights, covers approximately 75,000 $km^{2.}$. While the fishing area is small by international standards, it has the potential to provide valuable high grade protein to feed the Timor-Leste people and to provide employment, significant income earning opportunities and foreign exchange from fisheries.

The fisheries sector was almost completely destroyed in 1999 and has taken some years to recover. Although major constraints still exist such as loss of income due to lack of storage, infrastructure and cost of fuel and gear limitations restricting fishing to small-scale inshore activity. Some fishing occurs for local markets and vessels from other countries often fish offshore. Few East Timorese fish as their primary livelihood, such as those from Arturo Island, although most located in coastal areas fish for partial subsistence/income. Approximately 6,000 fishers (2001) operate in centres around the coastal areas in particular Dili, Arturo Island on the north and Viqueque districts on south coast with variation across communities in relation to fishing dependence and strategies. Many fishers' livelihood strategies are based on agriculture with part-time fishing, although Arturo Islanders are mostly fulltime fishers operating larger boats and in offshore areas. Much artisanal activity occurs within 300m of shore as well as inshore gleaning by women.

Following the withdrawal of Indonesia from Timor-Leste in 1999, the level of fishing activity fell significantly, both as a result of Indonesian fishermen leaving and from the serious damage inflicted on locally owned fishing boats, gear, and infrastructure. Surveys indicate that Timor-Leste coastal marine resources remain relatively healthy although there are signs that heavy fishing has impacted reef fish resources around the Dili district. As well as encourage Timor-Leste fishers to continue to expand the national fishing sector, the challenge is to ensure this is done on a profitable and sustainable basis.

The value of Timor-Leste living marine resources and the benefit to Timor-Leste population, both short-term and long-term, will depend on how well these resources are managed. The communities living along the Timor-Leste coastline have, for generations, caught and used a wide range of tropical fish species including large tuna, many oceanic pelagic fish species, a wide variety of coral reef fish, deep water snappers and mangrove, estuarine, inland river and lake dwelling species. In addition, Timor-Leste people harvest crabs, shrimp, rock lobster, shellfish, squid, cuttlefish, octopus and seaweed. The people of Timor- Leste have access to a bountiful harvest. But though these resources are renewable, they are also finite and unless their use is

managed, will be subject to overexploitation. Therefore Timor-Leste must care for and nurture its resources and environment if it is to continue to provide significant benefits to Timor-Leste people.

Timor-Leste has many skilled fishermen, most of whom are part-time operators that combine fishing activities with working on the land and thereby currently exert limited pressure on living marine resources. Not all Timorese fishers are part-time. Many fishers from Atauro Island have a long history of fishing as their primary occupation. Some Atauro fishermen have experience of deep-sea fishing in the Pacific Ocean, the Indian Ocean and in the waters around Indonesia.

B.1. Bobonaro district

Situated 75 km off the west coast of Dili, Bobonaro district is in the border adjoining west Timor, Indonesia. The district has a land area of1, 368 km2, comprising six sub districts and 50 sucos (villages). Of the 50 sucos, only eight percent are coastal. Farming is the main source of income in the district with maize as the most important crop, which is intended for sale. Fifty-two percent of the sucos speak Bunak, followed by Kemak (36%), Tetun (8%), and Bahasa (4%) indicating that different ethnic groups live in the district. The Balibo sub district, which is adjacent to the west Timor border, has six sucos but only two, Batugade and Sanirin, are coastal. Atabai district has four sucos, two of which are coastal. The total population is only 11.6% of the total population of the Bobonaro district. It has 11 fishing centres and 315 fishers. Figure 5 shows total population changes of Dili, Bobonaro and Viqueque district from 2001 to 2004.

B.2.Dili district

Dili has the smallest land area, but has the highest population, being the capital of Timor-Leste. The population increased by 39% from the 2001 census with a current average household size of 5.5, the highest of the country. It is composed of six districts and 31 villages. Farming is the primary occupation of the population with maize as the most important crop used for subsistence. Interestingly, farming is also the main income source in Atauro sub district despite being an island where most fishers reside and are spread over all 18 fishing centres in five villages. Dili has the highest number of fishers (2039) with 31 fishing centres.

Atauro Island lies 23.5 km north of mainland Timor. It enjoys special administrative and economic treatment from the government as provided in the country's Constitution. It comprises of five villages; Vila, Bikeli, Beloi, Makili and Makadade. The island is 22 km long, 510 km wide and has an area of 150 km^2 *(Monk in Trainor and Soares, 2004)*. It is an extensive uplifted coralline reef to 600 m and has a broad fringing reef (30-150 m wide), but has no freshwater wetlands, tidal rivers or extensive mangrove (*Callell & Vech*, *Monk in Trainor and Soares, 2004)*. Roman Luan, a local non-government organization, assists the islanders with their livelihood, pre-school education, and marine resource conservation programs. Of the five villages, Biqueli is considered to have an advantage. The community is organized and members work together aside from being skilled fishers.

B.3. Viqueque district

Viqueque district is located in the southern part of Timor-Leste, 173 km from Dili. It has a land area of 1781 km^2 with a population of 66,434 as of the 2004 census, a 5.9% increase from the 2001 census (Table 1). There are about 15276 households with a 4.3 average household size, the lowest among the districts. There are five sub-districts and 35 sucos. Farming is the main

occupation of the people in the district. They consider rice as their most important crop which is mainly used for subsistence. Out of 35 sucos, 14 are costal and 42% of the population live in these areas. There are 8 fishing centres and 217 fishers in the district.

Table 1. *Profile of sites*

Indicator	Bobonaro	Dili	Viqueque
Area (km^2)	1368	372	1781
Increase	17.8	39.3	5.9
Number of sub districts	6	6	5
Number of villages	50	31	35
Number of coastal villages	4	16	14
Main source of income	Farming	Farming	Farming
Most important crop	Corn (62%)	Corn (82%)	Rice (60%)

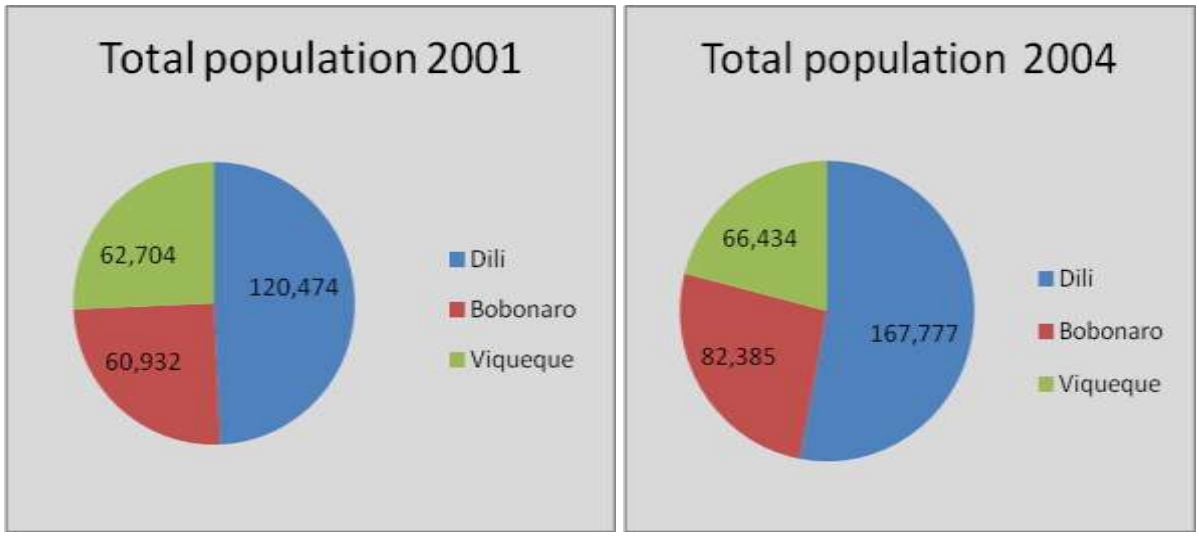


Figure 5. Total population of three districts (Bobonaro, Dili/Atauro and Viqueque)

C. Ethnicities and Languages

C.1. Ethnicity

The population of Timor-Leste is composed of various ethnicities such as; Austronesia (Malayo-Polynesian), Papuan, and a small Chinese minority. Timor-Leste could be described as Melanesian with Papuan overlays. The origin of the East Timorese population is mixed and this has led to the evolution of various district belief systems. The systems have provided the society with stability and resilience that has enabled them to withstand the subjugating rule of two foreign colonial powers.

C.2. Languages

The Constitution of RDTL established Tetum and Portuguese as the two official languages and English and Indonesian as the two working languages of public administration for as long as required. The results of the 2004 Census indicate that both Tetum (46.2%) and Indonesian (43.3%)

are the most widely spoken languages, whereas Portuguese ranks third and English is fourth. While Portuguese is the language of the governing elite, in the capital only 20% of the inhabitants speak the language.

In terms of ethnicity, 57% of the fishers are Tetum, 14% Macassae, 10% Kemak, and the rest are spread across eight other ethnicities in the districts.

In three districts (Dili, Bobonaro and Viqueque) Tetum is a common language with 49% followed by Bahasa (16%) and Bekeli (11%). Aside from Tetum, there are about 16 indigenous languages mostly in the district's coastal areas, for example Makasae (25%) and Naueti (20%) are two main languages used in Viqueque coastal Sucos. Other Languages such as Galole, Mambae, Fataluku, Makalero, Kemak, Bunak, Tokodede, Waimua are spoken by significant numbers of people in Timor-Leste.

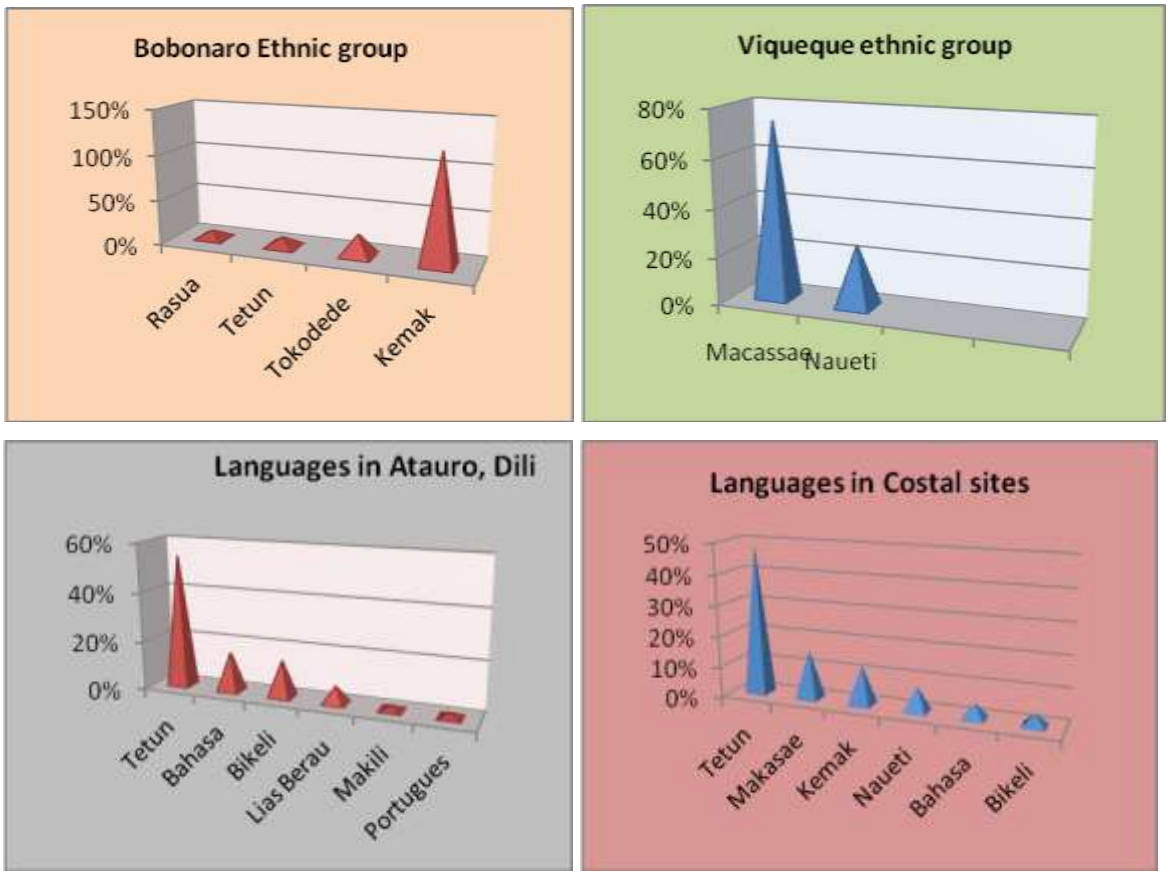


Figure 6. Main languages spoken in Bobonaro, Viqueque and Dili (Atauro) coastal suco/village

D. Timor Traditional Political and Clan Structure before the Portuguese

Prior to the arrival of the colonizers from Europe, the region was dominated by mini-kingdoms headed by powerful leaders, which are referred to as Sultans, towards the West of the archipelago, and as a Liurai in Timor. These leaders were continuously jostling for power and territory with the population bearing the coast of these wars. Their political structure was hierarchical and feudal in nature (Figure 7).

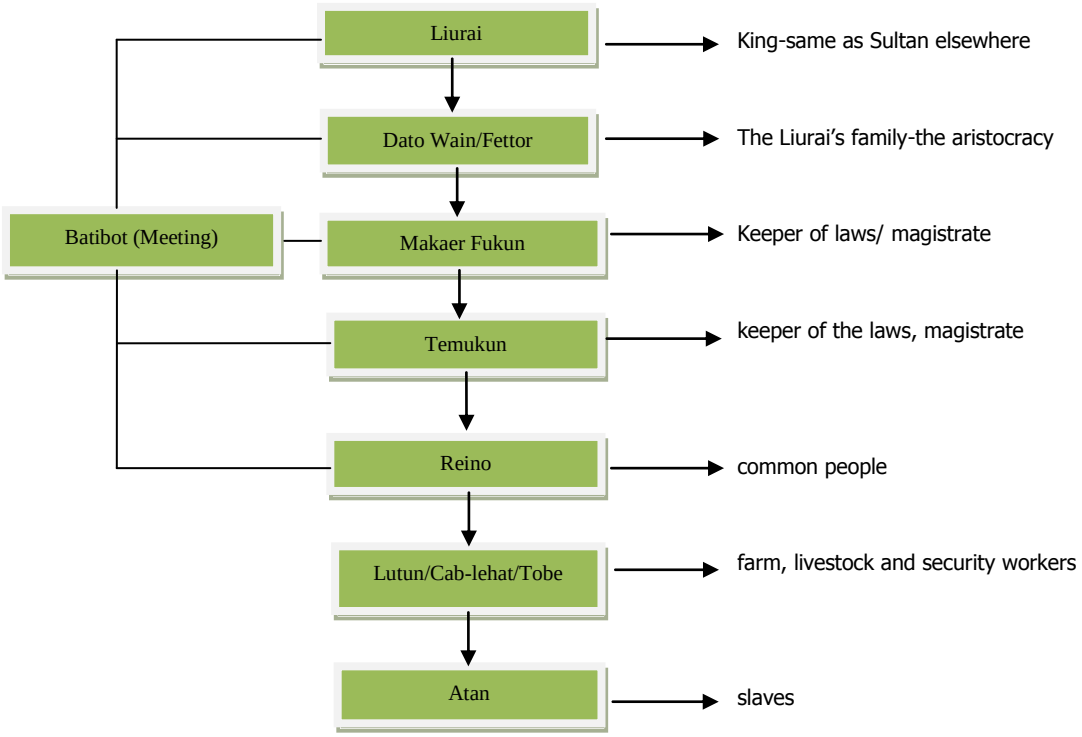


Figure 7. Political Structure Before the Portuguese

Following the Liurai was the extended family – Dato Wain, also called Fettor in some localities. The Liurai and his family usually owned large tracts of land and accepted tributes from Reino or the common people.

The maker fukun or judiciary carried out dual roles – they upheld the laws that enshrined the Liurai and acted as magistrate or judge. The Tembukan, also called Tumegao, carried out several roles – defence of the Liurai, serving as the Town Crier, general policing duties and organizing the common people, workers and slaves. The Reino are the common people and they paid taxes to the Liurai. They were permitted to attend meetings (*tesilia or sometime termed as biti-boot* – the name for a traditional pandanus mat) and they were able to organize their own clan meetings as were the clans of higher and lower status.

Separate from the *Reino* are the categories of workers – *Lutun, Cab-leha or Tobe*. They carry out farm work, livestock tending and security duties. They could be bonded to anyone qualified to attend the *tesilia* or meeting. They could not attend a meeting on their own but could seek an audience with superior clans including the Liurai on matters concerning their work. At the bottom of the hierarchy are the *Atan* or slaves – they worked for security, the judiciary, aristocracy and the Liurai.

The *Liurai* political structure provided security for the community and dealt with the most serious crimes. The day to day life of the people was controlled by the customs evolved by their clan, house or extended family. Most commonly, the *Liurai* controlled several clans.

The powerhouse of the clan is the *Uma Lulik Boot* – a large or senior Sacred House (Figure 8). Attached to the *Uma Lulik* Boot is the senior wise man or elder, the Maker *Lulik*-Keeper of the

oral tradition and history of the clan, who advises on ceremonies and provides the final say in serious matters and disputes. Objects of value and objects used in ceremonies are stored in the *Uma Lulik Boot*.

Associated with each *Uma Lulik Ki'ik* is a council of elders or wise men, known by various names such as *Mane Bot, Adat Nain or Tokoh Adat.* They have a range of responsibilities including inter alia: leading ceremonies inside and outside of the sacred house and also in households, negotiating *barlaki* (gifts for couples getting married), solving and resolving disputes, establishing *Tara Bandu* (a taboo aimed at protecting natural resources), initiating community work, advising villages on infrastructure (such as roads, water supply etc), and advising on when to plant as well as other agricultural matters. If the *Mane Boot* cannot resolve a dispute, they will call on advice from *Uma Lulik Ki'ik* and *Maker Lulik a*nd if still a resolution cannot be found, the dispute shall be elevated to the Makaer *Lulik* in the *Uma Lulik Boot.*

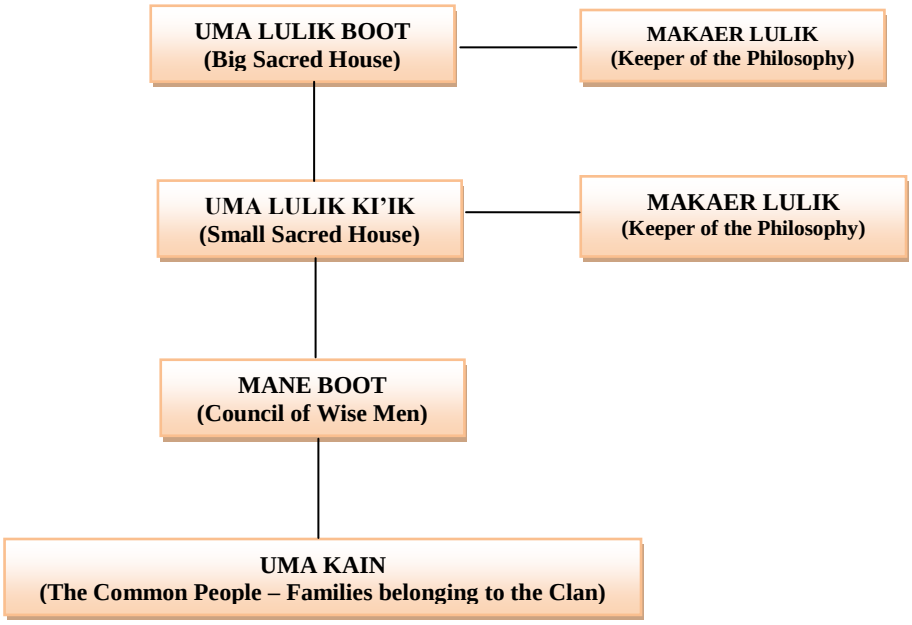


Figure 8. Clan Structure

D.1. Portuguese period (Colonization period)

During their occupation, the Portuguese followed the usual colonial strategy of utilizing the existing leadership to enforce rule of law. Thus, the *Liurai* were converted from kings to become the agents of the Portuguese government. Also selected by the Portuguese were a few *Liurai*, renamed *Dons* and put in charge of the other smaller groups of *Liurai* (Figure 9).

The addition of the Dons on top of the traditional political structure that existed prior to their arrival was the only change made by the Portuguese.

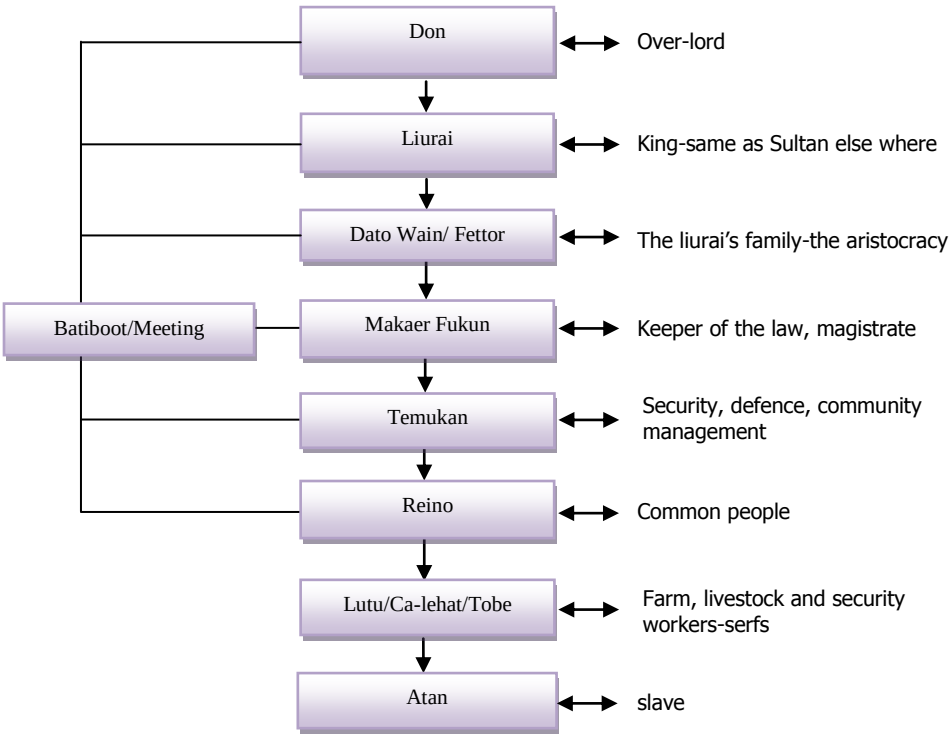


Figure 9. *Political structure during the Portuguese period*

D.2. Indonesian period (Integration period)

The Indonesians introduced elections – a new political system that was intended to sideline the traditional political system. *Liurai* were elected to the village political positions and so the people were able to maintain their traditional system up to the present, where it is still the basis of the traditional self-reliance system that still exists in most rural areas of Timor-Leste.

E. Socio-Demographics

E.1. Demography

Fishers are generally young with an average age of 38, and just over half (53%) of the fishing population fall below this age. They live most of their lives in the village (suco). Most (90%) of them are married with an average of 3.8 children. Of the three districts Dili (Atauro) has the lowest number of children (3.8) while Viqueque district has the highest (5.15)(Table 2). This may be explained by the higher number of households practicing family planning in Atauro, Dili (30%), but not among fishers in Viqueque (9%). It must be noted that most (72%) fishers do not practice family planning because of tradition and religion, among others. The average household size is 5.9. On the average, fishers only attain four years of formal education. In Viqueque district the fishers had the lowest educational attainment (3 years).

Most (62%) fishers are Protestants who mainly come from Atauro (Dili), followed by Catholics (35%) and Muslims (3%). In terms of ethnicity, 57% of the fishers are Tetum, 14% Macassae, 10% Kemak, and the rest are spread over eight other ethnicities in the districts.

Table 2. Selected Socio-demographic characteristic in three districts (Bobonaro, Dili and Viqueque)

Indicator	Bobonaro n =35	Dili n = 140	Viqueque n = 23	Total n =198
Average	34.17	40.05	33.4	38.3
Average year o residence	32.17	37.19	33	35
Civil status (%)				
Single	11	6	9	7
Married	86	91	91	90
Widower	3	3	0	3
Average number of Children	4.4	3.8	5.2	3.8
Average household size	5.9	5.9	6.2	5.9
Highest educational attainment	4.54	4.02	3.30	4.50
Religion				
Catholic	74	18	78	35
Protestant	26	77	22	62
Muslim	0	5	0	3

Source: FAO report on Socio-Economic issues in three districts selected survey (Bobonaro, Dili and Viqueque)

E.2. Occupation and income source

Job opportunities are few in the three districts (Dili, Bobonaro and Viqueque). In Bobonaro district, the major occupation of the coastal residents is limited to farming (75%) and fishing (25%). The same situation prevails in Atauro, Dili although the residents are equally engaged in fishing and agricultural activities. Thirty-two percent of the occupants, on other hand, claimed that job opportunities are neither good nor poor, and some fishers indicated that it was even good (25%) and very good. But 34% of fishers still maintained that there are few livelihood opportunities in their communities, particularly in Viqueque (57%).

Table 3 shows that fishing is the major occupation of most occupants (96%). The rest are in agriculture (3%) and labour (1%). Only two percent are fulltime fishers while the others have secondary jobs, primarily in agriculture (88%). The sometimes dangerous nature of fishing activities has resulted in the loss of lives in some families (7%). Yet, despite the risk 81% of those surveyed continue to fish. They considered the traditional aspect of fishing to be as valuable as the income they derived from it. Others claimed that they have no skill and lack the education to do other jobs. The new entrants (19%), however, were persuaded to start fishing due to the current increase in fish prices.

Of the ninety percent of fishers who are dependent on fishing, roughly 88% of their household income and 68% of their food comes from fish. The rest of the household income and food are derived from agriculture and other activities as well as money received outside of the household.

Table 3: *Major and secondary occupation*

Indicator	Bobonaro n=34		Dili n=140		Viqueque n=21*		Total n=195	
	f	%	f	%	f	%	f	%
A. Major Occupation								
Fishing	32	16	134	69	21	11	187	96
Agriculture	1	0,5	4	2	-	-	5	2,5
Labour	1	0,5	2	1	-	-	3	1,5
Total	34	17	140	72	21	21	195	100
B. Secondary								
Agriculture	27	14	126	65	17	9	170	88
Fishing	2	1	6	3	-		8	3,5
Employment	-	-	2	1	4	2	5	2,5
Labour	-	-	-	0,5	-	-	5	0,5
Business	3	1	-	-	-	-	2	1,5
Others	1	0,5	1	1,5	1	-	3	2
None	1	0,5	2	1			4	2
Total	34	17	140	72	21	11	195	100

(Source: FAO-*Socio-economic Issues in Timor-Leste Fishing Communities*)

E.3. Livelihoods in Timor-Leste Coastal Fisheries related with ATSEA

Timorese fishers are young and rely heavily on fishing as a source of income and food. The condition of fish resources is perceived to be good, but increased population puts pressure on the resource with new entrants to fisheries and the increasing demand for fish. Traditional and religious affiliations affecting family planning practices may be one of the limiting factors in curbing population growth. Moreover, lack of education and job opportunities within and outside the village limit the mobility of Timorese to explore other avenues to improve poor living conditions. Deforestation may have caused damage to potential natural resources due to negative flow on effects to the ecosystem.

Food production is inadequate to feed the population for certain months of the year in coastal villages. Malaria is common, occurring more than once a year per household. Sanitation is also poor and drinking water is inadequate in all coastal villages.

The 2004 census in Timor-Leste shows a 17.4% increase in population from the 2001 suco/village survey. It recorded a 16.4% increase in the total household. The population is young with 48%-50% being less than 16 years old, requiring more resources for education. It is generally recognized that unemployment, especially among the young, is one of the main problems of Timor-Leste.

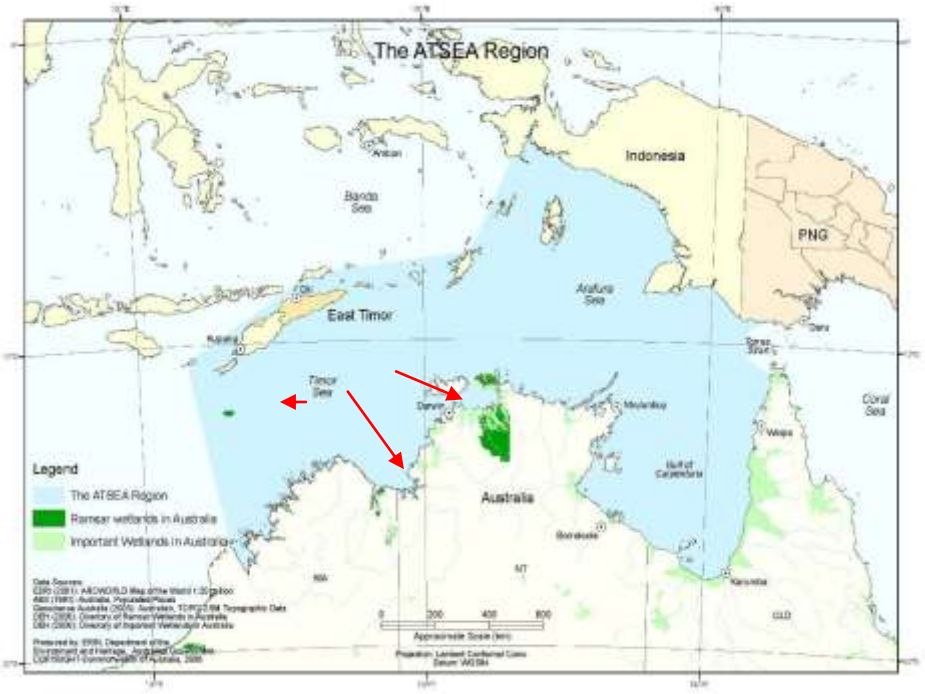


Figure 10. Timor-Leste and ATSEA

E.4. Coastal resource utilization

Figure 10 shows the geographic location of Timor Leste within the Arafura and Timor Seas Region. Timor-Leste has open access, multi species and multi gear fisheries. Generally, fishers use traditional methods with traditional management based on local regulation and controlled by village elders in some villages. It involves village feasting and public announcement of prohibition to the community in strategic locations (MAFF and OXFAM, 2004 *in* Baticados, 2005). The resource users are generally attached to coastal community fishing centers. Fishing centers are areas where fishers congregate and, to some extent, it also serves as a landing site. There are 151 fishing centers along the coast line and 4,964 fishers as of 2003 (Baticados, 2005). In organized centers, fishers agree on fish price and arrange for the traders to buy their catch. But in fishing centers that are not organized, there is a high level of competition in price levels and marketing for fish catch. Distribution of fishing centers and fishers is shown in Table 4.

Table 4. Distribution of fishing centers and fishers (adopted from Baticados, 2005)

District	Number of fishing centers	Number of fishers
Ainaro	2	25
Ambeno	13	370
Baucao	10	252
Bobonaro	11	315
Covalima	10	254
Dili		
Mainland	13	1527
Atauro island	18	512
Lautem	12	460
Liquica	31	541
Manufahi	5	121
Manatuto	18	370
Viqueque	8	217

E.4.1. Scale of operation and fishing income

Boat sizes, located in each district, range from 3m to 7m. In contrast, fishers have engines that range from a minimum of 3 Hp outboard engines to a maximum of 8 GT inboard engines. Table 5 shows that Dili district has the highest number of boats (989 units) followed by Bobonaro which has 330 boats, and Viqueque district which only has 92 boats. Viqueque fishers only use 8 HP (3) and 15 HP (19) outboard engines. In contrast, Dili fishers have engines that range from a minimum of 3 HP to maximum of 25 HP outboard engines. They also have inboards that have a minimum vessel capacity of 2 GT to a maximum of 8 GT. Bobonaro district has a total of 38 outboard and long tail engines.

Table 5. Type of boats and engines use in Bobonaro, Dili and Viqueque, MAP 2004

Indicator	Bobonaro	Dili	Viqueque
Boats without engine : Boat size :			
<3m	1	5	0
3-5 m	226	516	63
>5-7m	95	311	23
>7m	8	157	6
Total	330	989	92
Boats with engine : Outboard engine :			
3,3 HP	6	3	0
3,5 HP	0	2	0
8 HP	6	9	3
9,9 HP	1	1	0
10 HP	0	1	0
12 HP	0	1	0
15 HP	18	100	19
25 HP	0	8	0
Long tail :			
5 HP	0	2	0
5,5 HP	7	10	1
3,5 HP	0	1	0
In-board engine			
2 GT	0	7	0
5 GT	0	2	0
8 GT	0	2	0
20 GT	0	0	0
Total :	38	155	23

Figure 11 shows traditional boats used in Atauro/Dili.

Figure 11. Traditional boats used in Atauro/Dili and traditional fish landing site

E.4.2. Fish catch and fishing effort

Timorese fishers use more varied types of fishing gear; gill nets and hook line being the most common (Table 6). The spear gun is also popular among Atauro fishers. Fish catch also varies depending on the type of gear used. Thus more species are caught in Dili since the fishers in this district use many types of gear while the other two districts only use one or two types (Table 7).

Table 6. Types of fishing gear used in three districts (Bobonaro, Dili (Atauro) and Viqueque

Fishing gear	Bobonaro			Dili (Atauro)				Viqueque				Total	
	Number of user			Number of user				Number of user					
	Owned	%	Rented	Owned	%	Rented	%	Owned	%	Rented	%	Owned	Rented
Gill net	25	69	-	74	44	2	40	3	15	-	-	102	2
Fish trap	-	-	-	11	7	3	60	-	-	-	-	11	3
Crab pot	-	-	-	2	1	-	-	17	18	-	-	2	-
Hook and line	10	28	-	32	19	-	-	-	-	-	-	59	-
Spear gun	1	3	-	48	29	-	-	-	-	-	-	49	-
Total	36	100	0	167	100	5	100	20	100	0	0	223	5

Table 7. Types of fish caught per fishing gear by district:

Fishing Gear	Fish Catch		
	Districts		
	Bobonaro	Dili	Viqueque
Gill net	*Banyar/kakap merah (red snapper),Garopa (coral trout), kamera (red Emperor), coco (giant trevally), daun, (long tom), ikan manu (flying fish), Sardines, tengiri, kombong*	*Alualu (barracuda), atun (tuna), Banyar fatuk (fusilier), banyar Mutin (white snapper), bignangka (goat fish), bubara, coco (giant Trevally), comporlaya, buraka,daun (long tom), fatula, garopa (coral Trout), gurita (octopus), kakap, Kerbil, kamera (red emperor), ikan manu (flying fish), kafir (surgeonfish), tongkol (frigate mackerel),kalepa (butterfish), Karala, niru (blue tusk fish), kerapu (sea Bass), kitam, kompolaer,labul,lalusi,Sardines Lanjara (black marlin)*	*Tongkol (Spanish mackerel), sardines, Garopa toke (estuarine rockcod), Indian mackerel, coco (giant trevelly) Banyar (red snpper), kombong*
Hook & line		*Banyar (red snaper), tuna, boek fatuk, (lobster), burbara, buraka,ikan manu (flying fish), kombong, kamera (red emperor)*	
Crab pot		*Banyar mutin (white snpper), banyar (red snapper), kombong*	
Spear gun		*Banyar fatuk (red snapper), garopa (coral Trout),buraka,banyar (red emperor), coco (giant trevally), kerbil, gurita (octopus),ikan Manu (flying fish), kail, kerapu, (sea bass), Sardines, kitam,niru (blue tusk fish), salar, Kerbil, suntu (squid), kombong*	
Fish trap		*Atun (tuna),banyar (red snapper), boek Fatuk (lobster), lanjara (black marlin), Kerbil, garopa (coral trout), kerapu (sea bass), coco (giant trevelly), kombong*	

E.4.3. Marketing

Fish catch are sold fresh at the village, sub district and district levels. The fishing centers arrange the market with the traders who come from the district's capital. Fish price is agreed upon between the center and the trader. Trade brings in economic value to capital where fish price is high. Generally fishers complain of lack of cold storage, poor farm-to-market roads, increasing cost of fuel and lack of traders.

Table 8 shows a comparative estimate of a fisher's average annual income based on gear. Gill nets had mesh size varying from ¼ to 5.5 inches. The following assumptions were used in the calculation: 1) the cost of the fishing apparatus was already recovered; 2) fish consumed was deducted from the total catch; 3) labor paid/unpaid was estimated at $2 for 8 hours work.

Atauro fishers using gill nets have the highest estimated average annual income of $4,132, followed by Bobonaro district, $4,014 and Viqueque, $2,330. In Viqueque, fishers using hook and line ($2,588) earn more than those using gill net ($2,330). Within Atauro, Biqueli fishers have the highest estimated average annual income of $6,480 and the Makili the lowest, $2,070.

Table 8. Comparative estimated average annual income based on gear types by district:

Location	Fishing gear				
	Gill net (US$)	**Fish tarp (US$)**	**Crab pot (US$)**	**Hook & line (US$)**	**Spear gun (US$)**
A. Districts					
Bobonaro	4.014.36	-	-	-	-
Dili (Atauro)	4.132.53	617.10	794.10	501.17	713.26
Viqueque	2.330.83	-	-	2.588.61	-
B. Atauro					
Biqueli	6.480.43	-	-	1.153.30	906.10
Macadade	3.479.33	1.279.20	-	338.82	224.45
Maquili	2.079.61	4.93.45	794.10	-	680.27
Vila	3.023.35	-	-	-	928.27

E.4.4. Access to credit

Fishing cooperatives and local non-government organizations provide micro-financing to fishers in the form of loans for fishing gear or business capital in some districts. The fishers co-own the equipment and take turns in using it. Some of these loans are already fully paid while others have only paid a portion. Most fishers find it difficult to borrow money, particularly in localities where there is no existing organization or institution providing this type service.

E.4.5. Role of women in fisheries

Women's role in fisheries varies according to the local custom. In some villages in Timor-Leste, women serve as homemakers and their participation is confined to the preparation of meals. In other areas women mend nets and also carry the catch to the fishing center and are involved in the processing and selling of dried fish.

F. Coastal issues related with ATS

Table 9. Coastal issues

Issues	Development Needs
I. Resource-related	
A. Fish catch 1) Low technology and equipment 2) Lack skill to repair engine 3) Difficulty to identifying fishing ground 4) Poor condition upland forest resulting to siltation 5) No fish catch data to assess resource condition	Increasing capacity to deliver local fisherman Knowledge on skill
B. Market 1) No cold storage 2) No or limited fish traders in village level 3) Poor farm to market roads 4) Limited market 5) Lack of harbor to market fish catch	**Enforcement policy and regulation** by government
II. Community/household 1) Increasing population / new entrants to fishing 2) Limited education 3) None or limited job opportunity 4) Lack drinking water 5) Poor sanitation 6) Health problem 7) Low socioeconomic condition	To develop infrastructure to help stimulate the economy growth
III. Institutions and legal framework 1) Open access fishery 2) Limited regulation 3) Illegal Activities : ▪ Cut mangroves and other trees ▪ Incursion of commercial fishing vessels ▪ Trawl, fine mesh nets, bottom long line Operate within 200 m from the coastline ▪ Conflict Timorese and Indonesian fishers (contiguous coastline) 4) Lack skill to manage fishing centers 5) Fishing centers not organized	Improvement of capacity to increase of human Resource and create low and regulation

G. Socio-Economic Aspect and Following up Action

Important factors	Issue and obstacles	Possible path of solution		Work plan	
Complexity and lack of knowledge	National Unmanaged shifting from other activity to fishing	National Livelihoods alternative	Regional Provide socio Economic management	National Co-management system	Regional Regional cooperation on management system
Externalities					
Uncertainties	Lack of socio – economic	Need support and management	Need regional coordinator to	Socio economic co-management system	Capacity building on socio economic

Important factors	Issue and obstacles	Possible path of solution		Work plan	
	management strategy	strategy	provide assistance		
High demand for limited resources	Low access to market channels	No large company,	Open investment access	Strength low and regulation	Regional Cooperation on investment
Inappropriate incentives	- poorly structured on post harvest system	Re-structured on all levels	Provide technical assistance	Provide incentives to community to settle internal problems	Regional technical assistance
Poverty and lack of knowledge	Lack of alternative employment - resistance to change - coastal population growth - poor organization of fishers	Conduct social science research	Support of capacity building	Need regional technical assistance	Regional technical assistance

H. Gender Characteristics

According to the Timor-Leste 2004 Population and Housing Census Atlas produced by the National Statistic Directorate (2006) the number of males per 100 females in Timor-Leste ranges from 98 in sub district Iliomar-Lautem district to 120 in Dom Aleixo-Dili district. This means that there are 13% more females than males in Iliomar, Lautem and 20% more males than females in Dom Aleixo, Dili. The blue sub districts have sex ratios of 105 or more, indicating selective migration of males from eastern to central sub districts, especially Dili, in search of work and job opportunities.

H.1. Gender and Employment

The patriarchal culture that persists in Timor-Leste is reflected in the different roles and functions that men and women perform, and the unequal social status and conditions that they hold. Men and Women have unequal access to, and control of, basic services, goods, property and opportunities for participation in decision making processes.

A comparison of male and female employment patterns reveals some significant differences, particularly in the domestic and public sectors. Women represent 92% of the domestic labour while 72% of public sector jobs are held by males.

In the education sector, women and girls have fewer opportunities, as families prefer to invest in boys and men in hope of greater returns for the family. The pressure of domestic responsibilities also tends to contribute to high dropout rates of women and girls. In the health sector, Timor-Leste has one of the highest maternal mortality rates in the region and high fertility rates as a result of values associated with large families. Women are brought up to put the needs of their families and husbands before their own often resulting in significant levels of malnutrition in females.

These realities in the education and health sectors reinforce the marginal position that women have in economic and political spheres. The expanding practice of *barlake (bridge price)* is increasingly highlighted by women's organizations as the root cause of discrimination, persisting inequality and rising levels of domestic violence.

To overcome the persistent gender inequalities that exist in Timor-Leste, the Government is striving to build a society that enables both men and women to have equal access and control over goods, services and participation in decision-making processes across all sectors, to fulfil their potential and establish the foundation of economic growth and social well-being. The Government has re-affirmed its commitment to gender mainstreaming on many occasions, acknowledging that without redressing the inequalities that men and women face and the differential impact that policies have on women and men, economic growth and other national development goals will not be achieved.

Positive steps have been made towards gender mainstreaming in public policy and in forging a culture of equality in the Timorese society. Examples include the allocation of reserved seats for women in the Electoral Law about Heads of Suco and Suco Councils, gender training for policy directors, efforts to develop gender guidelines in key sectors and to draft laws concerning domestic violence. Despite these positive steps there is still some way to go in the effective implementation of gender mainstreaming.

In early 2008 an extensive exercise was undertaken by Rede Feto, the umbrella non-government organization in Timor-Leste on gender equality, to gather information on the implementation of the Platform for Action of the II National Women's Congress in 2004, and identify priorities for the Platform for Action of the III National Women's Congress 2008. The exercise identified obstacles to implementation and initiated discussions at the local level on current priority issues for women in Timor-Leste.

H.2. Legal and Regulatory Framework

Commitment to gender equality is explicit in the Timor-Leste Constitution (Article 17), which guarantees equal rights and responsibilities for women and men within the family, cultural, social, and economic life. The Constitution (Article 50) also guarantees protection against discrimination based on sex, as well as equality of rights and obligations in work and professional opportunities.

Timor-Leste ratified the Convention on the Elimination of all forms of Discrimination Against Women (CEDAW) in 2002, binding the Government of Timor-Leste to actively pursue policies and measures to eliminate discrimination against women, in all areas of public and private life, including the political sphere, legal framework, labour market, education and health sectors and land and property rights. Further, in 2008 Timor-Leste joined the UN's Global Call for Investment in Girls and Women, which aims to encourage the global community to re-define public investment policies and strategies.

In 2007, the new Government established the State Secretariat for the Promotion of Equality (SEPI) to respond to the demands for more attention to gender equality issues stated in the Second National Women's Congress of 2004. The SEPI builds on the experiences of the office for the promotion of Equality (OPE) established in 2002 and its predecessor, the Gender Affairs Unit, established during the United Nations Transitional Administration in East Timor (UNTAET).

In 2008, the Council of Ministers (CoM) approved the Organic Law for SEPI which set out a broader mandate and an extended administration structure to that of the previous OPE structure.

Five priority sectors were identified to promote the full participation of men and women in economic, social, political and cultural development including:

1. Promotion of a gender sensitive approach to the whole of government;
2. Commissioning of research to influence legislation, policies and programs;
3. Establishment of a network within government and civil society for dialogue and consultation to enhance the effectiveness of policies and programs;
4. Development and implementation of a communication strategy to improve understanding of gender issues across society
5. Development of the institutional capacity of SEPI to lead and support gender mainstreaming.

I. IUU Fishing

Illegal, Unregulated and Unreported (IUU) fishing occurs in Timor-Leste waters. This leads to a loss of local economic gain from fishing. It also acts to discourage foreign vessels from applying from fishing licences as their interest cannot be protected without an effective MCS system in Timor-Leste.

Maritime enforcement, particularly fisheries enforcement, is a complex and difficult task for a variety of reasons. The sheer extent of water under national jurisdiction often presents a massive task for government attempting to electively monitor and patrol in national waters. In many cases, a coastal state's exclusive economic zone (EEZ) is significantly larger than its landmass.

I.1. Actions

I.1.2. Regional cooperation in Arafura and Timor-Sea

Countries in the region should work together on compiling an overview of artisanal and industrial fishing and the current status of fish stocks, trade flows and markets.

I.1.3. Coastal State Measures

- Countries in the region should work together to improve data collection systems and to share information
- Countries in the region should work to develop a regional approach to identify, compile and exchange information on fishing operations and migration stocks in the region and straddling national jurisdictions.

I.1.4. Strengthening the Monitoring, Control and Surveillance (MCS) system

Countries should enter into appropriate sub-regional MCS arrangements to promote the elimination of IUU fishing within regions.

- Countries in the region should develop a regional MCS network to promote the sharing of information
- To coordinate regional activities to support the promotion of responsible fishing practices
- Undertake capacity building

J. Gaps and challenges

J.1. Policy and institutional gaps related to the sustainable management of the Arafura and Timor Seas

J.1.1. General Problems

The outlook for the environment sector in Timor-Leste remains bleak and the capacity to overcome the many existing problems is not very promising in the short to medium term. The common challenges within the environmental sector are outlined below:

1) General Environment
   - ❖ Lack of environment policy and climate change regulation.
   - ❖ Environmental laws and regulation are incomplete, and the enforcement of the existing environmental regulation and laws remain weak.
   - ❖ Limited financial support allocated to tackle environmental issues.
   - ❖ Extensive resource degrading human activities and their adverse impacts on environment quality such as shifting cultivation and fuel wood collection.
   - ❖ Lack of law and regulation implementation.
   - ❖ Lack of surveillance and law enforcement.
   - ❖ Application of technology that is not environmentally friendly.

2) Climate change
   - ❖ Lack of greenhouse gases inventory, limited climate and other meteorological data, and poor data collection tools and materials.
   - ❖ Limited human resources and expertise to deal with climate change impact assessment, vulnerability and adaption.
   - ❖ Education and public awareness on climate change related issues remains weak.
   - ❖ Lack of capacity in monitoring and evaluation of existing projects.
   - ❖ Research and systematic observation in development sectors related to climate change is non-existent and mitigation options in the area of renewable energy development are not broadly implemented in the country.

3) Concerted legal and technical efforts are needed to tackle the present massive deforestation which is leading to soil erosion, flood, drought and to poor water quality and availability as well as land degradation

4) Poor urban and rural sanitation poses serious problems, especially health risks, to the quality of life. Air and water pollution, solid waste and sewerage collection and treatment need urgent attention

K. The main issues and challenges related with Timor-Leste Policy Framework Development can be summarized as follows

- ❖ Limited human resources
- ❖ Number of staff on temporary appointments
- ❖ High centralized government function and financial management
- ❖ Lack of integrated legal management
- ❖ Lack of a coherent development policy in various levels
- ❖ Limited financial support
- ❖ Limited Law and Regulation

L. Recommendation on measures to address gaps and challenges

No	Institutions	Recommendations on Measures	Challenges
1	*Fisheries*	▪ Strengthen the Capacity of coastal fisheries management ▪ Strengthen MCS system ▪ Strengthen fisheries data collection systems ▪ Strengthen national fisheries statistical system	Lack of funding to institution, limited human resource, lack of effective governance and inadequate public awareness
2	*Environment*	▪ Strengthen capacity to answer resourcs management challenges ▪ Strengthen environmental management ▪ Strengthen environmental policy framework at national and local levels ▪ Strengthen cooperation with other stakeholders at national level and international level ▪ Reforestation	Limited human resources, lack of mechanism for management and lack of effective governance
3.	*Forestry*	▪ Strengthen framework at national level and district level ▪ Provide formal education ▪ Develop mechanism of forest management to control natural resources ▪ Support and management strategy ▪ Reforestation	Inadequate legal framework, limited human resources and lack of funding to institution
4.	*Tourism*	▪ Capacity building to support management challenges ▪ Strengtenh framework at national level and district level ▪ Effective governance at national and district levels to develop national policy and strategy	Inadequate legal framework

M. Recommendation on potential demonstration sites

1. The ATSEF project will be conducted in one or more districts in the south (Suai, Ainaro, Same, Viqueque, Lautem) and north coasts (Dili, Baucau, Manatuto, Liquiça, Bobonaro, Oecusse) of Timor-Leste. It assumes that fisheries and aquaculture can possibly be implemented in the south coast and north coast.
2. According to the Tourism Master Plan five districts have been identified as areas of tourism particularly marine tourism;
    a. Dili,
    b. Liquiça,
    c. Baucau,
    d. Lautem and
    e. Land tourism in Maubesse - Ainaro district.
3. The creation of tree nurseries, erosion prevention systems and balanced reforestation programmes are planned for all districts in Timor-Leste.
4. Potential to build on existing work of the FAO (2005-2008) in Timor-Leste to strengthen the capacity in fisheries information gathering for management projects. This project will be implemented around all district coastal fisheries. The project activities organized are designed to:
    - Create two MPA pilot projects of in two districts namely (Batugade MPA and Atauro MPA); both sites are located in the north coast of Timor-Leste. Use Marine Protected Areas as a tool for Fisheries Management for Timor-Leste.

- Harmonize and disseminate coastal fisheries management to coastal communities in 11 districts;
    1. Dili
    2. Lautem
    3. Bobonaro
    4. Liquiça
    5. Ainaro
    6. Baucau
    7. Manatuto
    8. Viqueque
    9. Oecusse
    10. Manufafi
    11. Covalima
- Provide information through the production of a bulletin for the local community for sharing information of fisheries development in the country.
- Organize training for District Fisheries Officers especially training on (1) Learning to lead, (2) Fisheries extention planning, (3) Basic fisheries statistics of data collection and analysis, (4) SWOT analysis, (5) Critical analysis of fisheries decree law and its implication for artisanal fisheries.

Tabulation of relevant importance factors of four components of the Policy Framework and Governance Institutions.

❖ Follow up Action:

Important factors	Issues and obstacles	Possible path of solution		Work plan	
		National	Regional	National	Regional
Complexity and lack of knowledge	- Low average education level - Limited shareholder knowledge	Transparency of decision making process	- Scale up knowledge - Common understanding problems	Set clear, practical achievable objectives and policies through stakeholder meetings	Formulate activities with regional stakeholders
Externalities	Weakness of regional cooperation	Participation of inter stakeholder working groups	Fishing rights, licence, territory, catch, capacity	Establish improved monitoring system	IUU Fishing summit
Uncertainties	Lack of effective governance	Improve existing regulation	Need integrative planning	National workshop to set up data and information	Formulation in Fisheries management plan
High demand for limited resources	- Unbalanced fishing pressure - High market demands	Provide fisheries management	Use high penalty to deter illegal fishing	Establish committees involving all user groups	Establish summit involving regional groups
Inappropriate incentives	Lack of mechanism for co-operation and coordination	Provide appropriate scheme incentives	Strengthen regional cooperation on mechanisms	- Economic diversification - local empowerment	Strengthen regional cooperation on incentives
Poverty and lack of alternatives	Lack of funding to institution	Provide appropriate technical assistance	Need regional assistance support	Strength of capacity building	Need regional capacity

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