



 UNOPS



# Transboundary Diagnostic Analysis

for the Arafura and Timor Seas Region

ATSEA Program | 2011

[www.atsea-program.org](http://www.atsea-program.org)



# **Transboundary Diagnostic Analysis for the Arafura and Timor Seas Region**

**Arafura Timor Seas Ecosystem Action  
Programme**



## Statement of Endorsement

The Project Board, with the following signatories, hereby endorse the ATSEA Transboundary Diagnostic Analysis (TDA) as presented at Canberra, Australia on 1 March 2012.

Country	Signature	Name	Agency
Australia		Mr. Travis Bover	Department of Sustainability, Environment, Water, Population and Communities
Indonesia		Mr. Purwanto	Agency for Marine and Fisheries Research and Development
Papua New Guinea		Mr. Andrew Taunega	National Fisheries Authority
Timor-Leste		Mr. Lourenco Borges Fontes	Ministry of Agriculture and Fisheries
UNDP		Mr. Jose Padilla	Asia-Pacific Regional Center
UNOPS		Mr. Uriel Heskia	International Waters Cluster



## **Citation details:**

ATSEA (2012). Transboundary Diagnostic Analysis for the Arafura and Timor Seas Region.

*Further information about this report can be obtained from Dr Tonny Wagey, [gabrielw@unops.org](mailto:gabrielw@unops.org), ATSEA Project Manager, Jl. Pasir Putih I, Ancol Timur, Jakarta Indonesia - 14430.*

Or visit [www.atsea-program.org](http://www.atsea-program.org)

## **Acknowledgements:**

The development of the TDA was funded by the GEF through UNDP with support of UNOPS. In compiling this report a number of individuals and organisations have provided in-kind support. We acknowledge the support from the following institutions: the Agency for Marine and Fisheries Research and Development of the Ministry of Marine Affairs and Fisheries of Indonesia, Indonesian Institute of Sciences (LIPI), Ministry of Agriculture and Fisheries of Timor-Leste, National Fisheries Authority (NFA) of Papua New Guinea, Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) of Australia, Charles Darwin University, and the Australian Institute of Marine Sciences (AIMS).

The authors would like to acknowledge the inputs from Indonesian, Australian, Papua New Guinean and Timor-Leste stakeholders who attended national and regional consultations and workshops during the development of this report during 2010 and 2011.

We would also like to thank ATSEA Focal Points from Indonesia, Timor-Leste, Papua New Guinea and Australia as well as the office of ATSEA Regional Project Management.

Special thanks to Drs. Anna Tengberg and Natasha Stacey for their untiring assistance and production of the final report.

Thanks to Dr. Dan Alongi for his valuable contributions in coordinating and authoring the biophysical profile for the TDA.

Thanks to members of the ATSEA National Inter-Ministerial Committees (NIMCs) and Regional Scientific Committee (RSC) for reviewing an earlier draft of this report and providing valuable inputs and direction.

Thanks to Johanna Karam for her assistance at the final stage of this report. Any errors are the responsibility of the authors.

The authors wish to dedicate this report to Joao Xavier Amaral from the Timor-Leste Ministry of Agriculture and Fisheries who sadly passed away during its writing.

## Disclaimer

*ATSEA has published the information contained in this publication to assist public knowledge and discussion and to help improve the sustainable management of the Arafura and Timor Seas. Where technical information has been prepared by or contributed by authors external to ATSEA, readers should contact the author(s), and conduct their own enquiries, before making use of that information. No person should act on the contents of this publication whether as to matters of fact or opinion or other content, without first obtaining specific independent professional advice which confirms the information contained within this publication.*

*While all reasonable efforts have been made to ensure that the information in this publication is correct, matters covered by the publication are subject to change.*

## CONTENTS

List of figures	iii
List of tables	iii
Abbreviations and acronyms	iv
Executive Summary	1
1 Introduction	5
1.1 Background to the ATS region, its global and regional significance	5
1.2 Structure of TDA	6
2 Methodology	7
2.1 Background	7
2.2 ATSEA TDA Methodology	7
2.2.1 Identification of the priority transboundary issues	8
2.2.2 Thematic Reports	9
2.2.3 Development of causal chains for the priority transboundary issues	9
2.2.4 Stakeholder analysis	10
3 Description of the ATS Region	11
3.1 Biophysical Characteristics	11
3.1.1 Biogeography and Large Marine Ecosystems	11
3.1.2 Physical Setting	11
3.1.3 Climate	12
3.1.4 Ocean Circulation	12
3.1.5 Diversity of Seascapes	15
3.1.6 Key Coastal Habitats	16
3.1.7 'Near-Pristine' Ecosystems	17
3.1.8 Global Stronghold for Marine Species	18
3.1.9 Ecological Connectivity	18
3.2 Socio-economic characteristics	19
3.2.1 ATS Region Government Administration	19
3.2.2 Demography	20
3.2.3 Language, Religion, Culture and Social Structure	20
3.2.4 Social and Economic Indicators	20
3.2.5 Economy, Employment and Income	22
3.2.6 Infrastructure and services	23
3.3 Socio-Economic Sectors	23
3.3.1 Capture Fisheries	24
3.3.2 Aquaculture	27
3.3.3 Mining	28
3.3.4 Oil and Gas Exploration and Production	29
3.3.5 Shipping and Ports	30
3.3.6 Marine Tourism	30
3.3.7 Agriculture	31
3.4 Legal and Institutional Setting	32
3.4.1 International law framework	32
3.4.2 Regional policy framework	35
3.4.3 National legislation, policies and institutions	40

<b>4</b>	<b>Priority transboundary problems</b>	<b>51</b>
4.1	Unsustainable fisheries and decline and loss of living coastal and marine resources	51
4.1.1	Description of the problem and justification of its transboundary importance	51
4.1.2	Impacts on ecosystem services and human well-being	52
4.1.3	Causal-chain analysis of direct and indirect drivers	52
4.1.4	Summary and recommendations, including potential short to medium term interventions	52
4.2	Modification, degradation and loss of coastal and marine habitats	55
4.2.1	Description of the problem and justification of its transboundary importance	55
4.2.2	Impacts on ecosystem services and human well-being	56
4.2.3	Causal-chain analysis of direct and indirect drivers	56
4.2.4	Summary and recommendations, including potential short to medium interventions	56
4.3	Marine and land-based pollution (e.g. marine debris, sediments, oil spills)	59
4.3.1	Description of the problem and a justification of its transboundary importance	59
4.3.2	Impacts on ecosystem services and human well-being	61
4.3.3	Causal-chain analysis of direct and indirect drivers	61
4.3.4	Summary and recommendations, including potential short to medium interventions	61
4.4	Decline and loss of biodiversity and key marine species	64
4.4.1	Description of the problem and justification of its transboundary importance	64
4.4.2	Impacts on ecosystem services and human well-being	64
4.4.3	Causal-chain analysis of direct and indirect drivers	65
4.4.4	Summary and recommendations, including potential short to medium term interventions	65
4.5	Impacts of Climate change	68
4.5.1	Description of the problem and justification of its transboundary importance	68
4.5.2	Impacts on ecosystem services and human well-being	69
4.5.3	Causal-chain analysis of direct and indirect drivers	70
4.5.4	Summary and recommendations, including potential short to medium interventions	70
<b>5</b>	<b>Stakeholder analysis</b>	<b>73</b>
5.1	Introduction to Stakeholder Analysis	73
5.2	Stakeholder Consultations prior to and during development of the TDA	73
5.2.1	Stakeholder Engagement Group	73
5.3	ATSEA Project Stakeholders	74
5.3.1	International stakeholders	74
5.3.2	Regional stakeholders	75
5.3.3	National stakeholders	76
5.3.4	Local stakeholders	80
5.4	Stakeholder Groups According to Priority Environmental Concerns	82
5.5	Recommendations	85
<b>6</b>	<b>Overall conclusions and recommendations</b>	<b>85</b>
6.1	Conclusions	85
6.2	Possible options for priority actions for the Strategic Action Program	86
<b>7</b>	<b>References</b>	<b>90</b>
<b>8</b>	<b>Annexes</b>	<b>97</b>

## LIST OF FIGURES

---

Figure 1: The Arafura and Timor Seas region, showing provinces in Indonesia and PNG and State boundaries in Australia.....	6
Figure 2: Millennium Ecosystem Assessment Framework (MA, 2005). The strategies and interventions in the MA framework are analogous to the actions recommended by the TDA for use in the development of the SAP .....	8
Figure 3: Diagram of Pacific to Indian Ocean Throughflow, northwest monsoon and Gulf of Carpentaria circulation pattern during the northwest monsoon.....	13
Figure 4: Seasonally averaged winds in the North West Marine Region at a height of 10 m above mean sea level during January, March, May, July, September, and November. ....	15
Figure 5: Sediment discharge (106 t yr <sup>-1</sup> ) from islands in the ATS region.....	19

## LIST OF TABLES

---

Table 1: Per capita consumption of fish and fisheries product, 2007 (FAO 2010a).....	24
Table 2: Number of fishers, total reported catch and reported value of catches across the ATS (2009).....	25
Table 3: International organisations engaged in ATSEA Programme.....	74
Table 4: Regional bodies engaged in ATSEA Programme.....	75
Table 5: Indonesian national agencies engaged in ATSEA Programme .....	76
Table 6: Timor-Leste agencies engaged in ATSEA Programme .....	78
Table 7: Australian national agencies engaged in ATSEA Programme.....	79
Table 8: Provincial and local-level governments in ATS region (excluding Australia).....	81



## ABBREVIATIONS AND ACRONYMS

---

ACIAR	Australian Centre for International Agricultural Research
ADB	Asian Development Bank
AFMA	Australian Fisheries Management Authority
AFZ	Australian Fishing Zone
AIMS	Australian Institute of Marine Science
AMFRD	Agency for Marine & Fisheries Research and Development (of MMAF – Indonesia)
ANU	The Australian National University
APEC	Asia Pacific Economic Cooperation
ATS	Arafura & Timor Seas
ATSEA	Arafura & Timor Seas Ecosystem Action Program
ATSEF	Arafura & Timor Seas Expert Forum
BPS	BPS-Statistics Indonesia
CCA	Causal Chain Analysis
CDU	Charles Darwin University
CI	Conservation International
CTI	Coral Triangle Initiative on Coral Reefs, Fisheries and Food Security
CSIRO	Commonwealth Scientific and Industrial Research Organization
DAFF	Department of Agriculture, Fisheries and Forestry (Australia)
DSEWPAC	Department of Sustainability, Environment, Water, Population and Communities (Australia) (previously named DEWHA)
DGCF	Directorate General of Capture Fisheries
EEZ	Exclusive Economic Zone
FAO	Food and Agriculture Organisation of the United Nations
FSP	Full Scale Project (of GEF)
GEF	Global Environment Facility
ILO	International Labour Organization
IMO	International Maritime Organization
IUCN	International Union for Conservation of Nature
IUU	Illegal, Unregulated and Unreported (fishing)
IS-LME	Indonesian Seas Large Marine Ecosystem
IWP	International Waters Programme
JCU	James Cook University
LIPI	Indonesian Institute of Sciences
MCS	Monitoring, Control and Surveillance (MCS)
MMAF	Ministry of Maritime Affairs and Fisheries (Indonesia)
MED	Ministry of Economy and Development (Timor-Leste)
MOU	1974 Memorandum of Understanding Between Australia and Indonesia
MPA	Marine Protected Area
NAILSMA	North Australian Indigenous Land and Sea Management Alliance

NAP	National Action Programme
NAS-LME	Northern Australia Large Marine Ecosystem
NDE	National Directorate of Environment (Timor-Leste)
NFA	National Fisheries Authority (PNG)
NGO	Non-Government Organization
NRETAS	Northern Territory Department of Natural Resources, Environment, The Arts and Sport
NRI	National Research Institute (PNG)
NRM	Natural Resource Management
NT	Northern Territory
NTT	East Nusa Tenggara
PNG	Papua New Guinea
PPG	Project Preparation Grant
RFLP	Regional Fisheries Livelihood Program
QLD	Queensland (Australia)
SAP	Strategic Action Programme
SEG	Stakeholder Engagement Group
SLA	Sustainable Livelihoods Analysis
SST	Sea Surface Temperature
TDA	Transboundary Diagnostic Analysis
TNC	The Nature Conservancy
TTG	Technical Task Group
UNDP	United Nations Development Programme
UNICEF	United Nations Children's Fund
UNOPS	United Nations Office for Project Services
UQ	University of Queensland
WA	Western Australia
WFP	World Food Programme
WGMAF	Working Group Marine Affairs and Fisheries
WWF	World Wide Fund for Nature

---

## EXECUTIVE SUMMARY

---

### **Major geographical features of the Arafura Timor Seas region**

The warm tropical Arafura and Timor Seas (ATS) are crucial globally, linking the Indian and Pacific Oceans and playing an important role in global ocean circulation. The world's climate is also greatly influenced by the El Niño-Southern Oscillation (ENSO) phenomenon and the Indian Pacific Warm Pool that exists in these seas. At the regional scale, the ecosystems of both seas play an important economic and ecological role in the four littoral nations bordering the Arafura and Timor Sea: Indonesia, Timor-Leste, Australia, and Papua New Guinea.

The ATS region is extremely rich in living and non-living marine resources, including major fisheries and oil and gas reserves. Significantly, the ATS region exhibits high productivity that sustains both small- and large-scale fisheries, including several high-value, shared trans-boundary fish stocks. These fisheries provide livelihoods for millions of people in the region, and make a significant contribution to food security for both regional coastal communities and populations and also, large populations in export market countries to the north, including China. The region is adjacent to the Coral Triangle which is considered to house the world's highest marine biodiversity. These seas contain the most pristine and some of the most highly threatened coastal and marine ecosystems in the world, underscoring the urgent need for trans-boundary management.

### **Objectives**

The overall objective of the ATS Transboundary Diagnostic Analysis (TDA) was to identify transboundary priority environmental concerns, their direct and indirect drivers, and impacts on ecosystem services and human well-being. With the TDA as the basis, the objective was also to present practical and implementable proposals for consideration during development of the ATS Strategic Action Programme (SAP).

### **Methodology**

A TDA is a widely-used tool within GEF International Waters Projects. The TDA is an objective assessment and not a negotiated document. It uses the best available verified scientific information to examine the state of the environment, and the root causes/drivers for its degradation. The TDA methodology used for the ATSEA Programme follows GEF International Waters best practice guidance, which has been combined with the ecosystem services framework developed by the Millennium Ecosystem Assessment that links environmental degradation to loss of ecosystem services and impacts on human well-being.

The TDA Technical Task Group (TTG) established by the ATSEA Programme and comprised of biophysical and socio-economic experts from the ATS littoral countries, brainstormed the list of five priority transboundary problems. Three Thematic Reports were developed by the TTG and project team and included a biophysical profile, a socio-economic profile, and a review of the legal and institutional framework for the management of the ATS at regional and national level. In addition, a stakeholder analysis was performed to identify core and general stakeholders.

### Priority environmental concerns

The TDA identified the following transboundary environmental concerns:

1. Unsustainable fisheries and decline and loss of living coastal and marine resources;
2. Decline and loss of biodiversity and key marine species;
3. Modification, degradation and loss of coastal and marine habitats;
4. Marine and land-based pollution, and
5. Impacts of climate change.

Poorly managed or unmanaged extraction of fish, prawns and other biota, coupled with other pressures such as pollution and disease, has led to overexploitation and, in many instances, to a decline in living resources within some areas of the Arafura and Timor Seas. The fisheries of the Indonesian Sea large marine ecosystem (LME) are very complex and diverse, reflecting the region's extraordinarily heterogeneous geography and species richness. While small-scale fishing predominates in the ATS region of the Indonesian LME industrial fisheries contribute considerably more in terms of economic value since they target high-value shrimp and demersal fish species. Reef fisheries are important to subsistence and artisanal fishers in some parts of the region.

Modification of coastal habitats has resulted in major changes in population structure as well as functional group composition, notably on coral reefs, and massive changes in ecosystem services of coral reefs, seagrass beds and mangroves. For instance, the important nursery and feeding ground role of mangroves as well as seagrass beds for fish and marine mammals have been lost over extensive areas. Habitat modification and loss have also contributed to the decline in populations of marine mammals such as dugong. Habitat degradation has significant trans-boundary implications in terms of reduced fish recruitment and impacts on migratory species as well as on biodiversity throughout the region.

Due to the lack of major urban settlements in the ATS region, major marine and land-based pollution impacts are largely localized and confined to coastal mining activities, poor catchment practices, offshore oil/gas exploration, and the effects of fisheries (e.g., marine debris, discarded fishing nets). The coastal and marine ecosystems of northern Australia are regarded as intact, containing some of the most pristine ecosystems in the world, due principally to low human population density. In contrast, the Indonesian Sea LME is polluted in many coastal areas.

Unsustainable direct harvesting and also indirect harvesting (via fisheries by-catch) is having a significant impact on populations of key marine species in the ATS region, particularly globally threatened coastal marine megafauna including migratory, rare, and threatened species (i.e. turtles, dugongs, seabirds/shorebirds, sea snakes, cetaceans, sharks and rays). The area encompassing northern Australia, Papua New Guinea and eastern Indonesia supports significant direct harvest of green turtles, and currently represents a significant threat to the conservation of Australian green turtle stocks. In Timor-Leste, illegal turtle harvesting for meat and shell remains a major issue. Populations of hawksbill turtle face major threats from direct harvest particularly in Papua New Guinea, with the northeast Australian hawksbill turtle stock in decline.

Low profile coasts, shallow continental shelves and macro-tidal conditions mean that the coastal and marine environments of the ATS region are particularly vulnerable to the impacts of climate change. By 2100, sea-level is projected to rise by between 18 and 59 cm. In the coast of West Papua, trend in sea level rise has been predicted to be between 0.75 - 0.765 cm/year. Such a rise in sea level is expected to increase the salinity of coastal groundwater as aquifers are affected by salt water intrusion. The low-lying coastal ecosystems of Northern Australia, such as mangroves and other wetlands, may be

particularly vulnerable to climate change. The interactive effects of rise in sea-level and cyclonic intensity, increased coastal inundation and storm surges may result in these ecosystems either retreating landwards as sea-level rises or disappearing if inundation is rapid and coastal relief is low. Predicted rises in sea-level up to nearly 80cm by the end of the century will impact rocky intertidal, mud- and sand-flats, coral reef, seagrass and mangrove communities.

### **Possible options for actions in key sectors**

Based on the causal-chain analysis of sectoral drivers of environmental degradation in the ATS, possible options for actions in key sectors were identified. Key direct drivers of many of the priority environmental concerns included unsustainable fishing practices, oils spills and land-based pollution, coastal development, unsustainable agricultural practices and deforestation. Key indirect drivers included lack of regulations, compliance and enforcement, overlapping mandates between sectors, low public awareness, and lack of livelihood alternatives. Possible actions to address the transboundary environmental concerns are below. They do not prejudge the outcomes of SAP development, nor will SAP development consider only the options presented here.

#### **1. Unsustainable fisheries, decline and loss of living coastal and marine resources**

- Strengthen joint action by member countries in the ATS region through various initiatives, such as RPOA to control Illegal, Unreported and Unregulated (IUU) and destructive fishing, to reduce fishing over-capacity, and strengthen the legal and regulatory framework and enforcement in the fisheries sector at regional and national levels.
- In addition, explore options for training and capacity building to be conducted since they are crucial for effective functioning.

#### **2. Modification, degradation and loss of coastal and marine habitats**

- Building assessment of the status of critical habitat and nurseries, such as mangrove, coastline, wetland and coral reefs in the ATS region, and on collaborative restoration of degraded habitats.
- Explore market-based approaches, such as supply-chain certification, and fair trade.
- This action could also include awareness raising, increased education and communication regarding current threats affecting coral reefs and the urgent need to protect them, as well as the importance of sustainable fishing practices.
- Actions should involve empowering local communities to manage the coastal ecosystem in a sustainable manner through strengthening of management and conservation efforts, support for livelihoods and implementation of awareness programmes.

#### **3. Marine and land-based pollution**

- Building commitment through national and regional public awareness and clean-up campaigns.
- Explore Regulatory Reform through coordination of policies and legislation across sectors at national and regional levels.

- Explore the potential for Public Private Partnerships (PPPs) on integrated coastal management (ICM) and exploring the possibility of PPPs to engage the private sector in ICM for activities such as sewage treatment.
- Where effective customary marine tenure regimes exist, and have local support small-scale fisheries for livelihood, poverty alleviation and food security outcomes through appropriate rights-based schemes for small-scale coastal fisheries should be supported.

#### **4. Decline and loss of biodiversity and key marine species**

- Promote regional alignment of national and local plans and actions to conserve biodiversity.
- Among other things, this could focus on exploring options for the establishment of a regional network of Marine Protected Area (MPAs), which may include natural heritage, cultural heritage and sustainable production areas. This could include projects to determine the potential for eco-tourism as well as for participatory conservation monitoring in ATS region.

#### **5. Impacts of climate change**

- Development and implementation of ‘no regrets’ adaptation strategies for the ATS region:
  - Ecosystem-based strategies, which aim to promote the adaptive capacity and resilience of ecosystems
  - Community-based strategies which aim to enhance the adaptive capacity of communities most vulnerable to climate change
  - Adaptive co-management strategies which integrate experimentation, monitoring and learning with livelihoods, governance and funding structures.

Possible cross-cutting actions which will be considered further during the development of the SAP include:

##### **1. Institutional arrangements and capacity building**

- Rebuilding the depleted shared fish stocks, restoring habitats, preventing pollution, conserving marine biodiversity and developing adaptation measures at regional scale.
- Regional transboundary fish stocks and ecosystem assessment including environmental changes. The implementation of this action could involve the national focal institutions in all member countries through joint survey and assessments of key and non-targeted species.
- Regional monitoring of economic valuation to support achieving the objectives of recovering and sustaining depleted fisheries; restoring degraded habitats and protecting threatened key marine species, and reducing land and marine based pollution. This valuation may be important to understand the total value of the ecosystem services and their contribution to the livelihoods of the coastal communities in the ATS region.
- A regional network of institutions engaged in community mobilisation and empowerment endeavours to support coastal livelihoods improvement through development of mariculture/aquaculture, fisheries post-harvest technology, training and extension programmes, and development of community-based management.

## 2. Regional level policy and governance

- A Regional Mariculture policy has considerable potential for expansion of species such as seaweed. It is important to understand the negative impacts of its development and the regional policy framework could assure proper development of mariculture and coordinate national policies of ATS countries to minimise negative economic and environmental impacts.
- Work towards regional coordination of policies and legal frameworks for biodiversity conservation and on regional priority areas for protection. This could encourage the establishment of Marine Protection Areas and implementation of national policies on designated protected areas and other conservation measures. It could also contribute to common achievable goals related to habitat restoration and conservation of biodiversity and key marine species in the region.
- Work with ATS members to build on the reports *Framework for Model Fisheries Legislation in South East Asia* (2010) for all ATS countries (reports available at [www.rpoa.sec.kkp.go.id](http://www.rpoa.sec.kkp.go.id)).
- Benefits from local stewardship should flow to the local communities through strengthening the legal and institutional arrangements.

# 1 INTRODUCTION

---

## 1.1 Background to the ATS region, its global and regional significance

The warm tropical Arafura and Timor Seas (ATS) are crucial globally, linking the Indian and Pacific Oceans and playing an important role in global ocean circulation (Meyers 1996, De Deckker et al. 2003). The world's climate is also greatly influenced by the El Nino-Southern Oscillation (ENSO) phenomenon and the Indian Pacific Warm Pool (Cai et al. 2005, Zhong et al. 2005, Kug et al. 2006, De Deckker et al. 2003) that exists in these seas. At the regional scale, the ecosystems of both seas play an important economic and ecological role in the four littoral nations bordering the Arafura and Timor Sea: Indonesia, Timor-Leste, Australia, and Papua New Guinea.

The ATS region is extremely rich in living and non-living marine resources, including major fisheries and oil and gas reserves. Significantly, the ATS region exhibits high productivity that sustains both small- and large-scale fisheries, including several high-value, shared trans-boundary fish stocks (Zijlstra & Baars 1990, Blaber et al. 2005, Ovenden et al. 2009). These fisheries provide livelihoods for millions of people in the region, and make a significant contribution to food security (in the form of protein and micronutrients) for both regional coastal communities and populations and also, large populations in export market countries to the north, including China (Dalzell & Pauly 1990, Field et al. 2009).

The majority of the maritime boundaries between Australia, Indonesia, Timor-Leste and Papua New Guinea fall within the ATS region and provide important shipping routes, particularly connecting some Australian ports to Southeast and Northeast Asian ports and the northern Pacific Ocean. With this dependence and importance of the living and non-living resources of these two semi-enclosed seas, the sustainability and effective trans-boundary, regional management of these 'shared seas' remain critical priorities for the four nations bordering this region (Morrison & Delaney 1996, UNEP 2005). The region is adjacent to the Coral Triangle which is considered to house the world's highest marine biodiversity.

These seas contain the most pristine and some of the most highly threatened coastal and marine ecosystems in the world (Halpern et al. 2008, Tun et al. 2008, Burke et al. 2011), underscoring the urgent need for trans-boundary management.



Figure 1: The Arafura and Timor Seas region, showing provinces in Indonesia and PNG and State boundaries in Australia.

## 1.2 Structure of TDA

The purpose of this Regional Transboundary Diagnostic Analysis is to provide an overview of five priority transboundary issues (i.e. unsustainable fisheries, habitat degradation, pollution, loss of biodiversity and impacts of climate change) and their impacts on ecosystem services and human well-being in the Arafura and Timor Seas region. The TDA identifies the key drivers of environmental degradation and links them to their causal sectors. The purpose is to provide sufficient levels of detail to give confidence in the analyses and recommendations for the future Strategic Action Programme (SAP) to be developed for the ATS. The Regional TDA is provided in the following format:

- Section 2 - Methodology: provides an explanation of the approach adopted for collecting information, analysing it and assessing the situation in the ATS including governance and stakeholder analysis.
- Section 3 - Description of the ATS region: provides a summary of the common features across the ATS, including biophysical and socio-economic characteristics of the ATS. An assessment of the regional ocean governance arrangements in the ATS is also included.
- Section 4 - The five ATS priority transboundary problems are described and analysed with an assessment of the impacts on ecosystem services and human well-being. A causal-chain analysis is presented with identification of the direct and indirect drivers of environmental degradation by key sector. Finally a summary and recommendations that



will inform the SAP development and demonstration projects are presented, including identification of potential short to medium term interventions.

- Section 5 – Assessment of Stakeholders: provides a summary of the key stakeholders engaged in ATSEA at different levels and categories for the ATS region environmental concerns.
- Section 6 – Overall conclusions and recommendations, including potential actions for the ATSEA SAP.
- References – An extensive list of publications is included providing further details and evidence of the conclusions summarised here based on three technical reports (Alongi 2011, ATSEA 2012, Stacey et al. 2011).
- Annexes

## 2 METHODOLOGY

---

### 2.1 Background

A TDA is a widely-used tool within GEF International Waters Projects. The TDA is an objective assessment and not a negotiated document. It uses the best available verified scientific information to examine the state of the environment, and the root causes/drivers for its degradation. It focuses on transboundary problems without ignoring national concerns and priorities and identifies information gaps, policy distortions and institutional deficiencies.

The TDA provides the technical and scientific basis for the logical development of a Strategic Action Programme (SAP) that is based on a reasoned, holistic and multi-sectoral consideration of the problems associated with the state of and threats to transboundary water systems and resources. The SAP embodies specific actions (policy, legal, institutional reforms or investments) that can be adopted nationally, usually within a harmonized multinational context, to address the major priority transboundary concerns, and over the longer term restore or protect a specific body of water or transboundary ecosystem. A TDA is also a valuable process for multilateral exchanges of perspectives and stakeholder consultation as a precursor to the eventual formulation of a SAP.

### 2.2 ATSEA TDA Methodology

The TDA methodology used for the ATSEA Programme follows GEF IW best practice guidance<sup>1</sup>, which has been combined with the ecosystem services framework developed by the Millennium Ecosystem Assessment (MA 2005) that links environmental degradation to loss of ecosystem services and impacts on human well-being (see Figure 2). The methodology thus consists of the following steps:

- Identification and initial prioritisation of transboundary problems
- Gathering and interpreting information on impacts on ecosystem services and human well-being of each problem
- Causal-chain analysis based on the MA framework that identifies direct and indirect drivers of loss of ecosystem services
- Completion of an analysis of institutions, laws, policies and projected investments.

---

<sup>1</sup><http://iwlearn.net/>

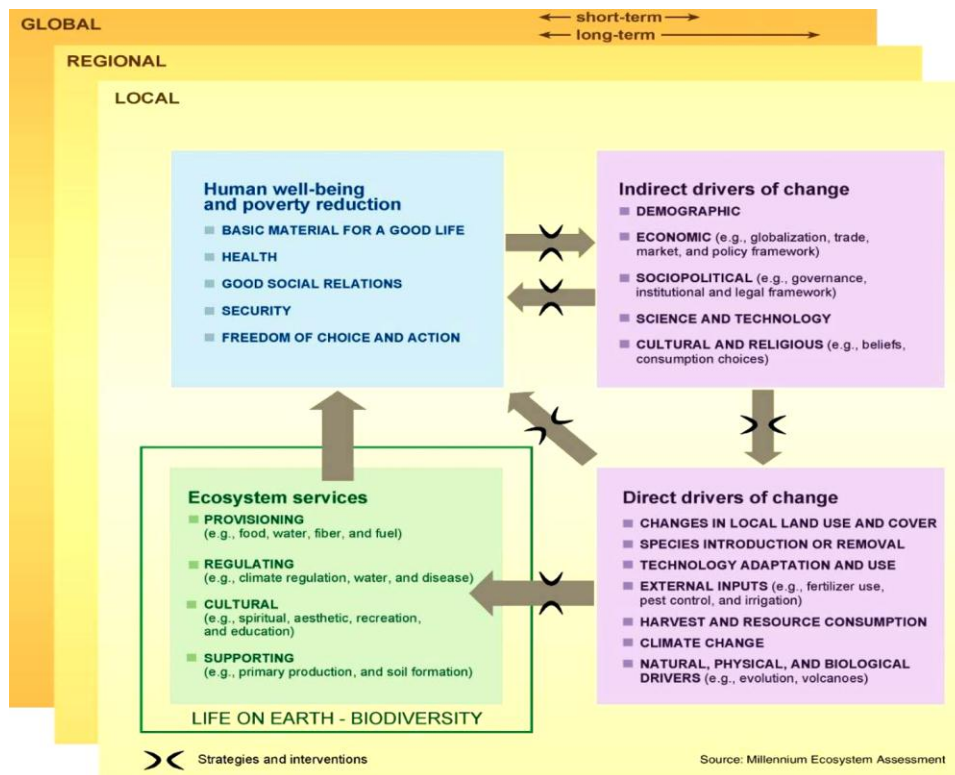


Figure 2: Millennium Ecosystem Assessment Framework (MA, 2005). The strategies and interventions in the MA framework are analogous to the actions recommended by the TDA for use in the development of the SAP

### 2.2.1 Identification of the priority transboundary issues

The first step in the TDA process was to agree on the transboundary problems. The initial stakeholder consultations and Preliminary Transboundary Diagnostic Analysis in the Project preparation phase had highlighted the main problems, but the TDA Technical Task Group (TTG) revisited them to agree on whether or not the list was complete, examine their transboundary relevance, determine preliminary priorities and examine the scope of each (list of TTG members is provided in Annex 2).

The TTG, established by the ATSEA Programme and comprised biophysical and socio-economic experts from the ATSEA littoral countries, brainstormed the list of five priority transboundary problems (see Box 1) in order to determine their significance and transboundary nature in the context of the ATSEA Region.

Box 1: Priority transboundary issues in the ATSEA (Alongi 2011)<sup>2</sup>

Priority Environmental Concerns	Key Causal Factors
1. Unsustainable fisheries & decline & loss of living coastal & marine resources	illegal, unreported and unregulated fishing; overexploitation; unsustainable practices; fisheries by-catch
2. Modification, degradation & loss of coastal & marine habitats	coastal development, bottom trawling, fuel wood (mangroves), dynamite fishing, pollution (sediments)
3. Marine & land-based pollution (e.g. marine debris, sediments, oil spills)	Coastal development (nutrients, sediments), mining (sediments, toxicants), land degradation (sediments), oil spills, marine debris
4. Decline & loss of biodiversity & key marine species	illegal harvesting, traditional indigenous harvest, fisheries by-catch (ghost nets, trawling, long-lines), habitat loss
5. Impacts of climate change including ocean warming and ocean acidification	Fossil fuel-based global energy consumption, land use, Land use change and forestry

## 2.2.2 Thematic Reports

Three Thematic Reports were developed by the TTG's and project team. The list of the Thematic Reports is shown below:

1. Biophysical Profile of the Arafura-Timor Seas (Alongi 2011)
2. Socio-economic Profile of the Arafura-Timor Seas (Stacey et al. 2011)
3. Legal and institutional framework for the management of ATS at regional and national level (ATSEA, 2012)

Each review and report used a similar structure and identified any gaps in knowledge; the impacts on ecosystem services and human well-being; the direct and indirect drivers of the impacts; and listed proposed options for addressing the identified problems. Consequently, the Thematic Reports constitute the main sources of information for the TDA.

## 2.2.3 Development of causal chains for the priority transboundary issues

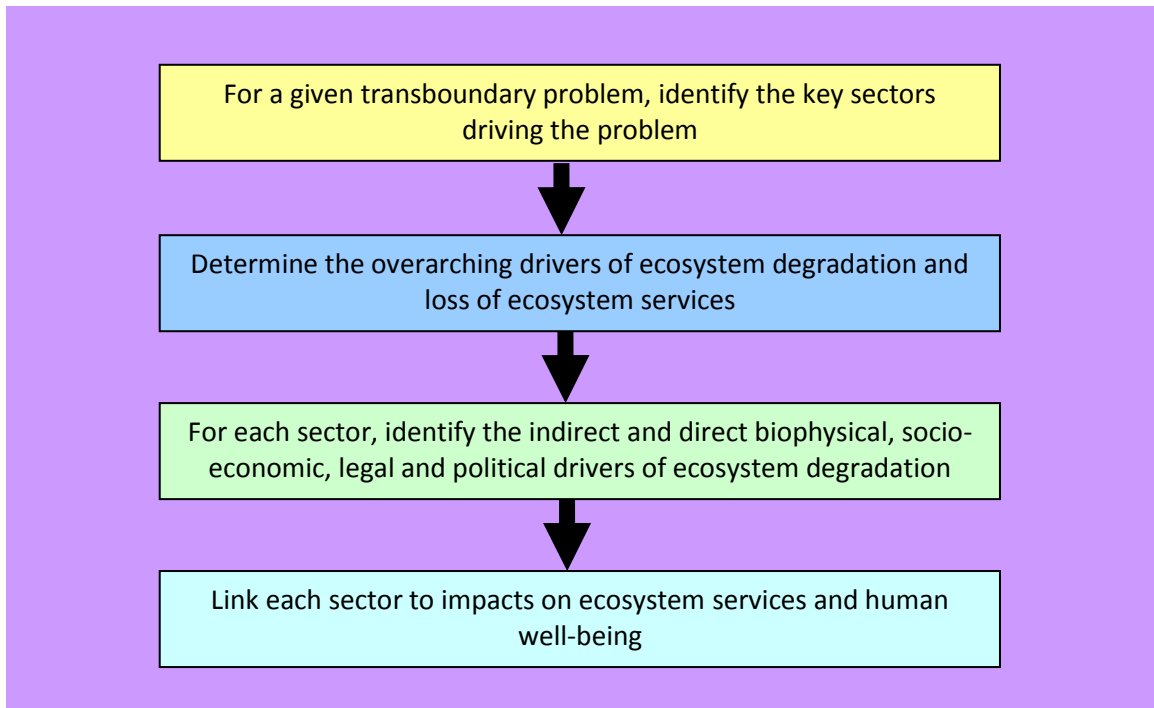
As part of the TDA, a Causal Chain Analysis (CCA) was conducted to identify the direct and indirect drivers of the priority transboundary problems and their impacts in the ATS. The CCA can also be used to identify possible future corrective actions.

The CCA methodology developed for this TDA was based on a combination of the approach used by the Global International Waters Assessment (GIWA) and the Orange-Senqu TDA and the Millennium Ecosystem Assessment (GIWA 2002, MA 2005, ORASECOM 2008). The methodology aims to link the sectors and drivers of transboundary problems with the impacts of the problem on ecosystem services and human well-being. The advantage of this approach is that it aids in the identification of well-targeted interventions that can address

<sup>2</sup> Table is an outcome from the 2<sup>nd</sup> TDA Technical Meeting, Dili, March 2011

both institutional and technical solutions to the problems. A step by step guide to the process is shown in Box 2 below.

*Box 2: Stepwise sectoral analysis approach to developing a causal chain.*



The CCA was coupled with a priority setting exercise that used the methodology developed by GIWA, for prioritization of main issues, sectors and impact on ecosystem services was provided (see Annex 1). Establishing priorities for actions implies not only an assessment of the severity of the problems, but also an analysis of what can be done to solve and mitigate these problems in each sector, and how to target them by appropriate policy measures. By understanding the linkages between the problems that are affecting the coastal and marine environment of the ATS and their direct and indirect drivers, decision-makers and policy-makers will be better positioned to support sustainable and cost-effective interventions.

#### 2.2.4 Stakeholder analysis

The compilation of a TDA requires a Stakeholder Analysis based on GEF International Water Projects Best Practices. The initial analysis of stakeholder engagement was performed during the Project preparation phase. Input to this analysis was provided through Stakeholder meetings at national and regional levels and personal communication with key persons from each ATSEA country. Identification of the core and general stakeholders was conducted during the Stakeholder Engagement Group (SEG) establishment in accordance to the agreed SEG guideline. The SEG was established to provide advice and support to the ATSEA Project Board and to assist in achieving synergies in implementing the ATSEA project.

## 3 DESCRIPTION OF THE ATS REGION

### 3.1 Biophysical Characteristics

#### 3.1.1 Biogeography and Large Marine Ecosystems

The waters of the tropical, semi-enclosed Arafura and Timor Seas (ATS) are shared by Indonesia, Timor-Leste, Papua New Guinea (PNG) and Australia. Biogeographically, the ATS region is located at the intersection of the two major Large Marine Ecosystems (LMEs), the Northern Australian Shelf (NAS) waters to the south, and the Indonesian Sea (IS) to the north. The latter is an integral part of the Indo-Malay Pacific and 'Coral Triangle' global epicenter of tropical marine biodiversity (Allen & Werner 2002). The IS LME includes the world's largest archipelagic nation, Indonesia, with a coastline exceeding 84,000 km and an estimated 17,805 islands covering an area of 2.3 million km<sup>2</sup>, of which 1.49% is protected. It also contains 9.98% and 0.75% of the world's coral reefs and sea mounts, respectively (Sea Around Us 2007). The NAS LME encompasses the northern continental shelf and margin of Australia and extends from the Timor Sea to the adjacent Torres Strait region and includes the Arafura Sea and Gulf of Carpentaria (the largest tropical epicontinental sea in the world). The LME covers an area of nearly 800,000 km<sup>2</sup>, of which 2.17% is protected, and contains 0.70% of the world's coral reefs (Sea Around Us 2007). Significantly, the region is also recognized as containing the most pristine, but also some of the most threatened, tropical coastal and marine ecosystems in the world (Halpern et al. 2008, Tun et al. 2008, Burke et al. 2011).

#### 3.1.2 Physical Setting

While the ATS region is dominated by two shallow continental seas – the semi-enclosed Arafura Sea (~30 - 90 m depth) and the less enclosed Timor Sea (50 – 120 m depth, with small areas >3000 m) – the region has complex bathymetry, climate, water circulation, and diverse shallow- and deep-water habitats. The NAS LME is dominated by shallow (<200m) shelf waters and semi-enclosed gulfs (Gulf of Carpentaria, Van Dieman's Gulf, Joseph Bonaparte Gulf), with water depths rarely exceeding 70m across most of continental margin. The Gulf of Carpentaria, Arafura Shelf and the Sahul Shelf were drowned less than 18,000 years ago by the latest post-glacial marine transgression (Harris et al. 2008); these waters contain Australia's shallowest and most extensive shelf waters. In the eastern region of the ATS, the broad, continuous continental margin between Australia and Papua New Guinea formed an emergent land bridge during the last ice age. Despite high local currents, there is very little net exchange of water between the Pacific and Indian Oceans through the adjacent shallow Torres Strait region (<15m at its shallowest). Within the Gulf of Carpentaria, there is some exchange of water and nutrients with the Arafura and Coral Seas, but flushing of the basin is considered to be slow and limited.

The western and northern regions of the ATS (including the northwest margin of Australia and the IS LME) are characterised by deeper waters, containing slope, rise and abyssal habitats, and several major geomorphic features, including the submarine valleys of the Arafura Depression, the submarine terraces (120-250m deep), and complex algal banks on the Sahul Shelf and the Timor Trough. The trough is an 850km long, NE-SW depression (2-15km wide, maximum depth = 3,200 m) that extends between the island of Timor and the Sahul Shelf. The Timor Trough is an integral part of the volcanic Banda Arc complex, the location of an active convergent plate margin. The IS LME is characterised by the convergence of three tectonic plates – the Eurasian, the Indo-Australian and the Pacific Plates – making the region geologically as well as topographically diverse.

### 3.1.3 Climate

The climate in the Timor and Arafura Seas is tropical maritime and is driven by the seasonal latitudinal movement of the Inter-Tropical Convergence Zone. The region is monsoonal, with tropical cyclones common in summer. The north Australian coastal areas show a gradation from the semi-arid area of northern Western Australia to the wet/dry monsoonal areas in the Northern Territory, which have a warm dry period from May to October with predominantly south-east trade winds, and a hot humid period from November to March. This hot humid period is associated with the north and north-west monsoonal maritime inflow which produces the 'wet'. The climate to the north of the Timor and Arafura Seas is similarly seasonal, but the greater topographic relief and mountainous interiors of the islands of Timor and New Guinea, particularly in Papua province, provide additional precipitation-producing mechanisms (Morrison & Delaney 1996).

Freshwater input to the Arafura Sea comes mostly from more than thirty southwest-flowing rivers in Papua and, secondarily, from some rivers flowing into the Gulf of Carpentaria and northern Australian shelf. Little fresh water flows from the Aru, Yamdena or Kei Islands to the ocean. Freshwater input to the Timor Sea comes from northward-flowing rivers in northern Australia during summer, and seasonally from southward-flowing tributaries on Timor, although total annual precipitation on the island ranges from 1600 – 2300 mm/yr.

The mean annual surface water runoff from Australia into the Timor and Arafura Seas is 173.2 tetralitres/year (Milliman & Farnsworth 2011). A distinguishing feature of the coastline in the NAS LME region is the large number of unregulated rivers. As such, it is one of the few areas of Australia where most rivers remain unaltered by damming and/or removal of water and catchment modification. The drainage basin for the Gulf of Carpentaria is very large, measuring around 1,200,000 km<sup>2</sup> with a total annual runoff of 64k<sup>3</sup>. (Torgensen, et al. 1983, Bishop & Forbes, 1991). In many areas there is evidence of decelerating coastal plain progradation, with estuary infilling from the sea (Woodroffe 1995). The limited progradation, together with continuing Holocene sedimentation under a stable sea-level, has contributed to a coastal transition from widespread mangroves to widespread freshwater wetlands.

In Indonesia and Papua New Guinea, catchments draining into the Arafura and Timor Seas vary considerably from the dry Timor catchments to wet Papuan catchments. The topographic relief of the interior of New Guinea, with snow-capped mountains in excess of 5000 m, provides some high energy rivers, such as the Digul River. Well-developed mangrove waterways exist along much of the coast which is characterised by fine sediment and low relief. Supra-tidal mudflats are found along coastal areas throughout the southern ATS region, particularly the arid and dry-tropical coastline in of the southern Gulf of Carpentaria and the Kimberley. These flats concentrate salt and nutrients for extended dry periods, releasing salty, nutrient-laden water into the coastal zone during the wet season. The significance of these events to marine processes is unknown.

### 3.1.4 Ocean Circulation

As part of the Indian Pacific Warm Pool, the area plays a vital role in both global ocean circulation and the world's climate; and is where a large proportion of heat and moisture is transferred from the ocean to the atmosphere (Meyers 1996, De Deckker et al. 2003). The warm ocean waters of the ATS (and the broader, IS LME) act as a 'heat engine' for global atmospheric circulation, with complex ocean-atmospheric dynamics thoroughly interrelated with the ENSO phenomenon. The major oceanographic feature of the ATS is the Indonesian Throughflow (ITF), a warm, low-salinity current flowing from the Pacific to the Indian Ocean, which crosses the north-western part of the ATS (Gordon & Fine 1996, Molcard et al. 2001, Gordon 2005)(Figure 3). The ITF carries up to 15,000,000 m<sup>3</sup>/s of water from the Pacific to

the Indian Ocean and plays a vital role in driving the world's climate. The ITF is closely coupled to large-scale, climate phenomena, such as ENSO, the Australasian Monsoon and Indian Ocean Dipole, and at the regional level, plays a key role in shaping Indonesia and northern Australia's climate and marine ecosystems (Cai et al. 2005, Zhong et al. 2005, Kug et al. 2006).

With limited net flow through the adjacent Torres Strait region, three main outflows of the Throughflow transit through deeper ocean routes, with the two outflows through the Ombai Strait and Timor Passage accounting for >80% of the total Indonesian Throughflow transport (-15 Sv) that enters the Indian Ocean (Gordon 2005). The ATS region thus represents a major nexus to further understand the role of this major boundary current. Water circulation is complex throughout the region, being a crucial factor driving the structure and function of the marine ecosystems and habitats in the ATS. Upper ocean circulation is determined mainly by the onset of the northwest and southeast monsoon seasons with parameters such as water density, temperature, pH and salinity driven by large-scale variations in river discharge, precipitation and major impinging ocean currents (Gordon 2005, Gordon & Fine 1996).

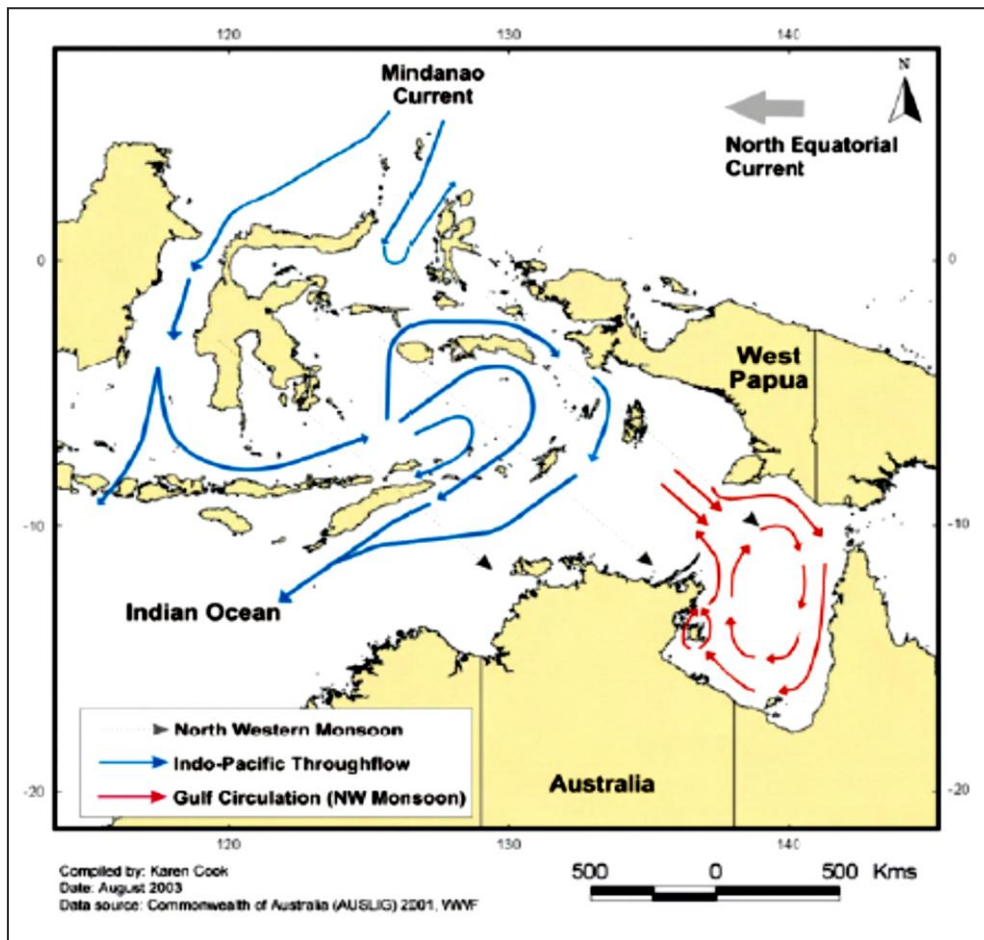
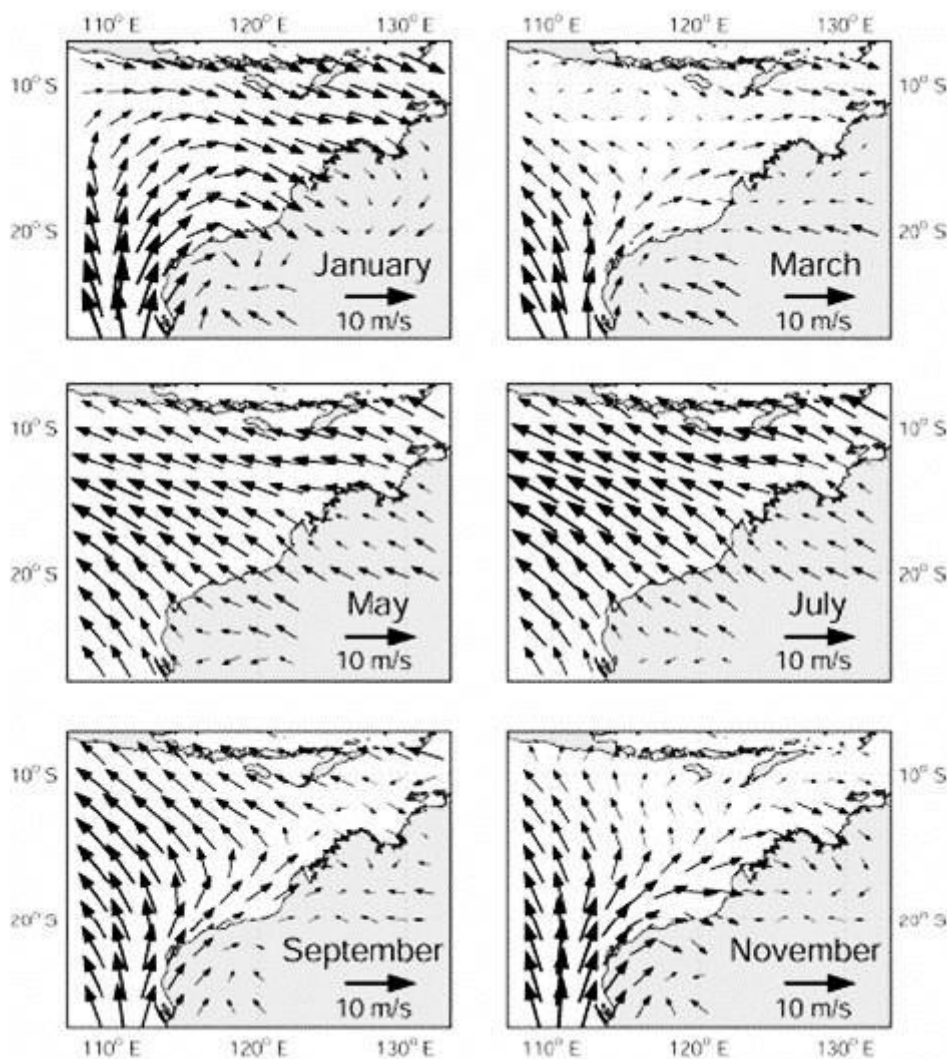


Figure 3: Diagram of Pacific to Indian Ocean Throughflow, northwest monsoon and Gulf of Carpentaria circulation pattern during the northwest monsoon.

There is seasonal fluctuation in sea-level in the Gulf of Carpentaria due to reversals in seasonal wind fields. The northwest monsoon winds set up water levels in the Gulf despite the available exit through the adjacent Torres Strait region, while the southeast trade winds compound the subsequent geostrophic relaxation (Figure 4). Implications of this may be

quite significant as the movement of water westward through the Arafura Sea may influence the onset of the Holloway Current and by extension the Leeuwin Current that affects the western seaboard of Australia (Ridgeway, *pers. comm.*).

The ATS is a high productivity ecosystem ( $>300 \text{ gCm}^{-2}\text{yr}^{-1}$ ), although many areas beyond the shelf are oligotrophic. Northern Australian waters are dominated by picoplankton, especially cyanobacteria (Burford & Rothlisberg 1999). Waters are relatively clear offshore and the euphotic zone can extend down to 100m across the shelf. Primary productivity is limited by nutrient availability and the influence of winds and tides in mobilising sediments (Burford & Rothlisberg 1999). Nutrient discharge from rivers is restricted to the summer wet season and is highly variable within and between years. Tidal mixing is a major contributor to the nutrient dynamics of this generally shallow LME. Bottom friction acts in a manner analogous to wind stress on the surface to mix the water-column. Monsoonal winds and tropical cyclones also contribute to nutrient enrichment of shelf waters (Condie & Dunn 2006). Tropical cyclones have a pronounced effect on the continental shelf and on the coastal ecosystems of the ATS, and are a significant source of seabed disturbance, sediment movement and storm surges, breaking down stratified layers of water that form in deeper offshore waters during the wet season and measurably disrupting benthic (seabed) species in shallower waters ( $<30\text{m}$ ).





*Figure 4: Seasonally averaged winds in the North West Marine Region at a height of 10 m above mean sea level during January, March, May, July, September, and November. These fields were calculated by vector averaging the 12 hourly outputs of the NCEP-NCA re-analysis dataset across the years 1982 to 1999 (Condie et al., 2006).*

Localised upwellings of cooler water also occur in the ATS region as a result of internal tides - shelf waves that travel along the seafloor from the continental slope to the shelf - and topographic effects (Gordon 2005). The influence and extent of these upwellings are poorly understood. The Banda Sea and the Aru Sea are areas of extensive seasonal upwelling and downwelling in relation to the monsoons (Moore et al. 2003). During upwelling periods, biomass, marine productivity and rates of nutrient recycling are greatly enhanced (Zijlstra & Baars 1990). Other areas subject to upwelling episodes are the Ombai Strait, Savu Sea, Timor Sea, Gulf of Bonaparte and the Gulf of Carpentaria, especially during the monsoon seasons, and high fish catches have been related to such events. During the northwest monsoon, low-velocity upwelling occurs along coastal Timor, the western coast of Tanimbar, the south-western coast of Papua near the Aru Islands, the north-western coast of Australia, northern Gulf of Carpentaria, and along the Gulf of Carpentaria. Medium-scale upwelling is found on the northern coast of Timor and in Ombai Strait. Low-velocity downwelling has been found at the eastern tip of Timor, northern Tanimbar and to the northwest of the Aru Islands. Again, these are areas of either intense fishing or are an important part of migration pathways for many marine mammals. The large-scale significance of these upwelling-downwelling events to the ecology of marine food webs in this region is poorly understood.

### 3.1.5 Diversity of Seascapes

A key physical feature of the ATS (and particularly of the IS LME) is the diversity of seascapes due to the interplay between the complex geography and the biophysical processes in the region (Tomascik et al. 1997). At the evolutionary scale, the geological history and unique archipelagic nature of the IS LME region, and the interactions between the complex bathymetry, topography, oceanography and ecology, has resulted in a diverse range of distinct coastal, shelf and pelagic ecosystems and habitats. Numerous large and small islands partition marine waters into different seas connected by many channel passages and straits. The complex and rapid currents of region are, in part, due to interactions with the complex archipelagic topography and seafloor features of the region.

Tides, seasonal monsoonal winds, rainfall and tropical cyclones also exert a significant influence on the biodiversity and habitats of the ATS through pronounced and seasonal effects on ocean currents, coastal boundary layers, vertical mixing and nutrient dynamics of shelf waters. Ambient water conditions throughout the ATS ranges from highly turbid conditions of the sheltered shores of the Aru Sea and the southern Gulf of the Carpentaria, to the clear waters of energetic coastlines of the islands of Nusa Tenggara Timor. Diversity of seascapes and distinct coastal and oceanic habitats is recognised as a major causal factor in the globally significant levels of coastal and marine biodiversity recorded in Indonesia and in the 'Coral Triangle' (Tomascik et al. 1997). High regional biodiversity is maintained because different types of reefs, with unlimited permutations of contrasting environmental conditions, are often found in close proximity to one another.

The deep-water trenches, passages and current systems of eastern Indonesia and the northern ATS region are increasingly being recognised as a global 'hotspot' and migratory pathway for many species of megafauna that frequently traverse through the region. The megafauna includes globally threatened cetaceans, such as blue, sperm, fin and humpback whales, turtles, elasmobranchs and other pelagic fish species (Dethmers et al. 2009). The Savu Sea, on the perimeter of the ATS, is recognised as one of the world's largest nurseries

for six whale species, including humpback whales, pilot whales and the highly endangered blue whales. Whales frequently pass through the deep ocean trenches in the Savu and Alor Seas and come up to the reefs to feed.

The island of Timor is particularly important as a major and globally significant corridor for migratory marine species, being located between major outflow passages of the Indonesian Throughflow. The deep-water (3 km deep) passages of the Ombai Strait and Timor Passage, adjacent to the north and south coast of Timor, respectively, are major paths for migrating marine megafauna (Dethmers et al. 2009). Migration is facilitated by Timor's very narrow, active northern coastal margin where localised upwelling of deep, nutrient-rich, water, attracts marine predators and their prey very close to the shoreline. Any increase in numbers of cetaceans and the timing of cetacean migration in Timor-Leste waters coincides with an increase in sea surface temperatures and with flow reversal and associated reduction in surface currents of the Indonesian Throughflow (Dethmers et al. 2009).

### 3.1.6 Key Coastal Habitats

Mangroves and freshwater and estuarine wetlands are a major feature of the sheltered, semi-enclosed waters of the ATS region. Indonesia (3,112,989 ha) and Australia (977,975 ha) account for nearly 30% of the global area of mangrove forest (Giri et al. 2011). The coastal regions of Indonesia, Papua New Guinea and Australia contain the highest levels of mangrove diversity with 45, 44 and 39 species recorded, respectively (Spalding et al. 2010). The areal extent of mangroves in Timor-Leste is to be determined, but probably occupies a few thousand hectares of shoreline (Boggs et al. 2009). Current research activities include broad scale habitat mapping of the south Timor coastline may help refine this figure. Mangroves are a valuable economic and ecological resource, being important breeding sites for a wide variety of wildlife (e.g., birds, fish, and invertebrates); a renewable resource of timber; and accumulation sites for sediment, contaminants, carbon, and nutrients. They also offer some protection against coastal erosion, strong waves, high tides, and tsunamis. The largest continuous area of mangrove forest in the ATS is along the southwest coast of Papua, although little is known of these forests.

Like mangroves, seagrasses are important coastal habitats because of their high rates of primary production, their ability to trap sediments and organic nutrients and their rich food chains. Tropical seagrasses are particularly important for turtle and dugong foraging, as well as critical nursery and feeding areas for penaeid shrimps, recreational and commercial fishes, crabs and marine crayfish. Some of the largest areas of seagrass in the ATS region are recorded in the shallow, sheltered waters of the Arafura Sea and Gulf of Carpentaria. The estimated 13,425 km<sup>2</sup> to 17,500 km<sup>2</sup> of seagrass in the adjacent Torres Strait region has enabled the region to be a globally important dugong and turtle habitat. Seagrasses in the Gulf of Carpentaria are less extensive than the adjacent Torres Strait region, covering about 900 km<sup>2</sup> of seabed in the 1980s. The extent of seagrasses in the northwest of Australia remains largely unknown. Within the ATS, 12 species of seagrass have been recorded for Indonesia waters, while 15 species of seagrass are recorded for northern Australia. Within the Arafura Sea, seagrasses have been reported in the Maluku Tenggara region, in the surrounding areas of Kei, Yamdena and Aru Islands, with a total of 11 species found. In the Timor Sea, 7 species of seagrass are commonly found. On the Sahul Shelf, surveys of Ashmore Reef have recorded 5 species of seagrass and also the highest average seagrass cover (2%) of the reefs of the Sahul Shelf, with 22.13 km<sup>2</sup> of seagrass beds (>10% cover) (Brown & Skewes 2005). In Timor-Leste, seagrass meadows are limited and primarily confined to inshore coral reefs and shallow coastal lagoons (Boggs et al. 2009). In a recent survey of the northern coast, a total of 5 species, and an estimated area of 2,200 ha of seagrass has been recorded (Boggs et al. 2009, Edyvane et al. 2009a). Current habitat

mapping research activities (2011/12) on the south coast of Timor-Leste, will survey marine and coastal habitats, including the potential to identify areas of seagrass habitat.

Due to the semi-enclosed nature of the ATS, coral reef development is largely restricted to the clearer waters (and energetic coastlines) of the offshore islands of eastern Indonesia, Nusa Tenggara Timur and Maluku region (Tomascik et al. 1997), Timor-Leste (Boggs et al. 2009) and the edge of the continental margin of the northern Australian Shelf, the Sahul Banks (Heyward et al. 1997) and in the Torres Straits. In contrast, coral reefs along the southern coast of Papua are poorly developed due to high river flow and subsequent turbidity. In the Timor Sea, fringing coral reefs are found around the islands of Timor, Tikus, Burung, Kera, Semau, Kambing, Mera and Rote. The vast majority of the ATS is dominated by shallow shelf sediments and turbid waters – conditions unsuitable for reef development. On Australia's northern shelf, approximately 97% of the shelf is dominated by shallow-water sediments, mostly <70m depth.

Along the continental margin within the NAS LME, extensive systems of reefs occur at the shelf edge (Heyward et al. 1997, Wells & Allen 2005). This shelf edge is characterised by a nearly continuous chain of submerged carbonate banks that rise from water depths of 150 m, with some banks rising from depths of 300m. There is also considerable difference between the reef fauna of these shelf edge coral reefs and reefs present on continental shorelines (Wells & Allen 2005). North of Ashmore Reef (Sahul Shelf), the reefs are made mostly of the coralline algae *Halimeda* as well as the skeletons of foraminifers and molluscs in lesser amounts. South of (and including) Ashmore Reef, the reefs are mostly constructed of hard corals skeletons. This zonation is caused by upwelling of cooler, nutrient-rich water from the Indian Ocean, which provides ideal conditions for hard coral development. North of this latitude, water temperatures are too high due to shallow water depths and throughflow of warm equatorial waters (Heyward et al. 1997).

Reports on the nature and extent of coral reefs, particularly in the inshore regions of the ATS, are very limited. Coral development in the Gulf of Carpentaria is limited (Weipa, Wellesley Islands, Groote Eylandt, and Cape Wilberforce). However, a 2003 survey revealed large tabletop-like coral reef structures 40-50 m deep in the southern part of the Gulf, including the 100 km<sup>2</sup> Big Reef, which has luxuriant growth similar to platform reefs in the Great Barrier Reef. Similar, deeper water, reefs may occur in this area (Harris et al. 2008), including extensive, pristine fringing reefs in the Kimberly region.

### 3.1.7 'Near-Pristine' Ecosystems

In contrast to some of the densely populated northern (IS LME) regions of the ATS, the southern coastal and marine waters of the NAS LME are sparsely populated, with relatively undisturbed catchments, resulting in 'near-pristine', globally significant, marine habitats and biodiversity (Halpern et al. 2008). The NAS LME contains some of the largest, pristine catchments, tidal estuaries, coastal wetlands, coastal savannah, tropical rivers and mangrove forests still relatively intact. The high coastal biodiversity of northern Australia is of major cultural, social and economic significance for Aboriginal people inhabiting these remote regions.

The coastal and marine biodiversity and resources of IS LME (and the Coral Triangle region) is under serious threat, with increased exploitation fuelled by exploding population growth (Tun et al. 2008, Burke et al. 2011). The extensive coastal zone of Indonesia supports approximately 60% of its 238 million people (BPS, 2010a); 67% of Indonesia's 7,000 coastal villages are located adjacent to coral reefs and thus heavily dependent on the reefs and their associated products for consumption and livelihoods. In 2008, this serious and recognized threat to Indonesia's coral reefs (and food security) was the major catalyst for the formation

of the major regional marine conservation program, the 'Coral Triangle Initiative on Coral Reefs, Fisheries and Food Security' (CTI) (Tun et al. 2008).

### 3.1.8 Global Stronghold for Marine Species

Due primarily to remoteness and lack of human disturbance, the southern waters of the ATS are recognized as a major global stronghold for many coastal and marine mega fauna including migratory, rare, threatened and endangered marine species, such as nesting colonies of shorebirds and seabirds, cetaceans (Corkeron et al. 1997), dugongs (Marsh et al. 2004, Saalfeld & Marsh 2004), sharks and rays, sawfish, turtles and sea snakes (Whiting & Guinea 2005). Many of these marine species and their habitats are undergoing rapid decline in the IS LME and also throughout Southeast Asia. With healthy populations, high species diversity and intact coastal, estuarine and marine habitats, the NAS LME is now a regional and global refuge for many species and will increasingly play a crucial role in maintaining biodiversity.

NAS LME waters contain 6 out of 7 world's turtle species, including globally significant populations of Green, Hawksbill, Leatherback and Flatback turtles, and the largest rookeries of Olive Ridley turtles in Australia and in the Southeast Asia-Western Pacific biome. All species within the NAS LME are exposed to significant threats to their survival. Two-thirds of the world's population of Flatback turtles breeds within the NAS LME with a major part of them foraging within the area.

### 3.1.9 Ecological Connectivity

Shallow continental shelves and semi-enclosed gulfs have resulted in strong connectivity in oceanographic processes and ecological processes, such as the movements of pelagic and migratory species. For instance, studies on offshore demersal snapper fisheries indicated no genetic difference between *Lutjanus malabaricus* caught in the Arafura Sea and Sahul Bank. Further, the stock of *Lutjanus malabaricus* taken from the western part of Timor Sea is likely to be a separate population from that found in the Arafura Sea and Sahul Bank (Blaber et al. 2005, Salini et al. 2006). This information has been critical in developing joint cooperative and complementary fisheries management arrangements in the ATS between Indonesia and Australia (Blaber et al. 2005). Similarly, recent genetic studies on two commercially harvested elasmobranch species (*Prionaceglauca*, *Sphyrnalewini*) have shown no genetic differences between Australian and Indonesian populations – prompting calls for co-management of these shared stocks (Ovenden et al. 2009).

In addition to shared fish stocks, globally significant populations of migratory protected species (turtles, dugongs, cetaceans, sawfishes, and elasmobranchs) are found throughout the ATS region, with major outflow passages of the Indonesian throughflow providing major migratory pathways for some of these species. Mark-recapture, satellite-telemetry studies and genetic studies are beginning to provide valuable information and insights about movements of individuals, and specifically, the magnitude and complexity of the migratory connectivity of key marine species (Stevens et al. 2000, Dethmers et al. 2006, Dethmers et al. 2010, Phillips et al. 2011, Sulaiman & Ovenden 2010).

Similarly, for the conservation and management of benthic ecosystems in the ATS, recent genetic studies on coral reefs in north-western Australia are improving our understanding of the scale and patterns of dispersal and gene flow connectivity of coral species and isolated reef systems (Underwood et al. 2009). These connectivity studies are critical for spatial management of coral reef ecosystems, particularly in planning and establishing Marine Protected Areas.

The ATS region is also characterized by strong land-sea connectivity. High standing islands in the IS LME (Timor, Papua New Guinea) and large catchment areas in the NAS LME, result in

high river discharge rates of freshwater and sediments to coastal waters. Such discharges can have significant impacts on coastal and offshore ecosystems. These rivers transport a disproportionately large amount of sediment to the ocean because of their generally small drainage basin areas, high topographic relief, relatively young and erodible strata (often impacted by human activities such as deforestation and agriculture) and seasonally heavy rainfall (Milliman et al. 1999, Milliman & Farnsworth 2011). Rivers on the islands of Sumatra, Java, Borneo, Sulawesi, Timor and New Guinea are estimated to discharge about  $4.2 \times 10^9$  t yr<sup>-1</sup> of sediment (Figure 5). These islands represent only about 2% of the land area draining into the global ocean, yet they are responsible for as much as 20 - 25% of the sediment export (Milliman et al. 1999). This strong coupling of land-sea processes underscores the critical need to address integrated catchment management, in managing the ATS region.

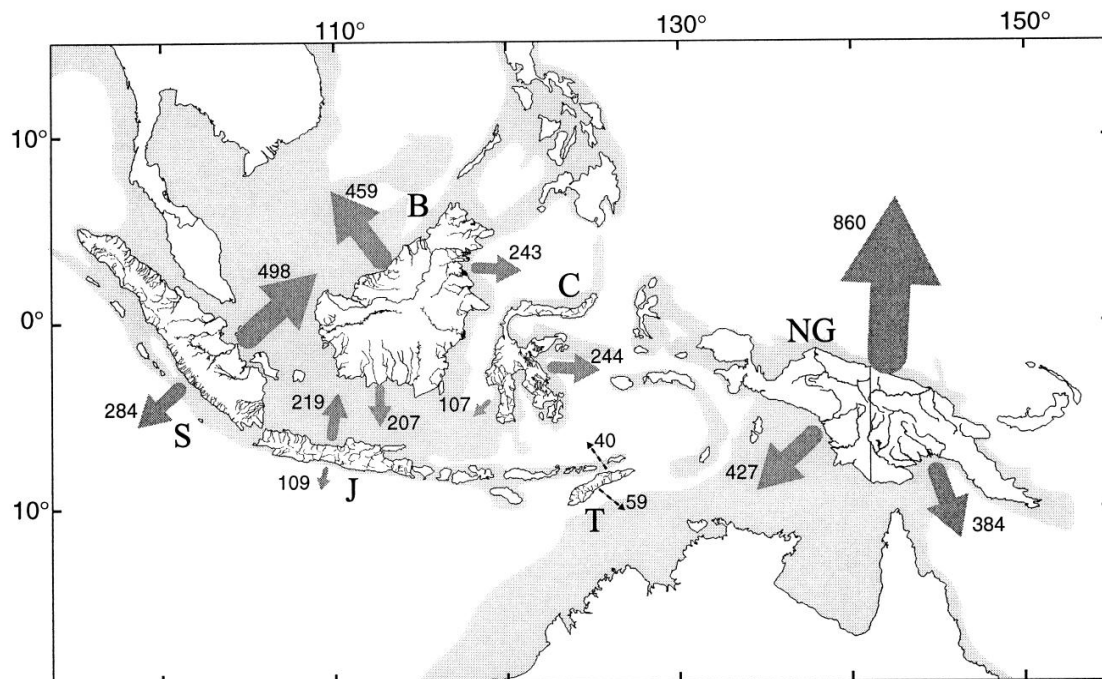


Figure 5: Sediment discharge (106 t yr<sup>-1</sup>) from islands in the ATS region.

Arrow width is proportional to annual load. Letters S, J, B, C, T, and NG refer to Sumatra, Java, Borneo, Sulawesi, Timor and New Guinea, respectively (Adapted from Milliman et al. 1999).

## 3.2 Socio-economic characteristics

### 3.2.1 ATS Region Government Administration

The Arafura Timor Seas (ATS) encompasses waters under the jurisdiction of four countries: Indonesia, Timor-Leste, Australia and Papua New Guinea. Three provinces in eastern Indonesia (East Nusa Tenggara, NTT) Maluku, and Papua), have 12 districts (kabupaten) within the ATS area. Two municipalities (Kota Kupang and the NTT provincial capital, and Kota Tual) are also situated adjacent to the region and are localities in which transboundary environmental problems may originate from or contribute to. Likewise, the City of Ambon, although located outside of the ATS region, it is important in addressing transboundary issues due to its role as provincial capital of Maluku.

In Timor-Leste, 11 out of the country's 13 districts have coastline within the ATS. Papua New Guinea has one district, the South Fly district of Western Province which borders the Arafura Sea. Administration of the northern Australian section is shared between the Australian Government (jurisdiction between 3 and 200 nautical miles of the Australian coastline), the

State Governments of Western Australia and Queensland, the Northern Territory Government, and includes an external territory (Ashmore and Cartier Islands).

Fishers, and vessels originating from within and outside the ATS region in Indonesia, and from other Southeast and mainland Asian countries are active in the region and the products are also bartered, eaten and sold far beyond the ATS region. Thus the transboundary area of relevance actually extends beyond those districts immediately adjacent to the Arafura and Timor Seas. There are vast differences in the socio-economic characteristics and conditions within and between each of the countries surrounding the ATS but communities also share many common issues. These include remoteness, cultural and linguistic diversity, coastal community poverty, reduced mobility and migration, and shared use and management of marine resources.

### 3.2.2 Demography

There are approximately 4.1 million people living in the Arafura Timor Sea region, of which approximately 2.8 million people live in Indonesia within 12 districts of ATS, 906, 435 in Timor-Leste, 310,000 in northern Australia and 46,000 in Western Province of PNG.

### 3.2.3 Language, Religion, Culture and Social Structure

The ATS region is extremely ethnically and linguistically diverse. The exact number of languages spoken in the region is unknown but at least 150 local languages (from more than 30 language families) are spoken among the many diverse indigenous and migrant ethno-linguistic groups.

Most languages belong to the Austronesian family of languages although some such as those spoken in parts of Timor-Leste (e.g. Fataluku and Bunak languages) or West Papua province (Papuan languages) and southern PNG belong to non-Austronesia language families. All countries have one or two official languages which are Bahasa Indonesia (Indonesia), Tetun and Portuguese (Timor-Leste), English and Tok Pisin (PNG) and English (Australia).

The basic social unit among indigenous rural communities is the extended family or 'clan' and membership is either through paternal or maternal lines.

Religions practiced throughout the region include Christianity and Islam as well many other traditional religious systems. Customary law (e.g. *adat*) practices are also widely followed by ethnic groups in all four countries in relation to marriages, deaths, inheritance, labour exchange, and land and sea management. Among some cultures in the region such as in Timorese social practices, 'origin groups' have great importance and inherited rights relating to ritual and symbolic beliefs associated with the sea expressed through ritual sacrifice, prayer and ceremonial acts (McWilliam 2003).

Some local and indigenous communities in the region have traditional access rights to land and sea areas. Cultural and spiritual activities and interests of people in the ATS region often extend into offshore waters.

### 3.2.4 Social and Economic Indicators

The level of development and social and economic status of people living in the ATS region varies considerably between districts and countries as does the size of the local economies and growth rates of economies. Levels of economic development in northern Australia are much higher than those of the other three countries, with annual per capita GDPs twenty or more times higher than those in the highest earning districts of ATS region of Indonesia or Papua New Guinea. Annual per capita GDP in all regions of Indonesia (except for Mimika district), Timor-Leste and PNG is below US\$1,000, with regions in the range of US\$200 to US\$400 (BPS Maluku 2010, BPS NTT 2009, BPS Papua 2010, FAO 2010b).

A look at the overarching human capital quality parameter based on health, education and income, the human development index (HDI), for each of the ATS countries demonstrates the difference in the development situations of the nations involved. With a HDI score of 0.937, Australia was ranked the second highest of the 169 nations with sufficient data for comparison (but this does not necessarily reflect the situation of the Indigenous population). Indonesia was ranked 108<sup>th</sup>, Timor-Leste was 120<sup>th</sup> and Papua New Guinea came 137<sup>th</sup> (UNDP 2010). Within Indonesia, the provinces bordering the Arafura and Timor Seas rate badly in terms of their HDI. Data from Indonesia's national statistics body show that in 2009, East Nusa Tenggara (NTT) and Papua were amongst the lowest scoring provinces for HDI in Indonesia ranking 31<sup>st</sup> and 33<sup>rd</sup> respectively out of 33 provinces<sup>3</sup>.

In Indonesia, Timor-Leste and PNG, poverty<sup>4</sup> is a significant issue and in some districts there has actually been a trend to increasing rather than decreasing poverty levels over the last decade. Approximately 30 percent of Indonesians are considered 'poor' based on the national classification system (living on less than Rp. 233.740 per month, BPS-Statistics Indonesia (2010)/ National Socio-economic Survey), although this varies across the country.

NTT is the poorest province in Indonesia and experts suggest rural poverty is worsening rather than improving particularly in Sumba, Rote, West Timor and Sabu islands and that over a million people require food aid. This is partly a result of deteriorating productivity due to environmental degradation (Fox 2011). Furthermore, based on Indonesian national survey, Papua Province has the highest percentage of poor people (BPS 2010). The portion of people living in poverty in Kupang city, NTT is comparatively small (9%) but in most areas within the ATS region of Indonesia the rate is above the 2007 national average of 30 percent. In Maluku Tenggara Barat district the proportion of poor people in 2007 was estimated to be 46 percent. The highest levels of poverty are generally found in rural areas. During the dry season, parts of Indonesia and Timor-Leste regularly experience periods known locally as the 'hungry season' and live a situation of chronic food insecurity. In NTT province experts suggest that food security is worsening due to decreases in agricultural productivity as a result of environmental degradation (Fox 2011). Chronic food insecurity is a major issue in Timor-Leste with most families practising food rationing for 1–6 months of the year (Borges et al. 2009).

The Western Province of PNG is one of the most disadvantaged in the country. Based on a national poverty standard, it is estimated that 54 percent of people in the South Fly District, are poor (Gibson et al. 2005).

Of the nations within the ATS, only Australia is classed as a 'developed country'. It should be noted however that there are vast differences between the economic status of Indigenous and non-Indigenous Australians in northern Australia. Indigenous people account for only 2% of Australia's population so their numbers have little effect on national statistics. Indigenous Australian incomes are comparatively low and there is heavy dependence on the state as a source of income when compared to the broader Australian community. Whilst poverty is high among Aboriginal communities, the poverty is relative rather than absolute compared with the other three ATS region countries. Aboriginal people are land rich (approximately 20% of Australia is part of the Indigenous estate) but cash poor (Altman 2007).

---

<sup>3</sup>[http://www.bps.go.id/tab\\_sub/view.php?tabel=1&daftar=1&id\\_subyek=26&notab=2](http://www.bps.go.id/tab_sub/view.php?tabel=1&daftar=1&id_subyek=26&notab=2) [accessed 14/07/2011]

<sup>4</sup>Defined as whether households or individuals have enough resources or abilities today to meet their needs (World Bank). There is considerable debate about measures of poverty globally.

Human capital is relatively low throughout the ATS region with low literacy rates (and levels of education), particularly in Papua and Timor-Leste and among Aboriginal populations in northern Australia. This relatively low quality of human capital presents one of the challenges in combating poverty in the ATS region area. Whilst improving in recent years, the general health status across the ATS is still relatively low.

### 3.2.5 Economy, Employment and Income

Agriculture is the largest form of employment throughout the ATS region of Indonesia followed by employment in the services sector. Employment opportunities in NTT Province, in Indonesia are limited by the fact that only 49% of the adult population have completed primary school with around 18% of the population never going beyond primary school (BPS, 2011). To some degree subsistence farming insulates NTT against some of the risks of being almost completely reliant on primary production but it is still vulnerable to fluctuating prices of cattle, coffee, other tree products and fish (Barlow & Gondowarsito 2009). Whilst education levels are somewhat higher in Maluku Province a lack of infrastructure and distance from markets limit employment opportunities.

Seventy-five percent of Timor-Leste's population live in rural areas – where poverty is most prevalent – and the majority of Timorese having a high dependence on rural agricultural livelihoods strategies (McWilliam 2003). Natural resource-related activities account for around 80% of employment in Timor-Leste (FAA 118/119 2004) though this tends to be focused inland and to the mountains rather than to the sea. As such, few Timorese communities depend on fishing for their livelihoods and they do not undertake the *merantau* traditions (long-range seafaring in search of livelihoods) as is the case with some migrant Indonesian fishers. Timor-Leste has large offshore oil and gas reserves with an estimated US \$8.17 billion estimated to be held in the National Petroleum Fund by the end of 2011 (UNDP 2011). Despite this apparent national wealth benefits have been slow to materialise within the population and food security, employment and sustainable livelihoods remain important issues for the country.

In its Strategic Development Plan for 2011-2030, the government of Timor-Leste has identified development of infrastructure and human resources to support growth in private sector jobs in the areas of broad-based agriculture, tourism and industries associated with the oil and gas sector as its key priorities (RDTL 2011).

The South Fly region of PNG is sparsely populated, under developed and economic activity is constrained by access to local markets with population centres located some 200kms away in the west of the Province. Thus the local largely subsistence-based economy is based on hunting and gathering of forest resources, fishing and small-scale shifting yam (and sago) cultivation<sup>5</sup>.

Northern Australia has a different economic structure from that of the rest of Australia (Stoeckl et al. 2011). Key features include an economy dominated by staples-based industries (mining, agriculture, and fisheries), some tourism and retail, and a majority of people employed in government services. Median weekly incomes vary immensely with the highest median incomes found in urban areas and mining towns (Darwin, Broome, Gove, and Weipa) (Larson & Alexandridis 2009). Employment opportunities are extremely limited outside major population centres and may pose the most significant barrier to development across the region (Larson & Alexandridis 2009). Natural resources-based industries providing direct employment for Indigenous people have increased in the last few years but employment levels are still low.

---

<sup>5</sup><http://whc.unesco.org/en/tentativelists/5062/> - accessed 1/08/2011



### 3.2.6 Infrastructure and services

The ATS region of Indonesia consists of hundreds of islands with many settlements far from administrative and economic centres with poor infrastructure and services outside of the main municipal areas. NTT Province has some of the poorest roads systems in the country particularly in the interior where many roads are unsealed, poorly maintained and frequently closed during wet season. The situation is similar throughout Timor-Leste.

The main Indonesian port within the ATS region is located in Kupang and besides Atapupu and Ende on Flores most other ports in NTT are 'barely developed'. These ports service passenger ferries with nearly 2 million people travelling on inter-island and national ferries (2005) (Barlow & Gondowarsito 2009). Telecommunications are improving with greater mobile phone access in rural areas, but in 2003 only 33% of households in the province were connected to electricity supply. Water supply is also a problem, particularly for those outside of main towns with only 17% of households in 2003 having access to piped water and the remaining households collecting water from central village wells. Water scarcity is a problem during the dry season in Timor and Rote (Barlow & Gondowarsito 2009).

In general, coastal areas of Timor-Leste have very poor infrastructure and coastal residents are not well connected to larger administrative and market centres (McWilliam 2003). There is currently very little maritime infrastructure in Timor-Leste. Electricity and water supply outside the capital Dili are unreliable and often non-existent outside district capitals.

Northern Australia is also far from core markets and supplies (mostly located in the southeast of Australia) but does have key centres within each state and territory (Carson et al. 2009). The towns of Darwin and Broome provide private sector services (shopping, entertainment and limited markets for product distribution) and government services such as health, education, defence and public services. Infrastructure in the northern Australian region is 'limited' compared to the rest of the country with a restricted all-weather road transport network and very few ports. Large parts of northern Australia are considered to be very remote (based on ARIA index) and rely on a network of major and minor airports as well as small and informal airstrips and aerodromes in the region (Larson & Alexandridis 2009).

The Arafura Sea region of Papua New Guinea is very remote with limited transport and services. Roads are in poor condition throughout the dry season and impassable in the wet. Bowe (*no date*) reports there no banking facilities in the district and only a few trading stores. Schools and health clinics suffer from chronic shortages of resources. Access is primarily via barge to the government station of Morehead, and to Bensbach with no direct air access (Bowe *no date*).

## 3.3 Socio-Economic Sectors

The oceanic, coastal and catchment areas of the ATS region support a wide range of economic sectors, from small scale to industrial fisheries. Other sectors in the region include multi-billion dollar mineral, oil and gas production industries, aquaculture, marine tourism, shipping/ports and inter-island trading, transport and defence related activities. There are major contrasts between the maritime economies and sectors in the ATS region with offshore oil and gas, shipping, fisheries and marine tourism still in their infancy in Timor-Leste compared to Australia and Indonesia (Bateman & Bergin 2011).

The most significant resources are the highly productive marine and coastal fisheries, other key marine species and associated habitats including coral reefs, mangroves, wetlands, seagrass beds, and coastal catchments.

Fisheries represent the most important sector of the Arafura and Timor Seas and are critically important to many communities in the region and the major socio-economic

activity with trans-boundary significance. Fisheries and marine resources have direct and indirect roles in supporting the livelihoods of millions of people living in coastal areas of the ATS region. Fish and fisheries have long been integral to socio-cultural and economic systems among Arafura and Timor Sea coastal populations. The populations in the ATS region are heavily reliant on fish as a source of micronutrients (e.g. Vitamin A, iron, calcium, EFAs) and protein, employment and income.

Key sectors and livelihood activities in the ATS region with the potential to lead to environmental and resource degradation include industrial, artisanal, subsistence and recreational fisheries; other related marine activities (aquaculture, coral and sand mining); onshore mining (e.g. gold, nickel, manganese); offshore petroleum and gas exploration and production; agriculture, forestry (e.g. logging) and coastal development.

Management, conservation and marine tourism (e.g. marine parks, ‘caring for country’ ranger groups) are also key sectors - often funded through development aid in Indonesia and Timor-Leste and through the Federal government in Australia. However, their impacts are considered minimal.

### 3.3.1 Capture Fisheries

In 2007 the capture fisheries sector accounted for nearly 2.5% of Indonesia’s GDP (KKP 2010). Annual consumption of capture fish across Indonesia in 2007 was estimated at 24 kg per capita reflecting the nation’s high fish consumption (Table 1). It is highly likely that the figure is greater in the Indonesian coastal communities within the ATS. The FAO 2008 Fisheries and Aquaculture Statistics Report (FAO 2010a) puts annual consumption in Timor-Leste at an average of 0.3 kg. The figure is however likely to be closer to 6.1 kg as estimated by fisheries surveys conducted by the Regional Fisheries Livelihood Project (RFLP) in 2010 (FAO 2011). This survey also revealed fish consumption to be far higher in coastal communities compared to non-coastal communities. Australia sits at 26.4 kg of fish per capita but this makes up only 5.5% of the total consumed proteins compared to 14.1% in Indonesia. It is however much higher than the 0.2% of Timor-Leste. As a nation, Papua New Guinea is closer to the Australian figures with annual per capita consumption of fish and fisheries products averaging 5.2 kg accounting for 6.9% of total protein consumption (FAO 2010a).

*Table 1: Per capita consumption of fish and fisheries product, 2007 (FAO 2010a)*

Country	Fish consumption (kg)	Protein from Fish (g/day)	Protein (g/day)	%of protein from Fish
Indonesia	24.3	8.0	56.7	14.1
Timor-Leste	6.1	0.1	51.1	0.2
Australia	26.4	6.1	110.1	5.5
Papua New Guinea	16.1	5.2	75.5	6.9

*\* Note: This table does not include micronutrient contributions from fish such as Vitamin A, iron, EFAs, and calcium.*

In 2008, the estimate production from capture fisheries in all Indonesia Fisheries Management Areas (FMA) was nearly 5 million tonnes, making it the world’s third largest capture fisheries producer (FAO 2009). Indonesian fisheries exports ranked third among agricultural exports behind palm oil and raw rubber in 2003 (ASEAN 2005). Total capture fish

production in Australia and Timor-Leste is approximately 4.1 and 0.01 percent of the Indonesian production respectively.

The fishery resources of the Arafura Sea region of Indonesia have been intensively exploited for some time now by three industrial-scale fisheries in Indonesia: a finfish trawl fishery, a shrimp trawl fishery, and a bottom long-line fishery. Hence, better management of these three industrial scale fisheries to obtain optimal and sustainable yields would have a major impact on fisheries resources in the Arafura Sea.

Within Australian waters, the Arafura and Timor seas have been among the last areas to be fully commercially developed by domestic Australian fleets. This has led to the unusual situation where sustainable production increases are expected for some Australian capture fisheries in the ATS. This is in contrast to the condition of resources in Indonesian waters of the ATS where fishing intensity (including the number of people engaged in fishing) is much higher and the reported landed value of the catch is considerably lower than the value of the landed catch in Australian waters. It is estimated that 213,000 Indonesians are directly employed as fishermen in capture fisheries in the ATS region (Table 2). A large but unknown number of women are also involved in the fisheries sector where they often play an important role in processing or selling artisanal catches. In most coastal and island communities of ATS, women collect marine products from tidal areas, and children under the official working age also involved in fishing activities. In contrast, in northern Australia only 625 fishers working in 16 different fisheries in the ATS region produced a higher value of catch compared to Indonesia and Timor-Leste.

Indonesia’s Commission for Stock Assessment 2010 report classifies many of the Arafura and Timor Seas fisheries as fully exploited or over exploited (Anon. 2010). For example in 2001 it was estimated that 85% or approximately 7,000 vessels over 50 gross tonnes were operating without a license (Resosudarmo et al. 2009). Average losses from 1991 to 2005 are estimated at around Rp. 11-17 trillion. More recently, 2006 estimates state that such IUU fishing is costing Indonesia more than \$USD 2 billion a year in lost revenues (Resosudarmo et al. 2009). In 2003 the government of Indonesia issued a policy to officially license foreign vessels of 100-300 GT through a licensing fee agreement. Illegal fishing practice in the Indonesian Arafura Sea has shown a decline since the implementation of the vessel re-registration policy in 2003 (Wagey et al. 2009). In the Australian Arafura Sea, illegal foreign fishing rose significantly up to 2006 then fell away due mostly to Australia’s deterrent policy, including fisher apprehension, vessel destruction and, at times imprisonment.

Table 2: Number of fishers, total reported catch and reported value of catches across the ATS (2009)

		Fishers	*Catch (t)	Value (AUD)	\$AUD / t
Indonesia	NTT	66,126	117,190	53.7 M	458.23
	Maluku	88,778	341,966	175.5 M	513.21
	Papua	57,631	228,165	460.2 M	2,016.96
<b>Total</b>		<b>212,535</b>	<b>687,321</b>	<b>689.4 M</b>	<b>1,003.09</b>
Timor-Leste		5,265	3,066	5.3 M	1,140.00
Australia		625+	13,340	110.3 M	8,271.81

\*Catch includes all wild caught species, such as fin fish, crustaceans and molluscs, and does not include aquaculture or pearl harvesting. Data from three provinces of Indonesia (source: DGCF 2010 ),

three states of northern Australia (Handley 2009, DEEDI 2010, Fletcher & Santoro 2010) and Timor-Leste (Dos Santos Silva 2009, Nugroho 2009)N DFA-MAF 2010).

Information for Australian states includes only the commercial fisheries that actively fish in the ATS and does not include recreational or subsistence fishing. Data from PNG is not available at time of writing.

In Timor-Leste although there is less information about the level of IUU fishing, data suggests that it might be quite high in the remote parts of its EEZ, e.g. in the area of the Joint Petroleum Development Area (JPDA). Recent estimates by Bateman and Bergin (2011) suggest that IUU fishing in Timor-Leste is widespread and that loss of income is approximately US\$36 million dollars per year. Timor-Leste has a limited capacity to manage IUU fishing at present. Incidents of poaching and cross border trade of shark fins, freshwater turtles and saratoga fingerlings have also been reported around the PNG-Papua border inside the Tonda Wildlife Management Area<sup>6</sup>.

Many communities across the ATS are highly dependent on subsistence and artisanal fishing to meet their immediate nutritional requirements and to generate income to meet the costs of other basic needs such as education. Fish provide a significant percentage of the population's animal protein and nutritional needs. While there remains a significant reliance on fish for protein, there is suggestion that fish is becoming less important in daily diets of these island communities in Indonesia due to overexploitation and environmental degradation (James Fox *pers comm.* 2011) although there is little empirical evidence to support this.

The Indonesian provinces within the ATS region contain diverse ethno-linguistic coastal populations engaged in multiple livelihood strategies. This includes either as i) full time fishermen and/or heavily reliant on marine-based resources for food and income or ii) part-time fishing communities (mixed-fishing/agriculture/other). It also includes long established local coastal populations with clear claims to tenure and migrant fishing populations, particularly in NTT and Papua and to a lesser extent in Maluku, who are either long-term or seasonal migrants (fishers and families) most commonly belonging to the Bugis-Buton-Makassar-Bajo maritime populations of eastern Indonesia but also the Madurese.

People move regularly and frequently between home villages and transient or semi-permanent settlements across the archipelago. Mobility is facilitated by kinship, economic ties (patron-client), and historical antecedents (Stacey 2007). Bajo, Bugis, Butonese, and Makassarese fishers and families originating from other areas of eastern Indonesia undertake seasonal travel to key ports and fishing grounds searching for products of high commercial value such as trepang, trochus shell, live reef fish, and shark fin. They compete for largely open-access and unmanaged resources (small-scale fishers are usually exempt from licensing), contributing to declining habitats and reef resources in some areas.

The most mobile and specialised of all these seafaring groups are the Sama-Bajo (often named Bajau, Sama-Bajau or Bajau Laut) and – frequently referred to as ‘sea nomads’ in the academic and popular literature (Fox 2005, Lowe 2006, Stacey 2007, Fox 2005). They depend almost exclusively for their livelihood and spiritual and social wellbeing on the highly biodiverse island, coral reef and oceanic environments in the Indonesian region. While ecological knowledge of the marine environment is highly regarded Bajo are often misrepresented in conservation literature as having negative impacts on the environment (Stacey et al 2012) and do not concern themselves with sustainable practices (Lowe 2006). Such responses tend to ignore social, economic and cultural complexities of migratory

<sup>6</sup> [http://wikipedia.org/Tonda Wildlife Management Area/](http://wikipedia.org/Tonda_Wildlife_Management_Area/) accessed 07 February, 2012

maritime-orientated livelihoods. This group is extremely vulnerable and marginalised as they lack secure sea tenure, are landless and considered a minority indigenous group [ILO Convention no 169 (1989) in (Borrini-Feyerabend et al. 2007)]. Access to capital assets differs markedly between local and immigrant fishers in Indonesia. Locals have access to land whereas immigrants do not. However, both local and immigrant fishers impact on local fisheries resources (Adhuri pers comm. 2010).

There have been over 300 years of transboundary sailing, fishing, cultural and trading activities between what is now Australia, the Republic of Indonesia and Timor-Leste, particularly between northern Australia and Indonesia (Fox 1977, Stacey 2007, Fox 2009). Artisanal scale fishers from various settlements in NTT, including the districts of Rote Ndao, Kupang and Pantar-Alor and from other regions such as South and Southeast Sulawesi and Madura region of East Java are engaged in both legal and illegal trans-boundary fishing in the Timor Sea. This has included a diverse number of groups but includes Bugis, Buton, Makassarese, Bajo, Madurese, Alorese (Pantar), Rotinese groups from eastern Indonesian islands. Indonesians can legally fish in the area of the AFZ under arrangements within the 1974 Memorandum of Understanding (MOU) which permits traditional Indonesian fishers to access a defined area known as the MOU Box. The total number of Indonesian fishers who participate in the MOU Box fishery is much larger than the number actively fishing at any particular time. There are a number of vessels that regularly visit the MOU Box fishery but there is a significant change in the make-up of crews, and while some fishers use the fishery on a regular basis, others use it only opportunistically. There were between 1,000 and 2,000 fishers in 2010 but the number may have been greater in previous years prior to border control.

Communities in Maluku are highly dependent on marine products for their livelihoods including food, particularly those living on small islands where access to agricultural land is limited. In 2009, around 9% of the population was employed in the fisheries sector. In practice, the majority of people living in coastal areas generally have double occupations, as farmers and fishermen. This strategy increases resilience to cope with seasonal changes in resource availability.

Local communities of Papua Province engage in small scale coastal fishing, working as labourers and trading. Along the eastern Arafura coast, there are a number of fishing communities who originate from elsewhere, predominantly the Bugis and Butonese, particularly in Mimika district. Very few indigenous people of Papuan descent live on this coast.

Dobo, the main town of Maluku has been a trading centre for marine products for centuries, and a staging post for voyages into shared seas by fishers targeting a variety of products. Fishers from the Aru, Kei (Tual) and Tanimbar Islands (Saumlaki) as well as smaller islands to the west of Tanimbar, depend on local resources from fishing and aquaculture. Many illegal trans-boundary fishing voyages to northern Australian (Arnhem Land) waters originated in Dobo and Saumlaki in the Tanimbars (Fox 2009, Fox & Sen 2002).

In Papua, the port towns of Sorong, Merauke and Kaimana (West Papua) are focal points for ATS fisheries from where both industrial and artisanal scale fisheries operate. Local communities engage in small scale coastal fishing and Bugis, Butonese and Mimika fishermen are active in the region. Illegal fishing voyages to the Gulf of Carpentaria usually commence in or around Merauke (Fox 2009).

### 3.3.2 Aquaculture

Aquaculture represents the world's fastest growing food production sector (Andrew et al. 2010) although not significant as a direct trans-boundary issue. It is seen as a viable means

of supplying the increasing demand for fish and other aquatic resources such as seaweed, as well as providing a sustainable livelihood in the ATS region. As with capture fisheries in the ATS, there is diversity in the scale of aquaculture operations, relating to different social, cultural and economic conditions within each country.

The effects aquaculture will have on the ATS are largely unknown. Production of high value fish and crustacean species is still highly reliant on other 'fish' from the region as feed for the cultured animals. Conversion rates are generally poor with many tonnes of fish consumed to produce a much smaller harvest of high value cultured animals. This may effectively reduce food supplies to the rural poor who may be unable to afford the high priced product (Arthur & Sheriff 2008) but may lose access to the low cost feed species.

Governance, policy and management present major challenges for aquaculture. Habitat degradation is possible – or even likely to occur – in some parts of the ATS unless aquaculture development is carefully managed. Additionally, if development is not carefully managed, the enterprises will be at heightened risk of disease outbreaks that could be catastrophic for the enterprises and livelihoods. In areas where regional aquaculture enterprises provide important livelihood activities for poor rural/coastal communities, disruptions are likely to force people back to capture fisheries to maintain their supplies of food and income.

### 3.3.3 Mining

The littoral zones of Indonesia are subject to increased mining industrial and artisanal activity including along coastal zones of the ATS region. Threats to coastal ecosystems from poorly regulated mining development such as erosion and sediment runoff, pollutants and mangrove infill, have direct deleterious consequences for coastal communities and inshore marine ecosystems. In West Papua and Maluku provinces in particular, there are significant levels of mining, oil and gas exploration across the region and a number of these prospects are likely to be developed in the near future. Manganese mining has expanded dramatically in West Timor since 2008, and includes many unregulated, small-scale ventures by individual farmers. Issues arising from mining activities include environmental degradation and damage, safety and health problems for the miners and impacts on other agricultural activities resulting from abandoning food production activities. The extent of involvement of coastal and fishing people and impact on coastal environments is unknown. However a newspaper report noted that fishers have moved to the mining sector as mine labourers (*Kupang Post*, 31/3/10 Editorial).

Artisanal mining can have big impacts because of the practice of strip mining to access the top layers and artisanal miners use mercury in processing which has harmful environmental and health effects. Gold mining has potentially polluting impacts from sediments and leaking of cyanide. Mineral sands and coal are mined in Papua.

The largest mine within the ATS river catchment area is Freeport-Indonesia mining company operating near Timika (copper/gold/silver). A proposed gas development at Bintuni Bay located south of the Bird Head peninsula region of West Papua will be the largest gas development in the Arafura Sea.

Timor-Leste does not yet have any significant mining industry beyond small-scale artisanal mining for sand and other building materials. The government is currently developing the nation's mining legislation.

In northern Australia several major mines exist in areas adjacent to Kakadu National Park (Ranger uranium mine), Gove (aluminium and bauxite), Groote Eylandt (manganese), McArthur River (Zinc), Karumba (Zinc) and Weipa (Kaolin, Bauxite)(DEWHA 2008a).

In Western Australia the most significant mines include the existing and proposed expansion of iron ore mining on Cockatoo and Koolan islands, the existence of undeveloped bauxite resources on Cape Bougainville, the Mitchell Plateau and East Kalumbaru and significant zinc and lead deposits at Admiral Bay, south of Broome. The Argyle diamond mine near Kununurra is one of the country's most well-known mineral resources.

The major economic activity in Western Province of PNG is the Ok Tedi Mine (copper) located at headwaters of the Ok Tedi River in the North Fly District. The mine is owned by PNG Sustainable Development Company and has been the subject of litigation by traditional landowners both in respect of environmental degradation and disputes over royalties<sup>7</sup>.

It would appear, however, that in general the ATS region is relatively pristine except for in the regions around some high impact activities that affect some significant coastal areas, while there are many smaller scale localised chronic impacts from human activities in the region

### 3.3.4 Oil and Gas Exploration and Production

The ATS and surrounding region contains extensive fields of oil and gas under various stages of operation, construction and consideration. This sector has the potential to have a significant impact on the population and socio-economic structure of communities adjacent to the coastal areas in the ATS region. Most current production is located in the western part of the archipelago. According to the Indonesian Energy and Mineral Resources Ministry, in 2011 investments in the oil and gas sector may exceed US\$16 billion.<sup>8</sup> Oil production has declined since the 1990s and production cannot keep up with increasing domestic demands.<sup>9</sup>

Natural gas production has increased along with increased domestic demand. Indonesia is reported to be the tenth largest holder of proven natural gas reserves in the world and the single largest in the Asia-Pacific region. One of the largest reserves is in Bintuni Bay, West Papua (north of ATS region). Within the ATS region a new project is under development, Abadi Masela LNG Terminal which will provide an important energy source for the country.<sup>10</sup>

The growth in the GDP in Timor-Leste since 2004 is attributed to the petroleum sector, with real petroleum GDP growth of 99% compared with real non-petroleum growth of 1%. However, only 0.07% of the population is employed in the petroleum sector. In a recent assessment of the maritime interests of Timor-Leste it was reported that revenue from the Bayu-Undan gas field is expected to provide US\$9.4 billion over the next 15 years. The next major field to be developed in the Timor Sea is the Greater Sunrise field and is expected to yield US\$24 billion over next 30 years (50% shared with Australia). An onshore processing plant will be located in either northern Australia or Covalima, Timor-Leste. Ability to respond to threats to the marine environment such as from oil spills is limited especially along south coast of Timor-Leste.

The oil and gas industries are major contributors to the Australian economy accounting for about 3.8 per cent of the total GDP in 2006-07. Australia is now the 18<sup>th</sup> largest producer of natural gas, the seventh largest exporter of LNG in the world and the third-largest LNG

<sup>7</sup>[http://en.wikipedia.org/wiki/Western\\_Province\\_\(Papua\\_New\\_Guinea\)](http://en.wikipedia.org/wiki/Western_Province_(Papua_New_Guinea)) – accessed 29/7/2011

<sup>8</sup><http://www.globserver.com/en/press/indonesia-told-hunt-oil-eastern-regions> - accessed 2/8/2011

<sup>9</sup>[http://en.wikipedia.org/wiki/Economy\\_of\\_Indonesia#Hydrocarbons](http://en.wikipedia.org/wiki/Economy_of_Indonesia#Hydrocarbons) – accessed 2/8/2011

<sup>10</sup><http://oil-and-gaspost.blogspot.com/2011/05/indonesian-govt-to-hunt-for-more-oil-in.html>;  
<http://abarrellfull.wikidot.com/indonesia-oil-gas-profile>- accessed 2/8/2011

exporter in the Asia-Pacific Region. The outlook for Australia's LNG industry is for continued high growth, with exports forecast to rise dramatically from 7.8 million tonnes in 1999 to 20 million tonnes by 2010<sup>11</sup>.

Major expansion of the gas sector continues in Commonwealth waters off the northwest coast of Australia. There is significant potential for the development of petroleum resources in the Browse and Bonaparte basins, off the Kimberley coast. These resources are estimated to be around half the volume of those in the Carnarvon Basin off the Pilbara coast (ACIL Tasman and Worley Parsons 2005, Clifton et al. 2007b).

The exploration, extraction and transport of hydrocarbons are also major industries in the ATS region. Previous oil spill events have shown that this is not without risk to marine habitats, biota and fishing activity throughout the region.

### 3.3.5 Shipping and Ports

In the ATS region, sea transport is important for the movement of general cargo/freight, livestock, commodities and mineral resources. It also provides transport for millions of people, particularly across the Indonesian archipelago. Port facilities and shipping services are all experiencing growth due to development, particularly in northern Australia.

In the Indonesian archipelagic state, shipping is extremely important for inter-island freight, linking regions, and providing transport for millions of Indonesians. In some islands off the Arafura Sea the only means of transportation available is by sea. Most goods are shipped through major ports (e.g. Makassar, Ambon, Bintuni Bay, Kupang and Merauke) and smaller feeder ports in the region. The national shipping line, Pelni provides passenger services to ports throughout the country, stopping at major ports of Kupang, Saumlaki, Dobo, Tual, Merauke, Timika, Kaimana and Ambon and smaller ports in Lesser Sunder islands. Hundreds of small inter-island ferries (motorised boats) also operate and are a highly important form of transportation in Indonesia, contributing significantly to local economies. Cargo ships, including traditional fleets of wooden motorised vessels also play an important role in transporting goods around the archipelago.

The capital, Dili has the only international port of entry to Timor-Leste. Small wharfs or jetties are located at Hera, Tibar, Com, Caravela, the enclave of Oecusse, and the island of Atauro. For Oecusse and Atauro the ports are the only means of access to from other parts of Timor-Leste. Shipping in and out of the Timor-Leste port of Dili continues to grow but administration of shipping is underdeveloped and Timor-Leste ports do not comply with international standards (Bateman & Bergin 2011).

In northern Australia, the major ports (Darwin, Dampier, Broome, Weipa, Karumba, Nhulunbuy, Groote Eylandt) are experiencing increased activity due to expansion in the resources sector and exports of major commodities (iron-ore, natural gas and other petroleum products, lead, zinc, manganese, nickel and copper) (DEWHA 2008a, DEWHA 2008b).

### 3.3.6 Marine Tourism

Indonesia has one of the most biologically diverse marine environments in the world and marine-based tourism is popular in many locations throughout the archipelago. The region is popular for a range of activities including diving, boating and surfing. However, the districts of eastern Indonesia within the ATS region have little in the way of tourism infrastructure and are not among the areas generally frequented by international or domestic tourists for

---

<sup>11</sup><http://www.austrade.gov.au/Oil-Gas-overview/default.aspx> - accessed 29/7/2011



marine based activities. Marine tourism is generally only small-scale but remains a growth area which is often promoted by local governments.

Marine tourism has been identified as a potential economic growth area for Timor-Leste, particularly along the north and east coasts to deliver social and economic benefits through employment and income generation (Edyvane et al. 2009b, Bateman & Bergin 2011). The Government of Timor-Leste supports the development of tourism and identifies it as a priority sector for employment development alongside agriculture and the oil and gas sectors (RDTL 2011). The government has actively supported a range of research projects exploring the potential for marine-based tourism (Boggs et al. 2009, Dethmers et al. 2009). In 2007, Nino Konis Santana National Park on the eastern-most tip of Timor-Leste was declared as the country's first National Park. The protected area includes a Marine Park which forms part of the Coral Triangle and is home to a diverse array of cetaceans, turtles, large pelagic fishes and relatively unharmed coral reef (Edyvane et al. 2009a, Boggs et al. 2009, Edyvane et al. 2009b).

Some ecotourism, including cultural tourism in coastal areas, interaction with marine mega-fauna (dolphins, whales), fishing competitions and diving outfits already exist however further development of these industries is reliant on improved infrastructure and services (Bateman & Bergin 2011).

In the regions of northern Australia abutting the Arafura and Timor Seas, commercial marine tourism is an important industry, although only a small component of the overall tourism sector. Activities include charter fishing, diving, snorkelling, whale watching and visitations on luxury cruise boats around the Kimberley archipelago and NT coast to view sparsely inhabited pristine marine and coastal regions. This industry is expected to grow over the coming years (DEWHA 2008b). In the northern region the marine tourism industries are largely associated with recreational fishing ventures which are projected to increase both in terms of effort, numbers and potentially movement from coastal to offshore areas (Fernandes & Greiner 2010).

### 3.3.7 Agriculture

The agricultural sector employs millions of people across the four nations bordering the ATS region. In all three countries besides Australia, the sector is dominated by subsistence farming with export opportunities limited by low productivity and distance from markets.

Indonesia's agricultural sector involves millions of people and three out of five families living in rural areas depend on farming as their main occupation (World Bank Report<sup>12</sup>).

In NTT, around 70% of the population depend on dry land farming for livelihoods (maize, legumes) although soils of islands in the ATS region are generally poor, made up of coral and rock, and unsuitable for many crops except cassava and maize (Fox 2011). The province is drought-prone and in the last few years has been affected by delayed monsoon and protracted dryness (UNICEF/WFP/FAO 2010). Annual burning is a common land management practice in NTT. The dry season across eastern Indonesia is long at around 8 months per year. The period between the late dry season and onset of the west monsoon is locally referred to as the 'hungry season' (*musim lapar*). Annual droughts and regular flash floods during the rainy season have worsened in recent years negatively affecting agricultural productivity. Production is also impacted on by pests, diseases, and high post-harvest losses (UNICEF/WFP/FAO 2010) and degraded environments.

---

<sup>12</sup><http://go.worldbank.org/RHGAAY6GY0>, accessed 28/7/2011

Agriculture accounts for around 59% of employment across the province of Maluku, but around 75% in rural areas. From 2002 to 2009, the overall contribution of agricultural to the province's GDP increased but the number of people employed in the sector decreased suggesting increased productivity but at the cost of overall employment (ILO 2011). Like much of eastern Indonesia, staple foods in Maluku have historically consisted largely of non-rice foods but due largely to government policy, wetland rice farming in Maluku increased dramatically over the past decade.

Food shortages, malnutrition and high levels of poverty are major problems in the mountain areas of Papua province where agriculture is dominated by sweet potato cultivation and pig raising. Sweet potato is the principal staple food for humans and the main food for pigs (Cargill 2009).

A lack of substantial local markets means that farmers of eastern Indonesia are disadvantaged by government policy. Licensing and regulation concerning agricultural products relate to inter-district, inter-island or cross border (export) transportation and trading of the commodities, which usually involve the payment of a host of government fees, administration costs, and third party contributions (Suharyo et al. 2007).

The majority of Timor-Leste has steep terrain, with a gradient of 30°, leaving only a very small area of land suitable for cultivated crops. However, agriculture is the main form of livelihood in the country involving approximately 80% of the population. Approximately one third of households rely on subsistence agriculture exclusively (World Bank Report<sup>13</sup>), producing little if any surplus for sale. The main cereal crop grown throughout the nation is maize which is grown by more than 80% of farmers and is supplemented by cassava, rice and sweet potato (Williams et al. 2008). Coffee is Timor-Leste's leading export commodity.

Agriculture in northern Australia is dominated by pastoralism and intensive irrigated agriculture, the latter concentrated in the Kununurra Kimberley region (Clifton et al. 2007a). Around 5% of land within the major catchment areas of northern Australia is used for intensive agriculture (Stoeckl et al. 2011) but a much larger area is used for livestock grazing based on unchanged land (Larson & Alexandridis 2009). Agriculture and forestry employed approximately 11.5% of northern Australia's workforce (Larson & Alexandridis 2009).

Much of the soil throughout PNG is low in quality with the majority of agriculture consisting of subsistence farming. Small incomes are earned in the South Fly district from the sale of food, fish and rubber. Much of South Fly experiences a long dry season, floods and poor soil, making it unsuitable for agriculture (NRI 2010). An estimated 70% of people grow food crops but the majority of this is subsistence farming with less than 8% engaged in crops for sale (NRI 2010).

### 3.4 Legal and Institutional Setting

#### 3.4.1 International law framework

A number of international treaties govern the use and management of ocean, seas and their resources. The international agreements most relevant to the ATS region are summarised below.

---

<sup>13</sup><http://go.worldbank.org/GN0Z5BCHB0> accessed 28/7/2011

### 3.4.1.1 United Nations Convention on the Law of the Sea (UNCLOS)<sup>14</sup>

Part IX of the 1982 United Nations Convention on the Law of the Sea (1982 UNCLOS) addresses the subject of “Enclosed and Semi-Enclosed seas”. Articles 122 and 123 in the Convention, which deal with enclosed and semi-enclosed seas<sup>15</sup>, recognise special geographical situations where two or more bordering states should cooperate in the exercise of their rights and the performance of their duty to coordinate in the management of shared marine resources and environments.

### 3.4.1.2 Fisheries related instruments

#### The 1995 UN Fish Stocks Agreement

The ‘United Nations Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks’ was adopted in 1995. The Agreement establishes significant principles for the conservation and management of fish stocks and emphasizes that all related management must be based on the precautionary approach and the best available scientific information and should promote optimum utilization of fisheries resources both within and beyond each state’s exclusive economic zone. The Agreement came into effect in December 2001.

#### The 1993 FAO Compliance Agreement<sup>16</sup>

This agreement addresses concerns over the reduction of fish stocks on the high seas as a result of IUU fishing and attempts to overcome the problem of reflagging and flag of convenience associated with fishing vessels attempting to avoid the application of high seas conservation and management measures determined by regional fisheries organizations. The Compliance Agreement promotes Compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas (1993 FAO Compliance Agreement) and was adopted in November 1993, entering into force on 24 April 2003.

#### Code of Conduct for Responsible Fisheries (CCRF)

The Code of Conduct for Responsible Fisheries (CCRF) was agreed in October 1995 as a guide (“guidelines”) for the management and conservation of biological resources of participating countries. Just as the 1993 FAO Compliance Agreement and the 1995 UN Fish Stocks Agreement, CCRF also urges countries to ensure that vessels do not catch fish that are not in accordance with the provisions of conservation. The CCRF also includes flag state obligations to perform effective control of fishing vessels. The FAO has issued International Plans of Action for sustainable fisheries management, as the implementation mechanism of the CCRF, namely:

<sup>14</sup> Timor-Leste is not signatory party to UNCLOS

([http://upload.wikimedia.org/wikipedia/commons/3/3e/Law\\_of\\_the\\_Sea\\_Convention.png](http://upload.wikimedia.org/wikipedia/commons/3/3e/Law_of_the_Sea_Convention.png))

<sup>15</sup> According to Article 122 of the 1982 United Nations Convention on the Law of the Sea (the 1982 Convention):

*For the purposes of this Convention, “enclosed or semi-enclosed sea” means a gulf, basin or sea surrounded by two or more States and connected to another sea or the ocean by a narrow outlet or consisting entirely or primarily of the territorial seas and exclusive economic zones of two or more coastal States.”*

<sup>16</sup> Timor-Leste is not signatory party to UN FA

- International Plan of Action for the Management of Fishing Capacity (IPOA-FISHING CAPACITY).
- International Plan of Action for the Conservation and Management of Sharks (IPOA-Sharks).
- International Plan of Action for Reducing incidental catches of Seabird in Long-line Fisheries (IPOA-seabirds).
- International Plan of Action for Illegal, Unreported and Unregulated fishing (IPOA-IUU).

#### *3.4.1.3 Biodiversity Related Instruments*

There are a number of biodiversity related instruments operating globally that are relevant to the ATS region.

- The Convention on Biological Diversity (CBD)
- International Convention for the Regulation of Whaling
- Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)
- Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar Convention)
- Convention on the Conservation of Migratory Species of Wild Animals (CMS, also known as the Bonn Convention)
- Convention concerning the Protection of World Cultural and Natural Heritage (World Heritage Convention).
- Strategic plan for Biodiversity 2011-2020 adopted in the tenth COP Convention on Biodiversity in Japan October 2010
- Protection of coral reefs for sustainable livelihood and development, UN Committee II resolution (co-sponsored by Indonesia, PNG, Australia and Timor-Leste)

#### *3.4.1.4 Pollution related instruments*

##### **Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (London Convention)**

The London Convention aims to promote the effective control of all sources of marine pollution and take practical steps to prevent pollution of the sea by dumping of wastes and other matter.

##### **International Convention for the Prevention of Pollution from Ships (MARPOL 73/78)**

MARPOL was initially adopted in 1973, based on an ecosystem approach to management. It is the main international convention covering prevention of pollution of the marine environment by ships from operational or accidental causes and includes six technical annexes. The Convention defines special areas of sea area based on oceanographic and ecological conditions and particular transportation traffic.

##### **Convention on Oil Pollution, Preparedness, Response and Cooperation**

The chief treaty addressing oil pollution by facilitating international cooperation to prepare for, and respond to, major oil and chemical pollution incidents and encouraging countries to develop and maintain adequate capability to deal with oil and chemical pollution

emergencies.

### Basel Convention

Another instrument dealing comprehensively with hazardous and other wastes is the 1989 Basel Convention on the control of transboundary movements of hazardous wastes and their disposal. The convention is the most comprehensive global environment treaty dealing with hazardous and other wastes, aimed to protect human health and the environment against the adverse effects of the generation, management, transboundary movement and disposal of hazardous and other wastes. On the issue of the wastes generated aboard ships, the Parties to the Convention have underlined the importance of close cooperation between the Basel Convention and the International Maritime Organization. This issue has raised the question of the relationship between the Convention and other treaties regulating maritime affairs that are under the framework of the IMO.

## 3.4.2 Regional policy framework

### 3.4.2.1 Environment

#### Action Plan for the Protection and Sustainable Development of the Marine Environment and Coastal Areas of the East Asian Region (East Asian Action Plan)

The **Regional Seas Programme** of the United Nations Environment Programme (UNEP) was established as a comprehensive approach to addressing environmental problems in the management of marine and coastal areas. UNEP formulated the East Asian Action Plan in 1981 which is governed by the **Coordinating Body on the Seas of East Asia (COBSEA)**. The main components of the Action Plan are: assessment of the effects of human activities on the marine environment; control of coastal pollution; protection of mangroves, seagrasses and coral reefs; and waste management. The programme does not include a mandatory convention but promotes compliance with existing environmental treaties based on member country goodwill. This program however does not cover the entire ATS region as countries participating in COBSEA include Cambodia, China, Indonesia, Republic of Korea, Malaysia, Philippines, Singapore, Thailand, and Vietnam.

#### Partnerships in Environmental Management for the Seas of East Asia (PEMSEA)

PEMSEA was established in 1999 as a regional activity following the **Regional Programme for Marine Pollution Prevention and Management in the East Asian Seas**, funded by GEF, implemented by UNDP and executed by IMO. PEMSEA became an independent international institution in November 2009, based in Manila, the Philippines. The aims of the programme are to protect the life support systems of the seas of East Asia and enable the sustainable use of their renewable resources through intergovernmental, interagency, and inter-sector partnerships. Participating countries to this programme include Brunei Darussalam, Cambodia, Korea, Indonesia, Japan, Malaysia, China, Timor-Leste, Philippines, Singapore, Thailand, and Vietnam.

#### Coral Triangle Initiative on Coral Reefs, Fisheries, and Food Security (CTI-CFF)

The CTI-CFF aims to bring together six governments in a multilateral partnership to conserve the extraordinary marine life in the region. Using coral and reef fish diversity as two major

criteria, the boundaries of Coral Triangle (CT) are defined by scientists as covering all or parts of the exclusive economic zones of Indonesia (Central and Eastern), Timor-Leste, the Philippines, Malaysia (part of Borneo), Papua New Guinea and the Solomon Islands. CTI officially launched a Regional Plan of Action for the CT at the World Ocean Conference in Manado, Indonesia, in May 2009. The action plan has five overall goals covering priority seascapes, ecosystem approach to management of fisheries and other marine resources, marine protected areas, climate change adaptation and threatened species.<sup>17</sup> In addition, each of the six participating countries has drawn up a National Plan of Action. Timor-Leste is engaged in the Asian Development Bank's (ADB) CTI Pacific programme in partnership with Papua New Guinea, Solomon Islands, Fiji and Vanuatu. The Australian Government is a development partner to the CTI.

### 3.4.2.2 Fisheries

#### APEC Fisheries Working Group (FWG)

The Asia-Pacific Economic Cooperation (APEC) was established in 1989 in response to the growing interdependence among Asia-Pacific economies. There are 21 member economies, including Australia, Indonesia and Papua New Guinea. The **APEC Fisheries Working Group (FWG)** was created by Senior Officials in 1991 and is one of several APEC working groups that define and support sectoral work programmes.

In 2005, the **Bali Plan of Action** was established to guide the priorities of APEC and its working groups that deal with ocean related issues. In 2011, the two working groups dealing with marine and fisheries issues, namely the Marine Resource Conservation Working Group (MRCWG) and the Fisheries Working Group (FWG) were merged to become the **Ocean and Fisheries Working Group (OFWG)**.

#### Western and Central Pacific Fisheries Commission (WCPFC)

The **WCPFC** was established by the **Convention for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean (WCPF Convention)** which entered into force on 19 June 2004. The WCPF Convention draws on many of the provisions of the 1995 UN Fish Stocks Agreement while, also reflecting the special political, socio-economic, geographical and environmental characteristics of the western and central Pacific Ocean (WCPO) region. The WCPFC Convention seeks to address problems in the management of high seas fisheries resulting from unregulated fishing, over-capitalization, excessive fleet capacity, vessel re-flagging to escape controls, insufficiently selective gear, unreliable databases and insufficient multilateral cooperation in respect to conservation and management of highly migratory fish stocks.

Among the ATSEA countries, Australia and Papua New Guinea are full members of WCPFC whereas Indonesia is a cooperating non-member.

#### Indian Ocean Tuna Commission (IOTC)

The Indian Ocean Tuna Commission (IOTC) is an intergovernmental organization established under Article XIV of the FAO constitution. It is mandated to manage tuna and tuna-like species in the Indian Ocean and adjacent seas.

---

<sup>17</sup> Interim Regional CTI Secretariat. Regional Plan of Action: Coral Triangle Initiative on coral reefs, fisheries and food security (CTI-CCF). Interim Regional CTI Secretariat, Jakarta, Indonesia, 2009

The objective of the Commission is to promote cooperation among its Members with a view to ensuring, through appropriate management, the conservation and optimum utilisation of stocks covered by this Agreement and encouraging sustainable development of fisheries based on such stocks.

The Members of the Commission are also expected to cooperate in the exchange of information regarding any fishing for stocks covered by this Agreement by nationals of any State or entity which is not a Member of the Commission.

The area of competence of the Commission is the Indian Ocean (defined for the purpose of this Agreement as being FAO statistical areas 51 and 57) and adjacent seas, north of the Antarctic Convergence, insofar as it is necessary to cover such seas for the purpose of conserving and managing stocks that migrate into or out of the Indian Ocean.

### Regional Plan of Action (RPOA) to Promote Responsible Fishing Practices (including Combating IUU Fishing) in the Region (South East Asia)

All ATSEA countries are signatories to the **RPOA** which is an agreement between eleven South East Asian countries to promote responsible fishing practices and combat IUU fishing, including the ATS. This voluntary instrument contains priority actions including: Strengthening Monitoring, Control and Surveillance (MCS), improving the current resource and management situation; implementing regional and international instruments; Capacity Building, Strengthening Coastal and regional State responsibilities, Port State measures.

The RPOA has established a Regional Monitoring, Control and Surveillance (MCS) Network, plus three sub-regional MCS networks which includes the ATS Network, membership being Australia, Indonesia, Timor-Leste and Papua New Guinea. Parallel with establishing the MCS networks, the RPOA developed an international-best- practice MCS Curriculum for use by member countries.

The RPOA has recently completed two major studies which have the potential to significantly improve the level of fisheries management in the ATS:

- (i) *Framework for Model Fisheries Legislation in South East Asia (2010)*– a study providing in-depth analysis of the gaps, strengths and weaknesses in each RPOA country’s fisheries legislation, and a detailed framework for legislation to foster regional harmonization of fisheries management arrangements including stronger legal action against IUU fishing. The study can be viewed at [www.rpoa.sec.kkp.go.id](http://www.rpoa.sec.kkp.go.id) .
- (ii) *Net Returns: A Human Capacity Development Framework for Marine Capture Fisheries Management in South East Asia (2011)* – a study to provide guidance to RPOA countries’ fisheries management, donor and technical agencies on capacity building priorities across eight major management themes, for example, fisheries management planning, fishing capacity management, strengthening MCS and information systems, and strengthening regional and international cooperation. This study can found at [www.daff.gov.au/netreturns](http://www.daff.gov.au/netreturns).

#### 3.4.2.3 Arafura and Timor Seas Experts Forum (ATSEF)

The Arafura and Timor Seas Experts Forum is a non-binding forum to foster collaboration between government and non-governmental organisations in Australia, Indonesia, Papua New Guinea and Timor-Leste in the pursuit of the sustainable use of the living resources of the Arafura and Timor Seas. It is open to, and encourages participation from, agencies and

individuals within the littoral nations and from international organizations, who are willing to advance the purpose of the Forum in accordance with the Memorandum of Understanding signed in October 2003.

The purpose of the Forum is to assist in achieving the goals of sustainable development and poverty alleviation, specifically for the littoral nations and for the coastal and indigenous communities, who depend upon the Arafura and Timor Seas for their livelihood. As a United Nations World Summit on Sustainable Development Partnership (Type 2), the objective of ATSEF is to provide opportunities to improve information sharing arrangements between the littoral states of the Arafura and Timor Seas. It provides an informal mechanism to identify cooperative research agendas and arrangements to enhance the nations' capacity to sustainably manage the Arafura and Timor Seas.

The five priority foci directing ATSEF research are:

1. Preventing, deterring and eliminating IUU fishing in the Arafura and Timor Seas
2. Sustaining fish stocks, marine habitats and coastal and marine biodiversity
3. Understanding the marine, coastal, and catchment system dynamics of the seas
4. Assisting sustainable and/or alternative livelihoods for coastal, traditional and indigenous communities
5. Improving capacity for data information, management and sharing between the littoral nations of the seas

#### *3.4.2.4 Indonesia-Australia Bilateral Cooperation*

##### Agreement between the Government of Australia and the Government of the Republic of Indonesia Relating to Cooperation in Fisheries (1992 Fisheries Cooperation Agreement)

The 1992 Fisheries Cooperation Agreement facilitates information exchange on research, management and technological developments, complementary management of shared stocks, training and technical exchanges, aquaculture development, trade promotion and cooperation to deter illegal fishing.

A current issue for the Australia-Indonesia relationship is IUU fishing. Cooperation takes place under the auspices of the **Working Group on Marine Affairs and Fisheries (WGMAF)**. Established in 2001, the WGMAF is the primary bilateral forum to enhance collaboration on primarily fisheries issues relevant to the areas of the Arafura and Timor seas. The Working Group brings together the fisheries, environment and scientific research portfolios and agencies from both countries. The Department of Agriculture, Fisheries and Forestry (DAFF) takes the lead for Australia and the Ministry of Marine Affairs and Fisheries for Indonesia<sup>18</sup>.

##### The Australia-Indonesia Fisheries Surveillance Forum

**The Australia-Indonesia Fisheries Surveillance Forum** coordinates cooperative activities between Australia and Indonesia that assist in the fight against IUU fishing in both Australian and Indonesian waters. The Fisheries Surveillance Forum was established in 2008 as a sub-working group under the WGMAF. The forum initiates information sharing, building surveillance capacity and the conduct of coordinated marine patrols between Australia and Indonesia. The Australian Customs and Border Protection Service takes the lead for Australia and the Ministry of Marine Affairs and Fisheries for Indonesia.

---

<sup>18</sup> <http://www.daff.gov.au/fisheries/international/cooperation/indonesia> [accessed 6/01/2012]



### MOU Box Area

The **MOU Box** Area provides Australia with a mechanism to manage access to its waters by Indonesian traditional fishers to continue their customary practice. It is an area of approximately 50,000 km<sup>2</sup> in size of Australian water in the Timor Sea where Indonesian traditional fishers, using traditional fishing methods only, are permitted to operate. The enabling document for this agreement is the Australia-Indonesia Memorandum of Understanding regarding the Operations of Indonesian Traditional Fishermen in Areas of the Australian Fishing Zone and Continental Shelf – 1974. Guidelines under the MoU were agreed in 1989 in order to clarify access boundaries for traditional fishers and take into account the declaration of the 200 nautical mile fishing zones. Fishers primarily target shark and reef top species including trochus and trepang. Successive research reports on reef top species in the MoU Box indicate that stocks in the area are depleted. Cooperation to progress management arrangements for the MoU Box is a priority for the bilateral fisheries relationship between the two countries.

#### 3.4.2.5 Australia-Papua New Guinea

##### Torres Strait Treaty

The **Torres Strait Treaty** is an agreement between Australia and Papua New Guinea that defines the boundaries between the two countries and how the sea area may be used. It was signed in December 1978 after long discussions between Australia and Papua New Guinea and was developed to remove any remaining doubts about the boundaries between the two nations.

There are two main boundaries:

- (i) Seabed Jurisdiction: Australia has rights to all things on or below the seabed south of this line and Papua New Guinea has the same rights north of the line; and
- (ii) Fisheries Jurisdiction Line where Australia has rights over swimming fish south of this line and Papua New Guinea has the same rights north of the line. The two countries have agreed under the Treaty to share these rights.

The **Protected Zone** is an area of the Torres Strait recognised by Australia and Papua New Guinea as needing special attention. The main reason for the Protected Zone is so that Torres Strait Islanders and the coastal people of Papua New Guinea can carry on their traditional way of life. People from both countries may move freely (without passports or visas) for traditional activities in the Protected Zone. The formation of the Protected Zone has also helped to preserve and protect the land, sea and air of the Torres Strait, including the native plant and animal life.

Part of the Treaty deals with commercial fisheries ensuring that commercial fishing in the Protected Zone is in harmony with traditional fishing, provides for commercial fishing by both Australia and Papua New Guinea and includes arrangements for the sharing of commercial catch. It allows both countries to work together in licensing and policing as well as in the preservation, protection and management of fisheries.

### 3.4.3 National legislation, policies and institutions

#### 3.4.3.1 Australia

##### Existing Laws and Institutions

**The Fisheries Management Act 1991** establishes the Australian Fishing Zone (AFZ) and underpins Australia's domestic compliance and enforcement powers which enable Australia to protect its valuable fishery resources. Under the *Fisheries Management Act 1991* and the *Fisheries Administration Act 1991*, the Australian Fisheries Management Authority (AFMA) has an obligation to sustainably manage Commonwealth fisheries in the Australian Fishing Zone. The Fisheries Management Act also sets the legislative basis for statutory fishing rights, licences and permits.

Australian fisheries are defined as those fisheries falling within the Australian Exclusive Economic Zone, which extends to 200 nautical miles from coastal baseline. To simplify jurisdiction, boundaries have been developed handing over management responsibility to the State, Northern Territory and/or Commonwealth Governments. Each State/ Northern Territory jurisdiction has responsibility for fisheries that lie within its internal waters (e.g. river, lake and estuarine fisheries) and, where applicable, adjacent fisheries within a three nautical mile boundary from the coastline. The Commonwealth has jurisdiction for fisheries that lie between 3 and 200 nautical miles of the coastline. When a particular fishery falls within two or more jurisdictions, an **Offshore Constitutional Settlement (OCS)** arrangement is generally developed and responsibility is passed to one jurisdiction.

Fisheries in OCS arrangements are defined in terms of species, fishing method and area. They underpin the major fishery management plans implemented under Commonwealth, state or Northern Territory laws. The OCS also forms the basis for ongoing cooperation between governments who share the management responsibilities. Alternatively, a Joint Authority may be formed whereby a fishery is co-managed through the legislation of one jurisdiction.

The Australian Government's **Harvest Strategy Policy** (DAFF, 2007) was developed to support implementation of the Fisheries Management Act, providing a framework that allows a more strategic, evidence based approach to the management of the key commercial stocks in Commonwealth fisheries. The objective of the Harvest Strategy Policy is *"...the sustainable and profitable utilisation of Australia's Commonwealth fisheries in perpetuity through the implementation of harvest strategies that maintain key commercial stocks at ecologically sustainable levels and within this context, maximise the economic returns to the Australian community"*.

A harvest strategy sets out the management actions necessary to achieve defined biological and economic objectives in a given fishery. Harvest Strategies are required to be developed for all Commonwealth fisheries, with the exception of those managed under joint authority arrangements with another Australian jurisdiction or under an international management body.

The **Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)** is the Commonwealth's overarching piece of environmental legislation. The EPBC Act requires that actions in the Commonwealth marine environment that are likely to have a significant impact on the environment undergo environmental impact assessment and must be approved before they can proceed. This Act also includes a requirement for all Commonwealth fisheries, where product is exported, and fisheries interacting with listed

threatened species, to undergo periodic assessment to determine the extent to which management arrangements will ensure the fishery is managed in an ecologically sustainable way.

Fisheries management arrangements also need to take into account the requirements under species recovery plans, wildlife conservation plans and threat abatement plans made under the EPBC Act.

The EPBC Act also provides the basis for the creation and management of marine protected areas. A number of marine protected areas already exist in the ATS, and a number of additional marine protected areas have recently been proposed in the context of marine bioregional planning.

Marine bioregional planning currently being developed under the EPBC Act will provide a foundation for ecosystem based management of the Commonwealth marine environment., Planning involves the identification of “conservation values”, the assessment of current and emerging pressures on conservation values, and the identification of regional strategies to identify such pressures.

### Legal Enforcement and Current Challenges

Legal enforcement is strong in Australia, as exemplified by the fisheries sector. Fisheries offences mostly entail breaches against the rules and regulations summarized above, unauthorized fishing ventures (i.e. fishing without a license or permit), or fishing during closed seasons. Penalties vary considerably for contraventions of state and territory fisheries laws. Western Australia and the Northern Territory employ a tiered penalty scheme based on offence history.

Low population levels and small fisheries mean that there are few problems associated with use of fishery resources. Some of the problems identified within the industry relate to resource sharing among commercial, traditional and recreational sectors, and also potential issues regarding interactions between industries using the same areas to extract resources, such as the fishing and oil and gas industries, or among different sectors, such as conservation and fisheries (J. Martin *pers. comm.*).

#### 3.4.3.2 Indonesia

### Existing Laws and Institutions

#### a. Environment

Implementation of environment management at the national level is undertaken by the Ministry of Environment, while at the local government (Province and District) level is by the *Local Agency for Environmental Impact Control (BAPEDALDA)*, or in some districts, the *District Environment Agencies (Badan Lingkungan Hidup Daerah)*. Laws and regulations concerning Coastal Zone and Small Island Management were recently introduced to manage, protect and conserve coastal and small island resources for the welfare of coastal communities (Law No. 27/2007). Law No. 32/2009 concerning environmental protection and management, addresses issues such as marine pollution and impact of climate change on marine ecosystems. Presidential Regulation No. 24/2008 concerning establishment of National Council on Climate Change reflects further concern on the environment issue.

However, challenges with respect to marine and coastal biodiversity conservation and management have been identified, including:

- Better policies, budget, facilities and planning on marine and coastal resources development
- Improvement on socio-economic and institutional capacity development of the eastern part of Indonesia, which includes Arafura and Timor seas region
- Improvement on coordination mechanism among government agencies involving in regulating coastal & marine resources.

### **b. Fisheries**

Monitoring, Control and Surveillance (MCS) and law enforcement have been developed, however IUU fishing remains a concern. Trawling in Indonesian waters was banned in 1980 by Presidential Decree No. 39 (1980) on Trawl Net Elimination. The only area excluded from this ban is the Arafura Sea east of 130° E, which includes the waters of the Kei, Tanimbar and Aru islands.

In 2009, the Fisheries Act No. 31/2004 was replaced by Act No. 45/2009 to strengthen the effort to eliminate Illegal, Unreported, and Unregulated (IUU) Fishing. However, the vast area of Indonesian seas means that enforcement is still challenging. To support better management of marine and fisheries resources, the Ministry of Marine Affairs and Fisheries has issued Ministerial Decree No. 1/2009 as an amendment to the decree number (No. 995/KPTS/IK210/29/1999) concerning Fisheries Management Area (FMA). Within this decree, the Arafura and Timor Seas belong to FMA-718 and FMA-573, respectively.

Alongside formal regulation, local coastal community also recognize and practice their local sea tenure.

### **c. Forestry**

Responsibility for management of mangrove forest remains at the Ministry of Forestry. Given the vast areas of mangrove in the Arafura and Timor region, the conservation of this ecosystem requires inter-sectoral and inter-governmental level coordination. The role of the Ministry of Forestry is also critical in conserving catchment areas directly linked to coastal ecosystems.

### **d. Mining**

The Ministry of Energy and Mineral Resources are responsible for management of mining. One of the largest mining operations in Indonesia is located in Papua and is likely to produce long term impacts on the Arafura Sea ecosystem. This Ministry must therefore be recognised as an important stakeholder in coastal ecosystem management. New legislation (Law No.4 of 2009 concerning Mineral and Coal Mining) has replaced Law no.11/1967 concerning Basic Provision of Mining. The current law (Law no.4/2009) postulates that to manage and seek potential minerals and coal, independent, reliable, transparent, competitive, efficient and environmentally sound management is required to sustainably assure national development.

### **f. Offshore oil and gas**

Information concerning the effects of offshore oil and gas mining in the Arafura and Timor Seas is still limited, even though several regulations concerning the protection of the environment from oil and gas activities have been issued.

### **g. Ports and shipping**

The Arafura Sea is recognised as one of the Indonesian Sea Lanes (Alur Lintas Kepulauan Indonesia – ALKI), providing important international shipping corridors in eastern Indonesia.

The Arafura Sea is also considered the most important fishing ground and therefore vessels operating in these waters are mostly fishing vessels. Government institutions responsible for regulating port and shipping in this area are the Ministry of Transport and the Ministry of Marine Affairs and Fisheries.

#### **h. Climate change**

The global climate change phenomenon has impacted the Indonesian region including the Arafura and Timor Seas. The National Council of Climate Change (Dewan Nasional Perubahan Iklim, DNPI) is responsible for coordination among government and non-government institutions in order to develop national mitigation and adaptation measures.

#### **Legal Enforcement and Current Challenges**

Provincial and district governments are responsible for management of environmental and marine resources according to Indonesian *Law No. 32 /2004 concerning Local Government and Regulation No.38/2007 concerning Government Authority and Province Authority as an Autonomic Region* .

The implementation of regional development by local government should be referred to the *Regulation No. 8 /2008: Phases, Planning, Management and Evaluation of Regional Development Plan Implementation* and its derivation in *Minister of Home Affairs Regulation (Permendagri) No. 54/2010*. The integration of spatial planning (Laws No 26/2007 and No 27/2007) which refer to the Strategic Environment Assessment (KLHS) is an embedded documents of the regional development plan.

Government Regulation (PP) No. 19/2010, stipulates that as representative of the central Government, the Governor is responsible for coordinating implementation of governance activities within Districts. *Minister of Home Affairs Regulation (Permendagri) No. 30 /2010 concerning Guidance of Marine Resources Management*, gives local government regulatory powers for management of ocean resources.

Consequently, there are several challenges faced by local government (district or/and provincial) in managing resources and the environment, among others:

1. Better coordination on planning and development of marine and coastal resources and environmental management among sectors
2. Improvement of budget, human resources and institutional capacity
3. Balancing of economic values and environment consideration
4. Improvement of development on policy, law and regulation concerning marine and coastal resources utilization.

#### **3.4.3.3 Papua New Guinea**

##### **Existing Laws and Institutions**

A number of key legislation are applicable to sea areas and are grouped under two main headings:

1. Legislation applicable to national issues; and
2. Legislation applicable to coastal issues, primarily dealing with customary rights.

##### **National Issues**

**National Seas Act, 1978** - describes and delineates the *internal waters; territorial sea (12nm); offshore sea (200nm) and archipelagic waters (interim)* to provide and assert rights

of Papua New Guinea under international law. The legislation does not in detail specify, responsibilities, duties and obligations of PNG as against other States as required by UN Convention on Law of the Sea. These gaps are being addressed through the proposed **Maritime Zones Bill** pending the completion and confirmation of the new archipelagic baseline of Papua New Guinea with a proper declaration of all maritime zones such as the internal waters; territorial sea; contiguous zone; exclusive economic zone; continental shelf and extended continental shelf.

The proposed Maritime Zones Bill will also provide rights and responsibilities of Papua New Guinea in all maritime zones in Papua New Guinea and provide for Marine Protected Areas and Marine Reserves to be established in PNG waters.

### a. Environment

Government departments responsible for environmental management are: the Department of Environment; National Maritime Safety Authority; National Fisheries Authority; PNG Ports Authority including Customs and the National Museum. The respective legislations of these organisations are summarised below.

- **National Environment Act** - provides for and gives effect to the National Goals and Directive Principles and regulates environmental impacts of development activities in order to promote sustainable development. The Department of Conservation is responsible for the Environment Act.
- **Environment (*Prescribed Activities*) Regulation** - further regulates the activities which pose serious harm to the environment. Prohibited fishing grounds under the Fisheries legislation are not included in the Environment Prescribed activities regulations so it is not clear if a ban on fishing could stop seabed mining.

### Provincial Environmental Laws

Provincial Governments can enact provincial laws on parks, reserves, gardens, scenic and scientific centres whilst the local-level Governments can enact laws on local environment, hygiene and sanitation, and protection of traditional sites pursuant to the effect of the Organic Law on Provincial Governments and Local Level Governments Act. The protection of traditional sites is important for purposes of traditional taboo fishing grounds or sea areas taboo to local communities.

Department of Environment is further mandated to administer the National Parks Act; Fauna (Protection & Control) Act; Conservation Areas Act and the Crocodile Trade (Protection) Act.

### b. Laws on Protection of the Environment from Shipping and Pollution

The National Maritime Safety Authority (NMSA) is responsible for regulating shipping, safety of ships, registration of ships and pollution from ships. The NMSA is created by the **National Maritime Safety Authority Act** but it derives its powers from the **Merchant Shipping Act**. The NMSA is also the regulator of all seafarer conditions of employment, qualifications of all seamen training at the PNG Maritime College and ensures all Papua New Guinea's international shipping and pollution obligations are met.

### c. Natural Resources

#### Oil and Gas Act 1998

The Act governs the exploration and production of petroleum (including oil and gas) in Papua New Guinea, including the offshore area, and the grant to traditional landowners and

Provincial Governments and Local-level Governments of benefits arising from projects for the production of petroleum (including oil and gas), and the processing and transportation in Papua New Guinea of petroleum and petroleum products.

#### **Mining Act 1992**

The Act regulates minerals rights of the State and mining developments including the regulation of benefits to land owners and Provincial Governments.

#### **Fisheries (Management) Act 1998**

The Act provides for promotion for the management and sustainable development of fisheries and for related purposes. The legislation is designed to encourage commercial exploitation of the fisheries resources. At present there is very little focus on Coastal or Community based fisheries.

The Fisheries Management Act provides most of the necessary arrangements to manage fisheries through designation of competent authority, which is the National Fisheries Authority, comprising the National Fisheries Board and the Authority, responsible for the management and development of the fisheries sector in accordance with the provisions of this Act under the overall policy direction of the Minister. The Fisheries (Management) Act does not apply in respect of the area to which the Fisheries (Torres Strait Protected Zone) Act 1984 applies.

#### **Customary rights to fishing**

The rights of the customary owners of fisheries resources and fishing rights are fully recognised and respected in all transactions affecting the resource or the area in which the right operates. The limitations of the fisheries laws will be discussed separately under coastal issues.

#### **Objective of the Fisheries Legislation**

The legislation is applies to all fishing and fishing related activities under the legislation. Under the scheme of the legislation, all fisheries are governed by Fisheries Management Plans subject to a licensing regime for the different fisheries based on a total allowable catch for each fishery.

The Act further strengthens fisheries development by ensuring enforcement responsibilities are carried out effectively within the National Fisheries Authority to ensure the overall fisheries managed sustainably. Fisheries enforcement is undertaken by NFA through its Monitoring, Control & Surveillance Unit. There are three key MCS functions: National Surveillance, National Observer Programme and National Vessel Monitoring System Program.

The **Environment (Prescribed Activities) Regulation under the Environment Act** is silent on the matters subject of prohibition notices under the Fisheries (Management) Act and to what extent seabed mining conflicts with such prohibition notices remains to be developed. Scientific data on other wider fisheries areas or marine ecosystems relevant for fisheries are sketchy to support arguments of potential damage to greater marine ecosystems which are declared prohibited areas.

Fisheries Scientific Research and documentation is not undertaken in a systematic way to enable National Fisheries Authority to make decisions on the status of various species for management purposes. Only recently efforts are now underway to collect data for coastal areas of concern and to develop management plans or arrangements to assist local communities. The Inshore Fish Aggregating Device 2010 is an example.

Fisheries research is therefore undertaken more on a case by case basis depending on the circumstances when the National Fisheries Authority is approached or through agreement such as the Tuna Tagging Programme with SPC.

### **COASTAL ISSUES**

- PNG's vast area makes it difficult to manage fisheries in totality.
- There is no clear National Strategy or Policy on Coastal Fisheries.
- Essentially there have been good efforts in the past to address coastal issues but no systemic options based on needs of communities to see them through.
- Coastal Fisheries are difficult to manage nationwide with high costs and are simply not viable on a large scale but could be reorganized on specific targeted case by case projects tailored to meet community needs.
- Past case studies could be reviewed and perhaps recommendations from many of these reports could be revisited to draw out the difficulties and impediments and readdressed them as lessons learnt identifying workable options tailored to suit a particular location or community's circumstances.

### **CURRENT EFFORTS BY NATIONAL FISHERIES AUTHORITY IN DEALING WITH COASTAL ISSUES**

Certain coastal fisheries activities are being managed by National Fisheries Authority with *trochus*, *beche-de-mer* and *live fish* managed through Management Plans and under license arrangements.

- *Aquaculture fisheries* have increased over the years under Management and license arrangements.
- Efforts are also underway addressing cooperative societies for local coastal communities.
- Many of the efforts are already addressed on case by case basis.

### **THE CURRENT LEGAL FRAMEWORK ON FISHERIES IN PAPUA NEW GUINEA**

In view of the decentralized sharing of political powers and responsibilities in Papua New Guinea, an important legislation to address is the **Organic Law on Provincial Government and Local Level Governments Act**.

The Constitution of PNG was amended to allow the Organic Law to be enacted to allow three levels of Government to operate in PNG to enable service to be delivered to communities at the lower levels of the community.

- The Organic Law allows three separate Governments to coexist National, Provincial, & Local Level Governments.
- It enables Provincial & LLGs laws to be enacted and administered by Provincial Governments & LLGs respectively.
- In essence through the administration of the Organic Law, services can be delivered to the local communities in rural PNG.
- However OL has limitations on the exercise of powers

### **Law making capacity of the three Levels of Government to enact Fisheries laws**



The principles of law making powers are provided in Section 40 of the Organic Law. The law making powers of the National Government are provided in **Section 41**. That basically reiterates that where a power is not specified in Section 42 or 44 remains with the National Government. It further provides that the National Government will make a law only if the matter is of national interest. However the term “**national interest**” is not defined by the Organic law nor does it further distinguish between what is a “*national interest matter*” or a “*provincial interest matter*” and this is relevant if we are to consider what fisheries are allocated to provincial or coastal communities to regulate and what fisheries remain with the National Government as *national interest fisheries*.

**Section 42** provides the law making power of the **Provincial legislatures** and provides a list of matters which Provincial Governments can legislate on. *Section 42(l); 2 and 3 provide that laws on fisheries and fishing can be enacted provided it is not large scale fishing or fisheries as declared by the Head of State acting on advice or further it is not inconsistent with the Fisheries (Management) Act.* But no guidance is given by the Organic law on what are large scale fisheries or fishing. In relation to coastal or community fishing these are matters which are not national interests therefore could arguably be made as a provincial interest matter. Again no guidance is given on what fisheries come under those headings to warrant relations at the provincial level.

**Section 44** provides the law making powers of the **Local Level Governments**. As above, it is noted that there is nothing specific on *community fisheries* to be regulated. The LLGs are not allowed to regulate daily fishing consumption needs, historical fishing rights or for their marine tenure systems based on traditional knowledge and practice. This is a gap. The scheme of the laws is designed in a way to sustain oral traditions to be maintained for assertion of customary rights.

What is noted is the unclear provisions on fisheries for local consumption; (not for sale) that goes on daily in people’s lives so this may have been an oversight by the drafters of the OL. But other laws would deal with customary fishing rights etc. as observed earlier and therefore not to be regulated by the Organic law. With these obvious gaps coastal communities cannot stand on their own and be heard with possible disastrous effects of resource developments which may impact on long term sustainable management of resources in their communities and fishing grounds.

## Legal Enforcement and remaining challenges

Key challenges of Fisheries Management Authority include:

- Lack of systematic and continuous maritime surveillance whether by sea air or land.
- Maritime Border Security controls may be difficult to monitor incursions and illegal entry and smuggling as surveillance is conducted on irregularly.
- Remoteness of many coastal communities makes coastal fishing opportunities, market access and regulations difficult for planning purposes.
- Lack of basic services and infrastructure developments in remote communities makes fisheries opportunities difficult to initiate and implement.
- Resource Mapping of marine resources to enable decisions on allocation of licenses or permits or management plans
- Social mapping of coastal communities to enable government to make decisions in resource allocations

## LIMITATION OF FISHERIES (MANAGEMENT) ACT TO COASTAL FISHERIES

Fisheries (Management) Act (FMA) as noted does not apply to regulation of customary fishing practices. Section 27 of the FMA further recognizes customary rights of fishing to where these rights exist. Much of customary fishing practices are left to communities themselves to apply based on the Customary Recognition Act, the Underlying Act, Land Disputes Settlement Act and the Village Courts Act as observed above.

**Both OL and FMA** do not provide for customary fishing, artisanal fishing and fishing for personal consumption or the general customary marine tenure systems. This is an obvious gap and limits the Government to fit coastal issues into the legal framework in terms of power sharing between the different levels of Government.

**OPTIONS FOR ADDRESSING COASTAL MATTERS:**

- Apply Section 76(1) (p) of the FMA by way of Regulations to deal with Artisanal fisheries as an option; probably easier and does not go before Parliament for debate and enactment.
- Delegations under section 40 of OL alluded to earlier where a level of government can use to delegate its powers to another level of government provided consultations take place.
- Address all other legislation such as Customs Recognition Act, Land Dispute Settlement Act, Underlying Law Act and Village Courts Act to see how fisheries issues at the community levels can be merged or aligned with overall government objectives in ensuring a sustainable framework on fisheries governance at the community levels.
- Amendments to Fisheries (Management) Act to allow designated coastal areas to be declared and managed by the National Government on a case by case basis.

**Recommendations as part of meeting challenges:**

- An **Overall Resource Mapping Exercise** should be undertaken for the entire PNG waters to identify all marine resources and to be its wider impacts to be undertaken by the PNG Government. This will guide the Government to make sound decisions.
- Dialogue is created with key stakeholders to amend the Organic Law to the extent that **provincial and community fisheries** are permitted to be undertaken by other lower levels of Government.
- Documentation of custom is undertaken by the PNG Law Reform Commission and Village Courts to guide the assertion of customary rights to fishing grounds and other marine resources.

#### 3.4.3.4 Timor-Leste

##### Existing Laws and Institutions

Timor-Leste has enacted three laws related to fisheries and the marine environment:

1. Ministry of Agriculture and Fisheries Organic Law No.08/2008
2. Law No. 12 / 2004 on fishing-related offences
3. Government Decree Law No. 6/ 2004 on general bases of the legal regime for the management and regulation of fisheries and aquaculture

4. Government Decree Law No. 5 / 2004 on general regulation on fishing
5. Government Decree No. 2/2005 on the establishment of fisheries licence tariff, inspection and services related to fisheries activities
6. Government Decree No. 4/2006 altered previous Government Decree No.2/2005.
7. Six Ministerial Diplomas also specify fishing regulations:
  - a. DM No.01/03/GM/I/2005 Defining the fisheries zone
  - b. DM No.02/04/GM/I/2005 Specifies aquatic species of high economic value
  - c. DM No.03/05/GM/I/2005 Allowable percentage of by-catch
  - d. DM No.04/115/GM/IV/2005 List of protected aquatic species
  - e. DM No.05/116/GM/IV/2005 Minimum catch-size and weight
  - f. DM No. 06/42/GM/II/2005 Fines for infraction of fisheries law

These laws not only provide regulation on fishing but also allow for customary fishing practices.

The Ministry of Agriculture and Fisheries (MAF) has the major role in managing the Arafura and Timor Seas and enacting these laws. According to the Decree Law 6/2004 National Consultative Council shall have consultative functions on all matters relating to fisheries and aquaculture.<sup>19</sup>

Within the MAF, the main actor is National Directorate of Fisheries and Aquaculture (NDFA). NDFA covers 5 departments:

1. Department of Fisheries Resource Management and Research on Aquaculture
2. Department of Fisheries Inspection
3. Department of Fisheries Industry
4. Department of Aquaculture
5. Department of Planning and Finance

The main roles of the NDFA are to consolidate planning, policy and to coordinate projects and activities relating to fisheries and aquaculture.

The NDFA has also been involved in several regional and international forums and agreements including the Coral Triangle Initiative (CTI), PEMSEA, African Caribbean Pacific (ACP) and South Pacific Community (SPC). Timor-Leste is co-operating closely with other countries in the region to improve regional marine outcomes.

Other government agencies roles and responsibilities in regards of Fisheries:

- a. **Ministry of Defence and Security** (State Secretary of Defence and State Secretary of Security) Navy and Police)
  - Surveillance and enforcement
  - Legal affairs (establish fishing zone, development of fisheries)
  - Legislation (assist with licensing mechanism)
  - need the confirmation
- b. **Ministry of Economic and Development** (State Secretariat of Environment, Department of Environmental Impact Assessment)

<sup>19</sup>As stipulated in Decree Law 6 / 2004 Art. 120

- Protection of biodiversity
- Environment watch dog

**c. Ministry of Tourism, Commerce and Industry**

The major player is National Directorate of Tourism. According to the IV Constitutional Government Programme 2007 – 2012 (RDTL 2007b:8), the government is committed to develop a structured tourism which will act towards a sustainable and responsible development of tourism, through the planning, coordination and harmonization of transversal policies, taking into account the need to render compatible the environment preservation, natural resources management and the land use planning. It envisions and industry that is based on the country's nature beauty. These are some parts of the country's nature that need to be developed:

- Sea life, corals in particular
- Coral reefs, under water caves
- The north coast for the developing beach tourism

**d. Ministry of Economics and Development**

The key actor is 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 is responsible for environment management in Timor- Leste through authority delegate to it based on Decree Law 3/2005 which specifies that it will encourage environmental protection to support the Secretaries State for Regional Coordination.

**e. Ministry of Finance**

In order to promote the exploitation/utilization of marine resources and aquaculture process, Ministry of Finance shall established Marine and Aquaculture Development Fund Refer to the organic law in the Ministry of Finance.<sup>20</sup>

### Legal Enforcement and remaining challenges

IUU fishing occurs in Timor-Leste waters. The disadvantages of IUU fishing is not only leading to economic loss of fishing rent but also discourage foreign vessels from applying from fishing licenses since their interest cannot be protected without MCS system in Timor-Leste.

The general situation of the environment sector in Timor-Leste remains bleak and the capacity to overcome existing problems is not very promising both in short to medium term. The common challenges within the environmental sector are:

- General Environment
  - Incomplete environmental laws and regulation
  - Limited financial support
  - Lack of implementation of law and regulation
  - Lack of surveillance and law enforcement
  - Application of technology that is not environment friendly
- The environment management framework lacks several important elements, such as:

---

<sup>20</sup>Stipulated in Decree Law 6 – 2004 Art. 121

- Proper legal framework for environment management including land and water rights
  - Environment and social impact assessment and regulatory framework for the mining concessions, logging, etc.
  - Environment management plans
  - Environment protection and conservation standards
  - Protected areas system and endangered species law
  - Forest management policy and law
  - Information and reporting system
  - Environment civil education.
- Relating to Climate Change, there are several problems identified:
    - Limited climate and other meteorological data and poor data collection tools and materials and lack of research programmes.
    - Limited human resources and expertise
    - Lack of capacity in monitoring and evaluation of existing projects

## 4 PRIORITY TRANSBOUNDARY PROBLEMS

---

### 4.1 Unsustainable fisheries and decline and loss of living coastal and marine resources

#### 4.1.1 Description of the problem and justification of its transboundary importance

Poorly managed or unmanaged extraction of fish, prawns and other biota, coupled with decreased viability of stock through pollution and disease, has led to overexploitation and, in many instances, to a decline in living resources within some areas of the Arafura and Timor Seas. The fisheries of the IS LME are very complex and diverse, reflecting the region's extraordinarily heterogeneous geography and species richness. While small-scale fishing predominates in the ATS region of the LME industrial fisheries contribute considerably more in terms of economic value since they target high-value shrimp and demersal fish species. Reef fisheries are important to subsistence fishers in some parts of the region.

Great uncertainties exist on the status of local fish stocks due to serious discrepancies in fisheries data and a potentially significant level of IUU catches. In 2004, total reported landings reached 2.2 million t, with a value of US\$1.2 billion. Overexploitation occurs in some areas of the IS LME, with some fish stocks exploited well beyond biological limits, especially in the coastal zone, which is exploited by 85% of Indonesian fishers. In addition, foreign fleets operating illegally continue to threaten Indonesian fisheries, but again, accurate data on the extent, the number of vessels and their mode of operations is inadequate. Over the past several decades many Indonesia coral reefs have been heavily and chronically overfished, with a major loss of productivity and cascading effects to other components of the ecosystem. Overexploited stocks include many species of reef fish such as groupers and threatened and endangered species, such as sea turtle and dugong. Benthic invertebrates such as trepang and clams are also overexploited, particularly around major coastal population centres.

Scientific evidence suggests that sedentary resources are being severely overfished in the Timor Sea transboundary fisheries. However, fishers active in the area indicate that

resources are more plentiful in the MOU Box than in Indonesian waters closer to their communities (Jim Prescott, AFMA *pers. comm.*), although this is relative. The MOU Box fisheries themselves are unregulated, both for sedentary species and shark, are likely to be overexploited and at risk of stock collapse. Managing the fishery and rebuilding the stocks could however have severe short term livelihood consequences, particularly as these fishers and their families are among the poorest of the poor, with recent World Bank statistics citing 53% of fishing families as below the poverty line (Fox 2009). Successfully reducing the number of fishers using the MoU Box would likely require parallel, or prior, development of alternative livelihoods.

In contrast, fish stocks in the Northern Australian Shelf (NAS) LME are small, but diverse. Commercially fished species include northern prawns, threadfin bream, skipjack tuna, Indo-Pacific anchovies, mud crab, barramundi, Australian salmon, shark, Spanish mackerel, snappers and reef fish. In the southern Arafura Sea and Gulf of Carpentaria, the prawn fishery is almost fully exploited. Crustaceans and molluscs dominate the catch, particularly in the Gulf of Carpentaria where prawns are targeted. However, the long term trend of the Mean Trophic Index for the NAS LME is one of decline from 1950 to the mid-1980s, followed by an increase which coincides with the increased landings of tuna and other large pelagic species.

#### 4.1.2 Impacts on ecosystem services and human well-being

Unsustainable fisheries and decline and loss of coastal and marine resources have serious impacts on the functioning of the overall ATS ecosystem and the services it can provide. Impacts include:

- Provisioning ecosystem services are reduced due to depletion of stock and loss of productivity of transboundary pelagic and demersal species, for example snappers and sharks
- Negative impacts on cultural ecosystem services include loss of traditional livelihoods and cultural identity associated with sea nomadism and cultural practices, such as rotational harvesting and the *Sasi* tradition
- Alterations to the regulating ecosystem services include changes to the food chain and increased risk for invasion of alien species that exploit the loss of species due to overfishing
- Impacts on supporting ecosystem services includes disruption of nutrient recycling due to overharvesting and in some cases shift to algae dominated systems due to loss of herbivore fishes.

The loss of these ecosystem services also have negative impacts on human well-being in terms of health and nutrition, wealth distribution, conflicts over resources and reduction of human security, including food security, equity, education, access to a clean environment, job opportunities and diversification of livelihoods.

#### 4.1.3 Causal-chain analysis of direct and indirect drivers

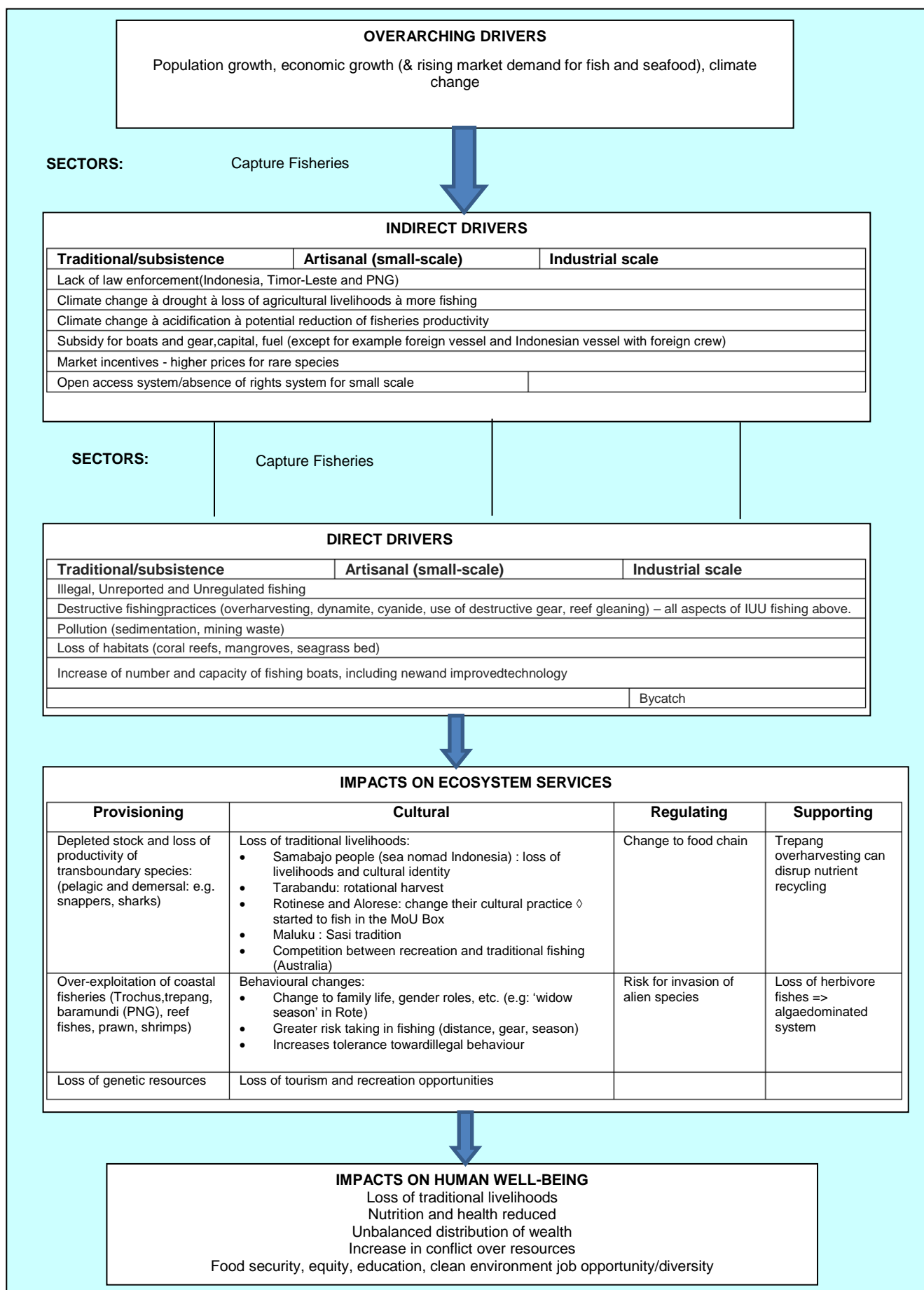
The causal-chain analysis for unsustainable fisheries and decline and loss of living coastal and marine resources is summarized in Box 3.

#### 4.1.4 Summary and recommendations, including potential short to medium term interventions

Unsustainable fisheries and decline and loss of living coastal and marine resources were accorded the highest priority in PNG, but are also high priorities in the other three countries (Annex 1):

- Artisanal fisheries are the main sector driving the decline and loss of fisheries in PNG and in Timor-Leste, while industrial fisheries are the main driver in Indonesia.
- Australia invests a considerable amount in combating IUU fishing in the ATS. Without this investment, the impact on the marine resources of the ATS would be more significant. Direct drivers of change in the fisheries sector that therefore need to be addressed in the short term include IUU fishing, destructive fishing practices, pollution, loss of habitats, technical and institutional capacity building and fishing fleet over-capacity
- Indirect drivers that need to be addressed in the medium term include lack of law enforcement, impacts of climate change, perverse subsidies, market incentives and absence of rights for small-scale fishers and the open access system. The development of alternative livelihoods for small scale fishers may be an option for future consideration.

Box 3: Causal Chain Analysis for Unsustainable fisheries and decline and loss of living coastal and marine resources





## 4.2 Modification, degradation and loss of coastal and marine habitats

### 4.2.1 Description of the problem and justification of its transboundary importance

Modification of coastal habitats has resulted in major changes in population structure as well as functional group composition, notably on coral reefs, and massive changes in ecosystem services of coral reefs, seagrass beds and mangroves. For instance, the important nursery and feeding ground role of mangroves as well as seagrass beds for fish and marine mammals have been lost over extensive areas. Habitat modification and loss have also contributed to the decline in populations of marine mammals such as dugong (Marsh et al. 2001). Habitat degradation has significant trans-boundary implications in terms of reduced fish recruitment and impacts on migratory species as well as on biodiversity throughout the region.

#### Mangroves

The harvest of mangroves trees for timber and fuel wood and the removal of mangroves for shrimp / fish ponds remains a critical coastal management issue in the region. In Timor-Leste total mangrove cover has being reduced by approximately 80% from 1940 (Boggs et al. 2009). Alongi (2002) indicated that approximately a loss of less than 5% of mangrove area in Indonesia took place from 1979 to 1997. In contrast, there has been little clearing or destructive use of mangroves in northern Australia. Mangrove communities are extensively utilized by Aboriginal people, but this use appears to be sustainable and not deleterious in the long term.

#### Coral Reefs

The situation for coral reefs is much more serious. Southeast Asia and the western Pacific contain more than 50% of the world's coral reefs (Bryant et al. 1998), but rapid growth in coastal human populations, coastal development and unsustainable fishing practices have led to a loss of coral reef at the rate of 1–2%/ yr (Bruno & Selig 2007). Over the last 30 years destructive fishing practices using explosives and cyanide have led to declining fish stocks, especially in Indonesia (Tun et al. 2008).

In the latest global re-assessment of coral reefs, Southeast Asia recorded the highest level of local pressure on coral reefs, where nearly 95% of reefs are threatened, with ~50% in the high or very high threat category (Burke et al. 2011). Indonesia (second only to Australia in the total area of coral reefs that lie within its jurisdiction), recorded the largest area of threatened coral reef, with overfishing and destructive fishing pressures driving much of the threat, followed by watershed-based pollution and coastal development. In contrast, Australia's coral reefs are recognized as the world's least threatened, with an estimated 14% threatened by local activities and just over 1% at high or very high threat; watershed and marine-based pollution is the dominant threat, but vast areas of Australian reefs are remote from such impacts (Burke et al. 2011). The ATS region thus includes some of the world's most unthreatened pristine reefs (i.e. NAS LME) and some of the most highly threatened reefs (IS LME). The chronic nature of anthropogenic disturbance in many parts of this region is being compounded by the effects of climate change (Carpenter et al. 2008).

#### Seagrasses

Seagrass meadows have declined within the ATS region, although data is sparse for most areas of Timor-Leste and eastern Indonesia. Widespread dieback of seagrasses has been

reported in the central and northern regions of the adjacent Torres Straits region. Major port and shipping activities are potential threats to regional seagrasses and cyclone-induced erosion has caused large loss of seagrasses in the southern Gulf. Land-based threats to seagrass beds arise from debouching of extractive mining wastes and from pastoral lands. These activities can greatly increase the amount of sediment/turbidity and pollutants associated with runoff produced after monsoon rains.

Seagrass loss has been identified as a potential source of localised declines in dugong populations in eastern Australia (Preen, 1995). In addition to anthropogenic impacts in the ATS region, natural events such as cyclones and floods can cause extensive damage to seagrass communities through severe wave action, shifting sand, adverse salinity changes and light reduction.

#### 4.2.2 Impacts on ecosystem services and human well-being

Decline and loss of biodiversity and key marine species have serious impacts on the functioning of the overall ATS ecosystem and the services it can provide. Impacts include:

- Negative impacts on provisioning ecosystem services include loss of food production from key coastal and marine habitats, loss of access to timber from mangroves for housing, fuel and boats, reduced income and loss of genetic resources
- Negative impacts on cultural ecosystem services include loss of ability to carry out cultural and spiritual practices, such as burials in mangroves, loss of tourism and recreational opportunities, loss of educational opportunities and decline in local ecological knowledge, skills and technology pertaining to habitat management as well loss of supporting social and cultural capital of local communities
- Loss of regulating ecosystem services include loss of hydrodynamics barriers and protection from erosion from storm surges by mangrove swamps, loss of connectivity among habitats, decline in coastal water quality, decline in freshwater quality from groundwater salinization, as well as reduction in carbon sequestration in mangroves and seagrass beds
- Impacts on supporting ecosystem services include loss of nursery function of habitats, alteration of nutrient cycling, reduction in primary and secondary production, increase in acid-sulphate soils, and change to microclimates.

The losses of these ecosystem services also have negative impacts on human well-being in terms of loss of access to safe food and water, and traditional food and medicine, which affects health. It also leads to loss of livelihood opportunities and increased vulnerability of coastal communities, as well as reduced social security caused by break down of social systems and cultural norms.

#### 4.2.3 Causal-chain analysis of direct and indirect drivers

The causal-chain analysis for modification, degradation and loss of coastal and marine habitats is summarized in Box 4.

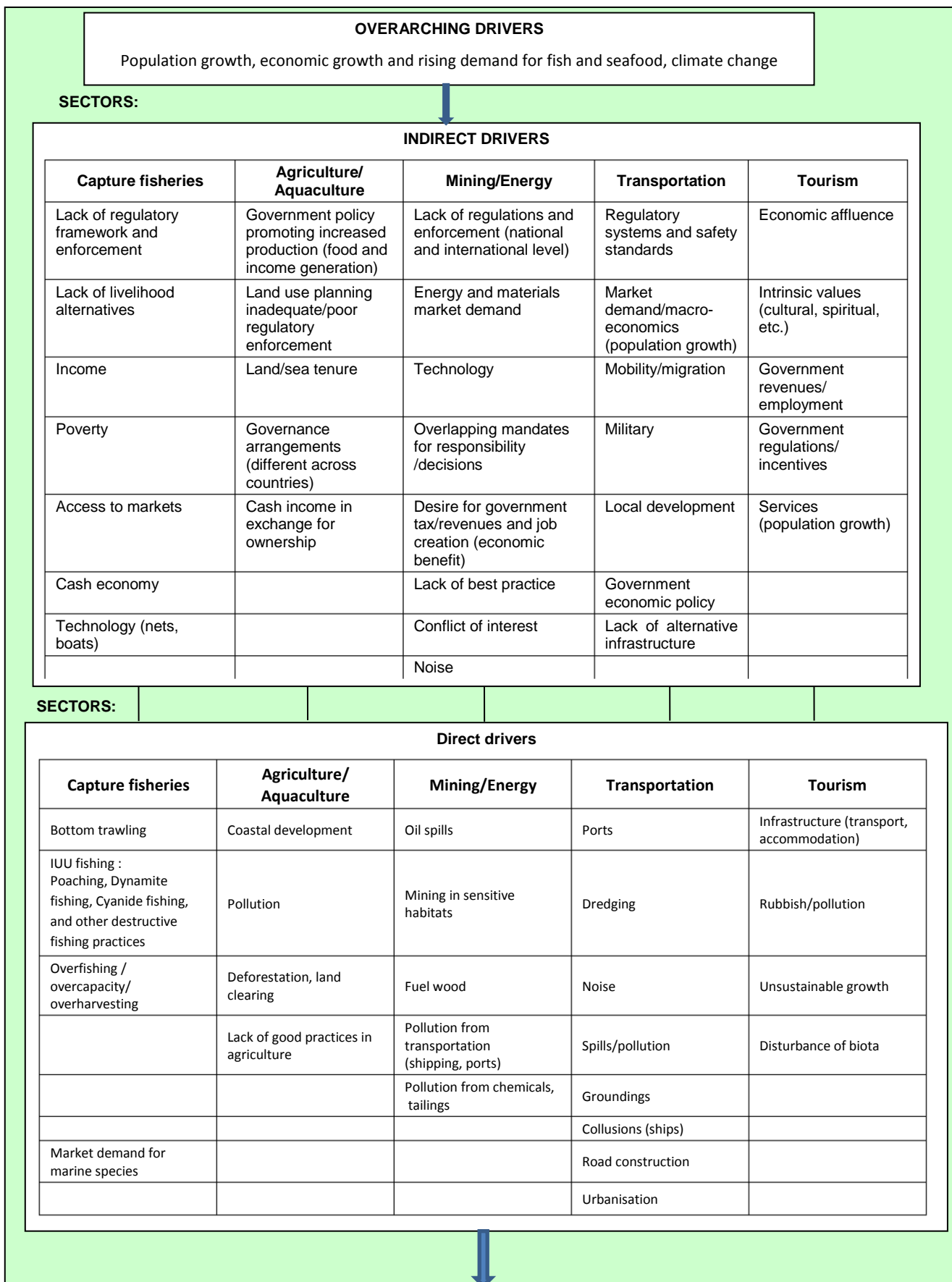
#### 4.2.4 Summary and recommendations, including potential short to medium interventions

'Modification, degradation and loss of coastal and marine habitats' was rated as the top priority in Timor-Leste, but was also given high scores by all the other countries making it the top priority across the region (Annex 1).

The main drivers for marine and coastal habitat degradation varied across the region:

- Lack of coordinated inter-agency planning for coastal development and deforestation are the issues driving the decline and loss of habitat in Timor-Leste, while in Indonesia and PNG, capture fisheries through destructive fishing practices is the main sector involved.
- In the capture fisheries sector, destructive fishing, practices involving bottom trawling, dynamite and cyanide fishing, etc. are key problems coupled with overharvesting and market demand for marine species that need urgent attention.
- Direct drivers in the Mining/Energy and Transportation sectors that need to be addressed in the short term include oil spills and pollution, mining in sensitive areas, and development of infrastructure, such as ports and roads. In addition, mining/energy, and transport also represent key drivers of the decline and loss of habitats in PNG.
- Indirect drivers that need to be addressed in the medium term include lack of regulations and enforcement as well as safety standards, over exploitation due to excessive market demand, and lack of best practice. An important indirect driver that needs immediate attention is the lack of coordination between sectors with overlapping mandates, and local development.
- Governance issues and limited human resource capacity are additional indirect drivers in Indonesia, PNG and Timor-Leste. Strengthening inter-agency co-ordination will facilitate the integrated protection of the marine environment in Timor-Leste and allow improved livelihood outcomes for coastal communities. Improved coordination between all levels of government in Indonesia, PNG and Timor-Leste would also facilitate development of sustainable resource management arrangements in the ATS region.

Box4: Causal Chain Analysis for Modification, Degradation and Loss of Coastal and Marine Habitats



*Box4: Causal Chain Analysis for Modification, Degradation and Loss of Coastal and Marine Habitats (cont'd)*

↓

IMPACTS ON ECOSYSTEM SERVICES			
Provisioning	Cultural	Regulating	Supporting
Loss of food production	Loss of ability to carry out cultural and spiritual practices (e.g burials in mangroves)	Loss of protection from erosion + storm surges (mangroves)	Loss of nursery function of habitats
Loss of access to timber from mangroves (housing, fuel, boats)	Loss of tourism and recreational opportunities	Loss of connectivity among habitats	Alteration of nutrient cycling
Loss of material for handicrafts (shells, coral, timber/fibre)	Loss of cultural identity associated with certain habitats	Decline in coastal water quality	Primary and secondary production (plants) reduced
Loss of income	Loss of educational opportunities	Decline in fresh water quality from groundwater salinization	Increase in acidsulfate soils
Depletion of genetic resources	Decline in local ecological knowledge and skills and technology (habitats and species)	Loss of carbon sequestration (mangroves, seagrass)	Change in microclimates
	Loss opportunities for social and cultural capital	Loss of hydrodynamics barriers (waves)	

↓

IMPACTS ON HUMAN WELL-BEING	
Traditional medicine	Biotechnology/bioactive
Secure livelihoods	Nutrition and water (drinking) and loss of food diversity
Health	Social security (social systems and cultural)
Increased vulnerability for communities in coastal areas	Education and learning

### 4.3 Marine and land-based pollution (e.g. marine debris, sediments, oil spills)

#### 4.3.1 Description of the problem and a justification of its transboundary importance

Due to the lack of major urban settlements in the ATS region, major marine and land-based pollution impacts are largely localized and confined to coastal mining activities, poor catchment practices, offshore oil/gas exploration, and the effects of fisheries (e.g., marine debris, discarded fishing nets). The coastal and marine ecosystems of northern Australia are regarded as intact, containing some of the most pristine ecosystems in the world (Halpern et al. 2008), due principally to low human population density. In contrast, the IS LME is polluted in many coastal areas as detailed below.

#### Coastal Developments

Urban expansion and industrialization has resulted in coastal pollution from domestic, agricultural and industrial wastes in the IS LME. Water pollution is found in virtually all populated and/or highly industrialised areas of Indonesia and is known to cause massive fish

kills, harvest failure from aquaculture and threats to human health. Industrial forms of water pollution are concentrated in the major urban centres, primarily the large cities. Oil spills, slowly degrading toxic wastes from chemical as well as non-chemical industries, agricultural runoff and heavy metals threaten coastal waters. This has resulted in severe pollution in some areas. Because of inadequate sewage disposal and treatment throughout the region, microbial contamination is severe, especially around urban centres. Eutrophication is also severe around urban centres, particularly in areas with limited water circulation and where sewage, agricultural and/or industrial discharges are present. Siltation rates in the IS LME are among the highest in the world. Pollution by suspended solids is severe in coastal waters with high turbidity over wide areas. This has resulted mostly from extensive deforestation in many watersheds, compounded by high rates of erosion and industrial mining. Solid waste is a severe problem locally, particularly around the cities, towns and villages where waste management is inadequate.

### Contaminants

Within the IS LME, chemical pollution from agricultural pesticides and industries is severe in localised areas. Mercury contamination from gold mining can cause serious health as well as environmental risks; mercury levels in the tissue of fish near gold mines are higher than levels recommended by the WHO for safe fish consumption. The disposal of toxic materials from mines via submarine tailings placement is of special relevance to Indonesian marine life. This LME forms part of both the main and Ultra Large Crude Carrier oil tanker routes between the Indian and Pacific Oceans. Furthermore, there is regular discharge of ship ballast waters. In addition to spills, there is chronic pollution from oil production facilities and refineries.

Within embayments in northern Australian waters and off the southwest coast of Papua, contamination by heavy metals and other industrial solutes occurs in proximity to point-sources, such as refineries, mining processing plants, and sewage treatment plants.

### Marine Debris

Harmful marine debris is an international issue both in terms of its sources and impacts. Preliminary analysis of derelict fishing nets found in the Gulf of Carpentaria suggest that foreign fishing nets from fishing operations outside Australian jurisdiction are likely to comprise the greatest proportion (around 80%) of all nets washing ashore on beaches there. Foreign nets are causing some of the greatest harm to marine animals, especially marine turtles.

Result of studies by using the satellite drifters and the computer model showed that the origin of derelict fishing nets found on the northern Australian coast could be the Coral Sea and South Pacific. Instead of pathways through the Indonesian Archipelago, these derelict nets may be drifting through the Torres Strait (Griffin, 2008).

A proportion of debris, other than derelict fishing nets could also have international origins. For example, thick rubber and plastic sheeting from which the soles of handmade thongs are made, believed to have originated from outside Australian waters, washes ashore on many parts of northern Australia. Marine turtles are particularly vulnerable to floating debris as some species of marine turtles are thought to mistake plastic bags and other items for jellyfish, while other turtle species, especially hawksbills, eat encrusting organisms that grow on floating plastics and nets, become ensnared when attempting to feed (Kiessling 2003).

## Sediments

Rivers and tributaries on the islands of Timor, New Guinea and northern part of Australia are discharging sediments into the ATS. Unfortunately, there are few whole catchment studies of sediment sources in the region. In the Laclou catchment on the north coast of Timor-Leste, <5% of river sediment comes from sheet and rill erosion of hill slopes. Landslides and erosion of river channels appear to dominate. The same result was obtained in the Caraulun catchment on the south coast of Timor-Leste. In short, the island is experiencing much greater loads of sediment debouching into the sea and probably affecting coastal habitats. Indeed, many mangroves along the south coast of Timor-Leste have been buried under these enhanced loads. Landslides are common within the Indonesia and in Timor-Leste, triggered by rainfall and/or earthquakes. The seismically active parts of the region are therefore likely to be subject to landslides more than elsewhere. Volcanoes are likely to be even larger sources of sediment. Deforestation and cultivation of the flanks of volcanoes has had a dramatic impact on erosion rates.

### 4.3.2 Impacts on ecosystem services and human well-being

Marine and land-based pollution has serious impacts on the functioning of the overall ATS ecosystem and the services it can provide. Impacts include:

- Negative impacts on provisioning ecosystem services caused by pollution include mortality of marine species, such as dugong and turtle and of economically important fisheries. In addition, noise pollution affects fish catches and migratory species
- Negative impacts on cultural ecosystem services include loss of culturally important species, such as turtles, dugongs and crocodiles, loss of skills – e.g. hunting, and loss of tourism and recreation opportunities
- Loss of regulating ecosystem services has led to increased run-off on near-shore ecosystems, such as mangroves, alteration of coastal hydrology and increased tidal flat development
- Supporting ecosystem services affected by pollution include nutrient cycling, often leading to eutrophication of coastal waters.

The loss of these ecosystem services also have negative impacts on human well-being in terms of livelihood opportunities, nutrition and health, access to resources and security from disasters, such as landslides.

### 4.3.3 Causal-chain analysis of direct and indirect drivers

The causal-chain analysis for marine and land-based pollution is summarized in Box 5.

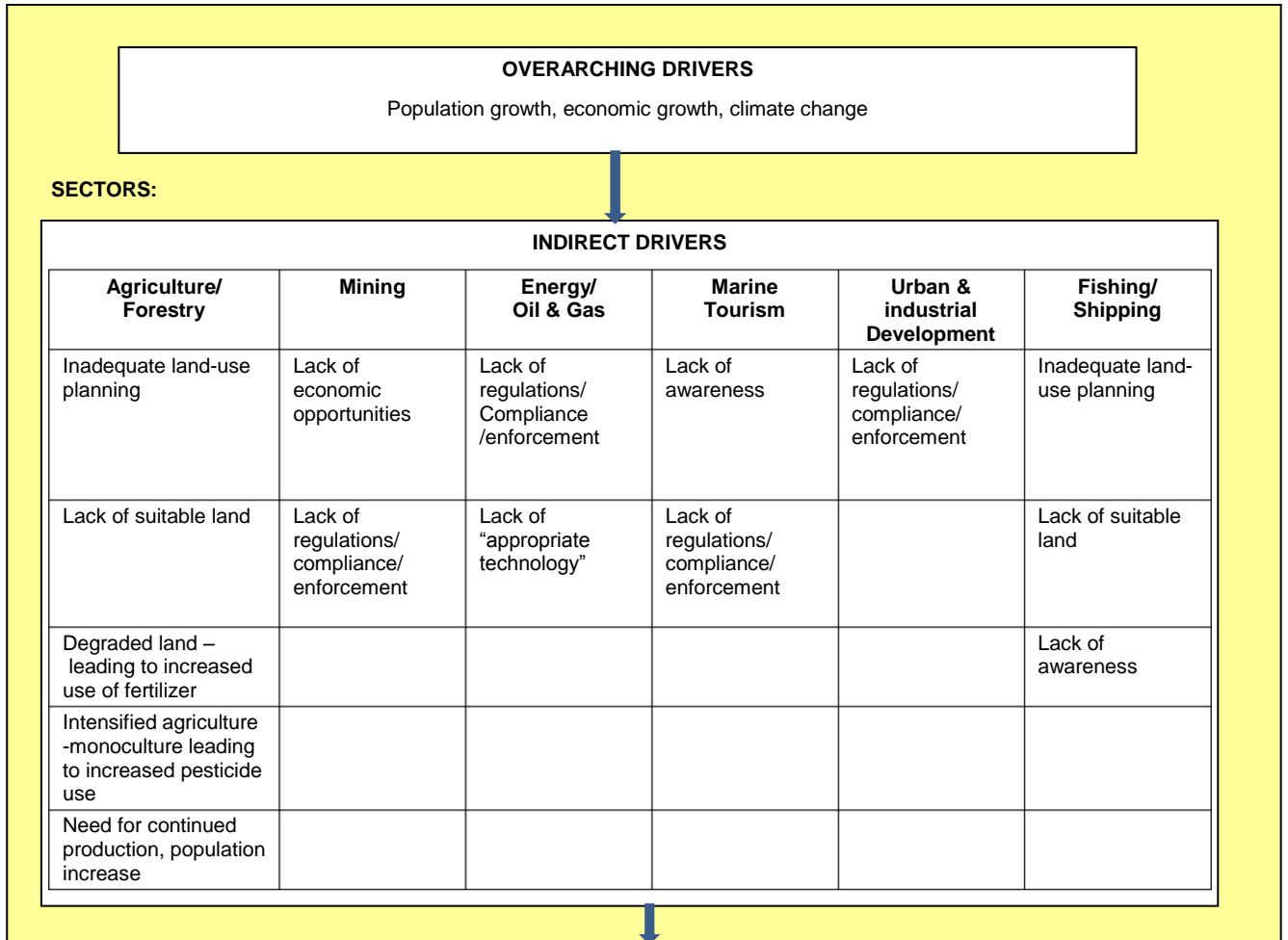
### 4.3.4 Summary and recommendations, including potential short to medium interventions

Marine and land-based pollution is a medium-level priority for all countries and ranks second overall at regional level (Annex 1):

- Pollution is a multi-sectoral problem and many sectors are driving the problem, such as mining, fishing and shipping, agriculture/forestry and energy/oil and gas.
- In the mining sector, direct drivers that need to be addressed in the short term include sand mining, disposal of tailings and chemical contaminants and seismic testing. In the fishing/shipping sector the direct drivers include discarded and lost nets, oil spill and waste.
- Agriculture and forestry activities need to be sustainably managed to reduce clearing of land, excessive use of fertilizers and pesticides, damming of freshwater sources and issues such as clearing of mangroves for aquaculture.

- Indirect drivers that need to be addressed in the medium term include lack of regulations, compliance and enforcement, inadequate land-use planning and lack of access to appropriate technology.

*Box 5: Causal Chain Analysis for Marine & land-based pollution (e.g. marine debris, sediments, oil spills)*





Box 5: Causal Chain Analysis for Marine & land-based pollution cont'd)

**SECTORS:**

**DIRECT DRIVERS**

Agriculture/ Forestry	Mining	Energy/ Oil & Gas	Marine Tourism	Urban & industrial Development	Fishing/ Shipping
Land-clearing – increased sediment	Sand mining – run-off	Oil spills – fixed platforms, ships	Marine debris – e.g. Fishing line, rubbish	Sewerage run-off	Nets (debris)
Chemical run-off – fertilizer, pesticides	Overburden, tailings, chemical contaminants	Discharge of production water and other waste	Increased number of boats	Industrial waste	Oil spills
Damming of freshwater sources – increased sedimentation	Seismic testing	Sedimentation from exploratory surveys		Increased run-off – e.g. oil-based waste, increased sedimentation	Waste
Mangrove conversion – aquaculture, seaweed farming					

**IMPACTS ON ECOSYSTEM SERVICES**

Provisioning	Cultural	Regulating	Supporting
Mortality of Marine species- e.g. dugongs, turtle (marine debris), economically important fisheries species	Loss of culturally important species, such as turtles, dugongs, crocodiles	Land-based run-off affecting near shore ecosystems, i.e. mangrove	Nutrient cycling – affected by eutrophication (land-based pollution from mining etc.)
Noise pollution affecting fish catches and migratory species	Loss of skills – e.g. hunting	Alteration of coastal hydrology	
Aquaculture/mariculture decline	Loss of tourism and recreation opportunities	Increased in tidal flat development	

**IMPACTS ON HUMAN WELL-BEING**

Adequate livelihoods	Diversification of livelihoods
Nutrition and health	Security from disasters

## 4.4 Decline and loss of biodiversity and key marine species

### 4.4.1 Description of the problem and justification of its transboundary importance

Unsustainable direct harvesting and also indirect harvesting (via fisheries by-catch) is having a significant impact on populations of key marine species in the ATS region, particularly globally threatened marine megafauna (i.e. turtles, dugongs, seabirds/shorebirds, sea snakes, sharks and rays).

The area encompassing northern Australia, Papua New Guinea and eastern Indonesia supports a significant direct harvest of green turtles, and currently represents greatest significant threat to the conservation of Australian green turtle stocks. Since the 1980s, this harvest has accounted for many tens of thousands, possibly up to 100 000 turtles, annually (Limpus & Chatto 2004). In Timor-Leste, illegal turtle harvesting for meat and shell remains a major issue especially in the recently declared Nino Konis Santana National Park and Marine Park (Edyvane et al. 2009a). Populations of hawksbill turtle face major threats from direct harvest particularly in Papua New Guinea, with the northeast Australian hawksbill turtle stock in decline (Limpus & Chatto 2004). Indirect harvesting and mortality is also a significant threat to turtle populations in the ATS region. Estimated 5,500/year incidental by-catch with 800 direct mortalities from the Tiger Prawn sector of the Northern Prawn Fishery (Kimberley to Cape York), with a total direct and indirect mortality of 2,100 turtles/year from the entire Northern Prawn Fishery (Poiner and Harris, 1996).

Further, trawl by-catch mortality has been identified as the primary cause of the recent decline in east Australian loggerhead turtle breeding numbers. Another significant source of indirect turtle mortality is from entanglement in lost or discarded nets.

The fate of dugong is not any better than for most species of turtle in the region. Hunted for thousands of years, often for its meat and oil, many populations are close to extinction. The IUCN currently lists the dugong as a species vulnerable to extinction. Despite being legally protected in many countries, the main causes of dugong population decline are hunting, habitat degradation, and fishing-related fatalities. Within the adjacent Torres Straits region, indigenous harvest of dugong is legal, but sustainability has been a concern since the early 1980s (Marsh et al. 2004, Marsh et al. 2001). Indirect harvest of dugongs through net entanglements is another major source of mortality. Fishing activities which could potentially affect dugong populations are commercial barramundi fishing using set nets, inshore shark fishing using pelagic nets, bait fishing using nets to catch bait for mud-crabbing and staked coastal nets used by coastal net fishery.

Less data is available on the non-commercial harvest of sharks and rays. Recreational fishers in the Northern Territory catch sharks while fishing for other species. Reef fishing accounted for most (74%) of the total shark catch. Indigenous fishing mostly takes place close to communities and outstations, in inland or near coastal waters. Sharks and rays are one of the more important groups of fish caught by indigenous coastal-dwelling people in the NT.

### 4.4.2 Impacts on ecosystem services and human well-being

Decline and loss of biodiversity and key marine species have serious impacts on the functioning of the overall ATS ecosystem and the services it can provide. Impacts include:

- Negative impacts on provisioning ecosystem services include loss of food provided by threatened species, loss of materials for handicrafts, such as shells, bones, coral, fibre, etc. and loss of genetic resource
- Negative impacts on cultural ecosystem services include loss of traditional livelihoods associated with e.g. hunting of culturally important species, such as dugongs and

harvesting of turtle, loss of tourism and recreational opportunities, loss of educational opportunities and decline in local ecological knowledge, skills and technology, such as hunting, as well as loss of supporting social and cultural capital of local communities

- Alterations to the regulating ecosystem services include changes to the food chain and increased risk for invasion of alien species that exploit the loss of indigenous species due to overharvesting, as well as reduction in carbon sequestration in mangroves and seagrass beds
- Impacts on supporting ecosystem services include disruption of nutrient recycling due to overharvesting, and reduction of primary and secondary production.

The loss of these ecosystem services also has negative impacts on human well-being in terms of loss of access to diverse food and traditional medicine, which affects health. It also leads to loss of livelihood opportunities and increased vulnerability of coastal communities, as well as reduced social security caused by break down of social systems and cultural norms.

#### 4.4.3 Causal-chain analysis of direct and indirect drivers

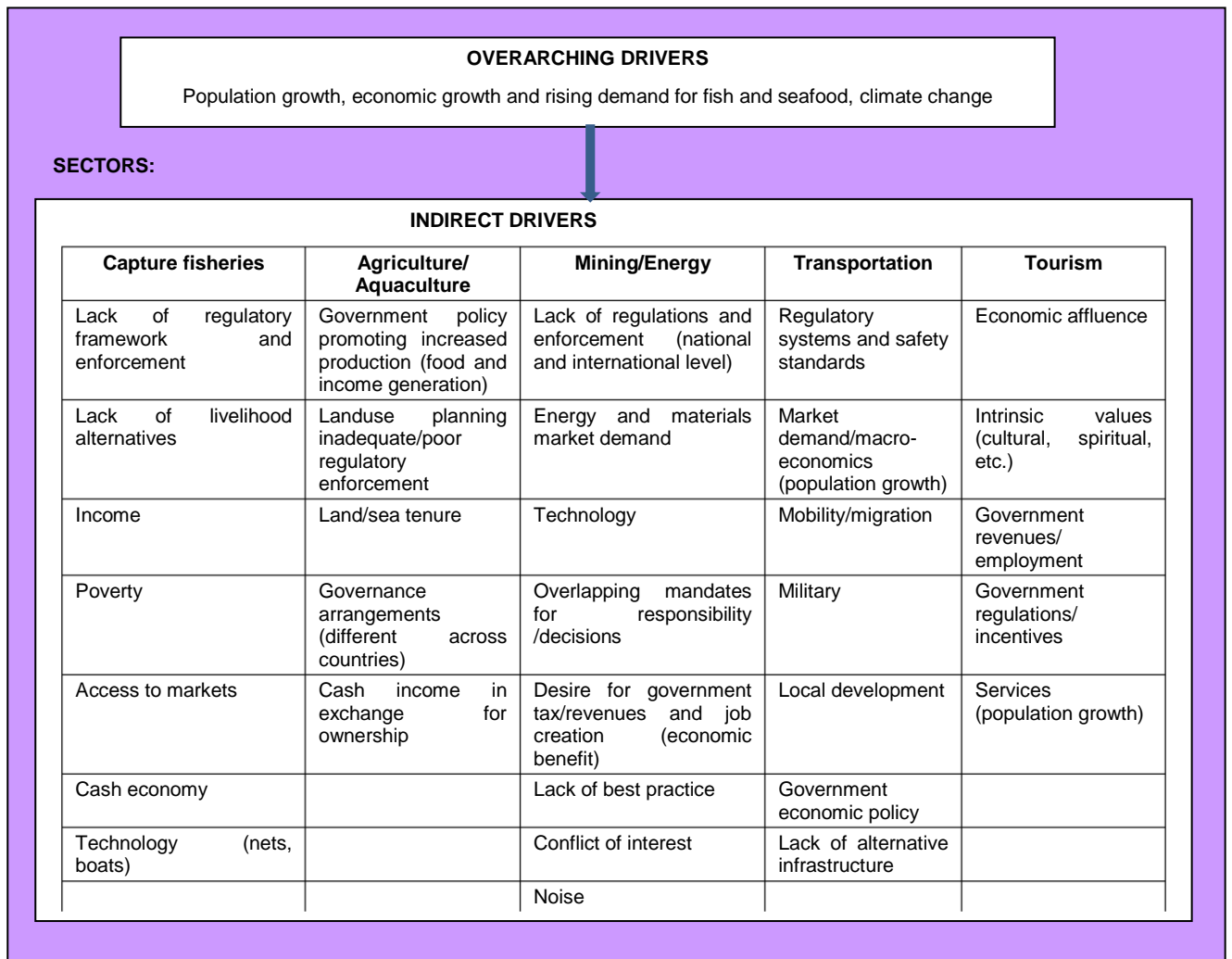
The causal-chain analysis for decline and loss of biodiversity and key marine species is summarized in Box 6.

#### 4.4.4 Summary and recommendations, including potential short to medium term interventions

Decline and loss of biodiversity and key marine species was considered to be the top priority in Indonesia, but was not considered equally important by the other countries (Annex 1):

- Capture fisheries is the main sector driving the decline and loss of biodiversity and key marine species in Indonesia and is also important in Timor-Leste and PNG, where tourism and mining/energy were also considered important.
- Direct drivers in the fisheries sector that need to be addressed include destructive fishing, overharvesting, marine debris and lost and discarded nets that kill marine species, such as turtles, IUU fishing, and weak management and enforcement systems. In the tourism sector, infrastructure development and unsustainable growth together with pollution and disturbance to biota need to be addressed. In the mining sectors, oil spills, mining in sensitive habitats and pollution problems need urgent attention.
- Indirect drivers that need to be addressed include lack of regulatory framework and enforcement, poverty and lack of livelihood alternatives, as well as access to markets and technology. Invasive alien species potentially have a negative impact on marine biodiversity. Alien species can be found in ballast water, introduced through aquaculture or introduced via unintentional shipping transportation. High risk areas need to be identified and appropriate management techniques developed.

Box 6: Causal Chain Analysis for Decline and Loss of Biodiversity and Key Marine Species



**Box 6: Causal Chain Analysis for Decline and Loss of Biodiversity and Key Marine Species (cont'd)**

**SECTORS:**

DIRECT DRIVERS				
Capture fisheries	Agriculture/ Aquaculture	Mining/Energy	Transportation	Tourism
Destructive fishing	Coastal development	Oil spills	Ports	Infrastructure (transport, accommodation)
Overfishing/overcapacity /overharvesting	Pollution	Mining in sensitive habitats	Dredging	Rubbish/pollution
Bycatch	Deforestation, land clearing	Pollution from transportation (shipping, ports)	Noise	Unsustainable growth
Nets (debris, ghost nets)	Lack of good practices in agriculture	Pollution from chemicals, tailings	Spills/pollution	Disturbance of biota
IUU fishing			Groundings	
Market demand for marine species			Collisions (ships)	
			Road construction	
			Urbanisation	
			Discharged ballast	



IMPACTS ON ECOSYSTEM SERVICES			
Provisioning	Cultural	Regulating	Supporting
Loss of food production	Loss of traditional livelihoods: e.g. Kiwai people (PNG): depletion of dugongs and turtle	Change to food chain	Alteration of nutrient cycling
Loss of material for handicrafts (shells,bones, coral, timber/fibre)	Loss of tourism and recreational opportunities	Risk for invasion of alien species	Primary and secondary production (plants) reduced
Loss of income	Loss of culturally important species, such as turtles, dugongs, crocodiles	Loss of carbon sequestration (mangroves, seagrass)	
Depletion of genetic resources	Loss of educational opportunities		
	Decline in local ecological knowledge and skills and technology – e.g. hunting		
	Loss opportunities for social and cultural capital		



IMPACTS ON HUMAN WELL-BEING	
Traditional medicine	Biotechnology/bioactive
Secure livelihoods	Nutrition and loss of food diversity
Health	Social security (social systems and cultural)
Increased vulnerability for communities in coastal areas	Education and learning

## 4.5 Impacts of Climate change

### 4.5.1 Description of the problem and justification of its transboundary importance

#### Coastal Inundation

Low profile coasts, shallow continental shelves and macro-tidal conditions mean that the coastal and marine environments of the ATS region are particularly vulnerable to the impacts of climate change. By 2100, sea-level is projected to rise by between 18 and 59 cm. In the coast of West Papua, trend in sea level rise has been predicted to be between 0.75 - 0.765 cm/year. Such a rise in sea level is expected to increase the salinity of coastal groundwater as aquifers are affected by salt water intrusion. The low-lying coastal ecosystems of Northern Australia, such as mangroves and other wetlands, may be particularly vulnerable to climate change. Shallow-water and intertidal habitats are most vulnerable to sea-level rise, increased intensity of cyclones and increased temperatures. In particular, the interactive effects of rise in sea-level and cyclonic intensity, increased coastal inundation and storm surges may result in these ecosystems either retreating landwards as sea-level rises or disappearing if inundation is rapid and coastal relief is low. Predicted rises in sea-level up to nearly 80cm by the end of the century will impact rocky intertidal, mud- and sand-flats, coral reef, seagrass and mangrove communities.

#### Rising Temperatures

The impacts of global warming are likely to vary significantly throughout the region. In the ATS region, the vulnerability of reefs to thermal stress and coral bleaching is likely to be reduced in the western region due to its complex bathymetry and deep-water outflow passages, and greater in the shallow, tidally dominated, shelf areas of the Sahul Shelf, Arafura Sea and the Gulf of Carpentaria. The pattern of coral bleaching across the Arafura-Timor Seas region is unlikely to be uniform owing to spatial and seasonal differences in sea surface temperatures and currents, and the influence of the Indian Pacific Warm Pool. There have been at least seven major coral bleaching events in the adjacent Coral Triangle between 1979 and 2005, including several pan-global bleaching events since 2002, all associated with ENSO events. The Coral Triangle as a whole is known to experience a pronounced increase in SST during phases of ENSO. Coral bleaching strongly affects local and regional species distributions and densities of nearly all hermatypic corals; species replacement may also occur resulting in range shifts in the most affected coral species.

Climate change is also one of the major hazards facing the long-term future of global biodiversity. Some key marine species likely to be particularly affected by rising air and sea temperatures in the region include marine turtles and sea snakes, and also, coral reefs (Heyward et al. 1997). Global climate change could have profound effects on marine turtle population dynamics in the ATS. However, not all impacts of higher, and more variable, temperatures may be negative. For instance, mangrove photosynthesis may increase with increased growth of forests. Any functional enhancement of mangrove forests may however be counterbalanced by responses to other changes in climate, as detailed below.

#### Ocean Acidification

Ocean pH is being lowered as a direct result of the massive amounts of human-produced CO<sub>2</sub> being released into the atmosphere and dissolving in the ocean to form carbonic acid which releases hydrogen ions. A wide range of marine organisms are expected to be negatively affected by the decline in pH, most especially organisms that secrete calcium carbonate shells.

In the Arafura and Timor Seas, acidification will lead to declining numbers of calcareous organisms, most spectacularly, of coral reefs. It is estimated that nearly one-third of all coral species within the adjacent Coral Triangle face elevated risk of extinction as a direct result of climate change and other anthropogenic impacts. Pelagic and other benthic communities will also be affected as a lowering of pH will affect the metabolic energy balance of many marine organisms. For instance, squid are intolerant to short-term exposure to high CO<sub>2</sub> seawater, but some fish appear to be more tolerant. The community composition of plankton will be altered because pteropods, foraminiferans, coccolithophores and crustaceans, such as pelagic copepods and shrimp, will find it much more difficult to calcify under lower pH conditions. The same is envisioned for benthic communities on both hard and soft substrates, with the loss of some species of echinoderms, molluscs and crustaceans, especially many commercially-viable and artisanal species.

### Extreme Events (rainfall, cyclones)

More rain and more variable rainfall will result in more variable salinity, especially in intertidal and shoal estuarine and marine habitats. Euryhaline organisms will tend to be favoured over stenohaline organisms; truly marine species will be less likely to migrate to less salty, shallow-water habitats. More tolerant species will survive but many species more sensitive to climate change will disappear. More intense storms and cyclones will result in fewer organisms less able to tolerate and adapt to shallow tropical waters, especially intertidal organisms, and will result in scouring of many biota from hard substrates. Conversely, drier conditions will increase salinities to intolerable levels for many species; either scenario would lead to a decline in densities as well as species diversity.

The expected climatic events and the probable impacts on marine biota and their ecosystems in the Timor and Arafura Seas are overwhelmingly negative. Even positive impacts such as an increase in mangrove production may have negative consequences in the long-term if habitat destruction continues and only the most tolerant plant and animal species survive. These impacts on the marine biome will have substantial social and economic impacts in Timor-Leste, Indonesia and Australia. Artisanal and commercial fisheries will decline due either to decreased fisheries productivity or to enhanced production of undesirable species at the expense of more edible organisms.

### 4.5.2 Impacts on ecosystem services and human well-being

Impacts of climate change negatively affect the functioning of the ATS ecosystem and the services it can provide. Impacts include:

- Negative impacts on provisioning ecosystem services include changes in food production caused by shifts in species distribution, composition and migration patterns, changes to aquaculture and mangroves caused by inundation, and habitat changes caused by rising temperatures, such as coral reef reduction
- Negative impacts on cultural ecosystem services include loss of livelihoods associated with e.g. fisheries and agriculture, and loss of culturally significant species caused by e.g. changing sex ratios (turtles), etc.
- Alterations to the regulating ecosystem services include changes to coral reef systems, coral bleaching, changes to ocean currents and upwelling in the Indonesian Through Flow, increased incidence of extreme climatic events, changes in rainfall patterns, and life cycle changes – e.g. mass spawnings and seagrasses.
- Impacts on supporting ecosystem services include changes in zooplankton/phytoplankton production, changes to the chemical composition of water leading to acidification and coral reef reduction, and decreased production of *Helimeda*.

The loss of these ecosystem services also have negative impacts on human well-being and will affect food security and livelihoods, as well as having carry-on effects to each nation's economy and social structure. Moreover, a decline in coral reefs and mangroves will affect shoreline stability, tourism, groundwater resources, sewage, and flood mitigation. It will increase poverty and malnutrition, affect food prices, unemployment and urban migration.

#### 4.5.3 Causal-chain analysis of direct and indirect drivers

The causal-chain analysis for impacts of climate change on the ATS is summarized in Box 7.

#### 4.5.4 Summary and recommendations, including potential short to medium interventions

Impacts of climate change was considered to be the top priority in Australia and was also given relatively high priority by Timor-Leste, but was not considered equally important by Indonesia and PNG (Annex 1):

Climate change is not a result of local energy production or agriculture or fisheries – it is a global issue and will have an impact in the ATS as much as anywhere else. Given the uncertainty inherent in climate change modelling, its ecological impacts, and the interactions of other future drivers of change such as population growth and related ecosystem impacts, potential interventions should focus on 'no regrets' adaptation strategies for the ATS region instead of climate change mitigation, which should be addressed at the global level. These 'no regrets' strategies can be defined as those which yield benefits even in the absence of climate change, and which are flexible and therefore less likely to be 'maladaptive'. These strategies are largely targeted at maintaining and enhancing the resilience of linked social-ecological systems to unexpected perturbations and change, including climate change.

Such strategies broadly fall within three categories: ecosystem-based strategies, which aim to promote the adaptive capacity and resilience of ecosystems in order that they may provide a range of ecosystem services, including climate change protection; community-based strategies which aim to enhance the adaptive capacity of communities most vulnerable to climate change; and adaptive co-management strategies which integrate experimentation, monitoring and learning with alternative livelihoods, governance and funding structures. Examples of strategies that could be considered in the ATS are:

##### a) Ecosystem-based strategies

- Preservation and restoration of mangrove forests which can provide coastal protection from storms surges and erosion linked to sea level rise.
- Preservation and restoration of native riparian and hill slope vegetation, which can minimise river bank erosion and sediment and nutrient transportation onto coastal coral reef and other ecosystems, particularly in more intense storms and rainfall episodes.
- Establishment of marine protected areas for coral reefs which account for connectivity and continued regeneration. Reefs can also provide storm surge protection, and underpin fisheries production.

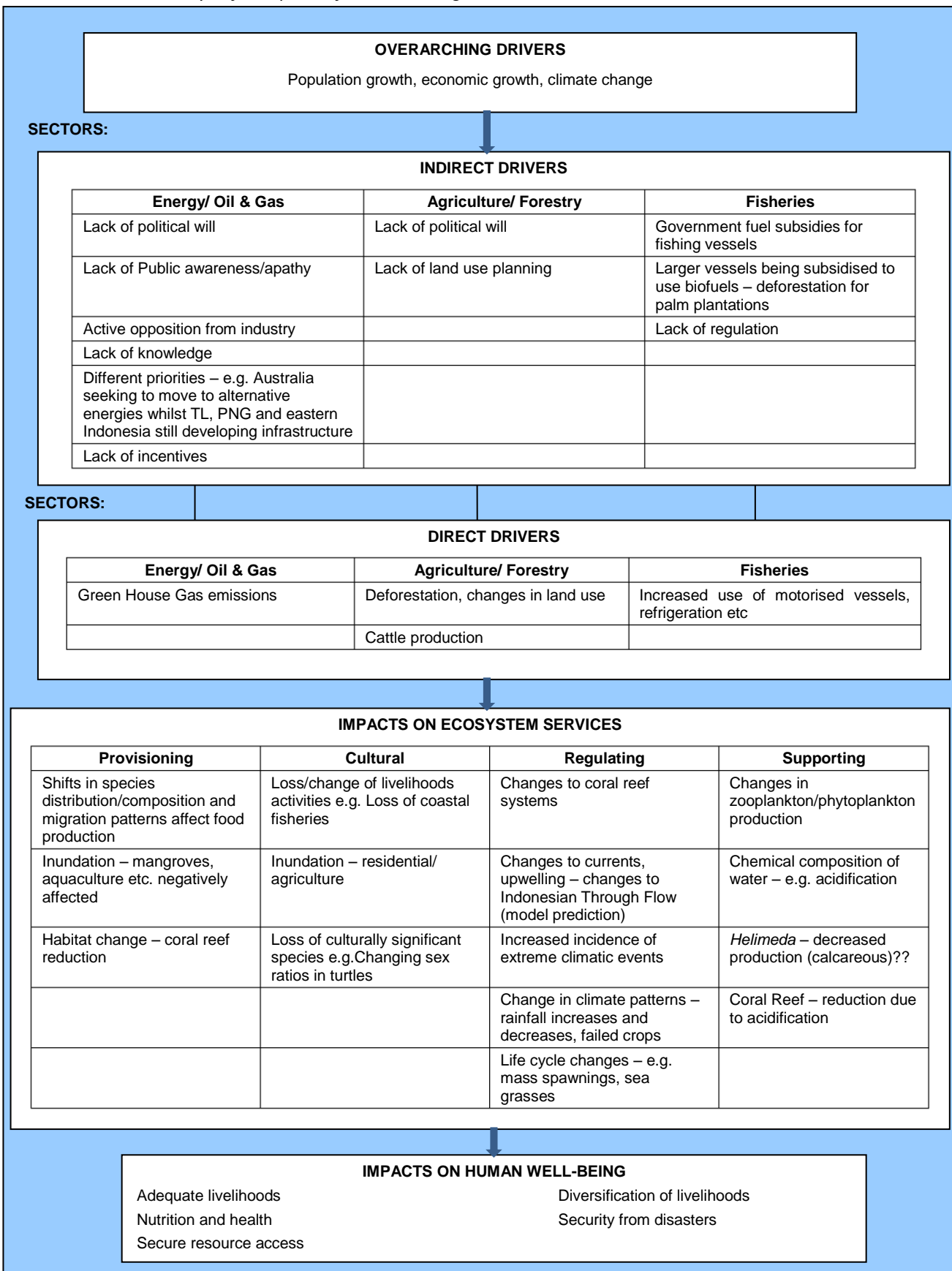
##### b) Community adaptive capacity

- Increasing community education and awareness of climate change and its potential impacts is imperative if communities are to respond proactively. For example, field schools for fishermen and farmers have been successfully trialled in many parts of Indonesia and the Pacific.



- Improving traditional institutions and NGOs to support formal government is important to enable education, awareness and proactive action. This is particularly necessary in less developed areas for the ATS where formal government is poorly resourced.
  - Improving community health and education is key to mobilising human and social capital for all adaptation and development projects and programs.
- c) Adaptive co-management
- Sustainable utilisation of marine resources, and those terrestrial resources which are linked (e.g. coastal catchments and vegetation) is vital to enhance the resilience of marine ecosystems to climate change and other drivers. This requires the combination of science, traditional knowledge and trans-boundary partnerships.
  - Novel funding schemes such as Payments for Ecosystem Services or conservation trusts could be trialled to provide the financial incentive for local communities to protect key habitats (e.g. coral reefs, mangroves, turtle nesting beaches) which provide ecosystem services to off-site stakeholders.
  - Alternative livelihood initiatives such as eco-tourism, aquaculture and sub-contracting of natural resource policing and enforcement by governments could be trialled. There are many local initiatives underway in the ATS region, but little evaluation and extension of such projects in order that they may be applied more widely.

Box 7: Causal Chain Analysis for Impacts of Climate Change



## 5 STAKEHOLDER ANALYSIS

### 5.1 Introduction to Stakeholder Analysis

The ATSEA project is designed to contribute directly to the prevention and management of regional threats in the Arafura and Timor Seas. **Stakeholders** are all people, groups, communities and organisations with an involvement in the transboundary environmental problem or its potential solutions. It can include those who depend on a resource, whose activities affect the resource or have an interest or stake in these activities. Stakeholders may include local users, government agencies, non-government organisations, civil society, universities and researchers. A **stakeholder representative** is a person with the authority to act as spokesperson for a group of stakeholders. It is important to distinguish between stakeholders and stakeholder representatives.

### 5.2 Stakeholder Consultations prior to and during development of the TDA

The existing ATSEF partnership has provided effective mechanism for engaging relevant stakeholders in the ATSEA program. Since its inception, more than 60 Indonesian groups have been engaged in ATSEF including government, environmental NGOs, universities, and community organizations. In Australia, Indigenous organisations have been integral to the development of ATSEF. Government support and participation is strong, and marine research agencies and universities have been integral to ATSEF arrangements. The Timor-Leste Government has been a strong supporter of ATSEF since it evolved, and local community representation and NGO engagement continue to grow as Timor-Leste's capacity develops. PNG was formally admitted to ATSEF in October 2011.

Prior to development of the TDA in 2011, consultation meetings with key provincial, national and regional stakeholders on priority environmental concerns, drivers and impacts were conducted during 2008-2009 as part of a preliminary framework TDA. During these meetings, stakeholders demonstrated that they were very engaged and eager to be involved in the ATSEA programme. Since ATSEA commenced in June 2010 a series of workshops have been held to further develop the TDA and its component socioeconomic and biophysical reports. These have engaged regional, national and provincial level stakeholders.

#### 5.2.1 Stakeholder Engagement Group

Management of the ATSEA Project is overseen by the ATSEA Project Board, consisting of members from the Governments of Indonesia, Timor-Leste and Australia - with Papua New Guinea joining in October 2011 - as well as UNOPS and UNDP. It has been recognised that the involvement of a broad range of stakeholders will be critical in addressing issues of relevance to the ATS region. The ATSEA project therefore established a Stakeholder Engagement Group (SEG) in September 2011 to work in partnership with the Project Board. The SEG will provide advice and support to the Project Board. In particular, members may identify scientific issues of relevance to the Project Board, including global concerns that pertain to or affect the ATS region. In addition to this core objective, the SEG may also serve to achieve synergies in implementing the ATSEA project.

SEG members consist of experts and stakeholders from Australia, Indonesia, Papua New Guinea and Timor-Leste with various specific scientific interests. There are two major categories of membership: Core Members, and General Members. Core Members have a more active role in the SEG, and are responsible for working with the PMO to coordinate effort towards priority issues and activities, including input to and completion of the TDA, SAP and NAPs. General Members have a less active role, more information sharing role. SEG

members come from the four ATSEA countries, from Government Institutions, Universities, NGOs, and other related institutions.

### 5.3 ATSEA Project Stakeholders

Stakeholders with some involvement or interest in the ATSEA project are identified at four geographical levels, that is, international, regional, national and local levels.

The major categories of stakeholders involved in this project are:

- Governments of Indonesia, Timor-Leste, Australia and Papua New Guinea
- Coastal and indigenous communities
- Commercial industry sectors
- Scientific research institutions and research agencies
- Environmental and other NGOs

#### 5.3.1 International stakeholders

The three main international stakeholders in the ATSEA project are the GEF as the main source of funding, UNDP as the Implementing Agency (IA), and UNOPS as the Executing Agency (EA). Other international stakeholders include other UN agencies implementing projects in the region with linkages to ATSEA goals include:

1. Asian Development Bank and World Bank
2. Food and Agriculture Organization (FAO) in relation to international and national fisheries management issues (and regional/national offices such as in Timor-Leste),
3. International Maritime Organization (IMO) in relation to the international regulation of shipping and pollution, and
4. United Nations Environment Programme (UNEP) in relation to its Regional Seas Program.

Building links with these agencies with a view to fostering their support for and engagement in ATSEA is an important element of the project.

Major international environmental NGOs such as WWF, IUCN, CI, and TNC are also active in various activities in the Arafura and Timor Seas and can play an important role in the success of the ATSEA project. The WWF Indonesia provides co-finance for this project and will play an active role in its implementation.

*Table 3: International organisations engaged in ATSEA Programme*

<b>Stakeholder</b>	<b>Role/Interest</b>
GEF	ATSEA Funder
UNDP	Administration and management of ATSEA
UNOPS	Administration and management of ATSEA
ADB/World Bank	CTI – CFF programme funders
FAO	Active in ATS region on similar projects, IUU fishing
IMO	Pollution conventions and protection
UNEP	Global environment in development agenda setting for sustainable (marine and coastal ) development
WWF	Active in marine conservation ATS region
IUCN	Global approaches to NRM, tools, policy
CI	Active in marine conservation in Arafura Sea

### 5.3.2 Regional stakeholders

There are a range of stakeholders at the broader regional level, including a number of major multi-lateral programmes and projects, including:

- Arafura Timor Seas Experts Forum (ATSEF)
- The Regional Plan of Action (RPOA) to Promote Responsible Fishing Practices including Combating IUU Fishing in the Region (South East Asia)
- The RPOA Sub-regional Arafura and Timor Seas MCS Network
- Coral Triangle Initiative on Coral Reefs, Fisheries and Food Security. (CTI): participating countries, donor agencies and NGOs
- Partnerships for the Environmental Management of the Seas of East Asia (PEMSEA) and the Sustainable Development Strategy for the Seas of East Asia (SDS-SEA)
- UNEP Coordinating Body for the Seas of East Asia (COBSEA)
- Asia-Pacific Economic Cooperation (APEC)
- Association of South East Asian Nations (ASEAN)
- Australia- Indonesia Working Group on Marine Affairs and Fisheries
- Australian-Papua New Guinea Torres Strait Treaty
- Designated Authority (DA) responsible to a Joint Commission and Ministerial Council, representing Australian and Timor-Leste to regulate petroleum activities in the Joint Petroleum Development Area.
- The National Petroleum Authority (Autoridade Nacional do Petróleo - APN) of Timor-Leste is responsible for managing and regulating the resources of the Joint Petroleum Development Areas – shared between Australia and Timor-Leste –and waters within Timor-Leste’s exclusive economic zone.

Table 4: Regional bodies engaged in ATSEA Programme

Stakeholder	Role/Interest
ATSEF	Improved information sharing and collaborative research for sustainable management and poverty alleviation of ATS region.
CTI	Related program active in the adjacent Coral Triangle region
PEMSEA	Coordinating role in the exchange of data and knowledge on management of LMEs in the East Asian Seas, including ATSEA
UNEP	Administration and management of ATSEA
APEC Ocean and Fisheries Working Group	Supporting sectoral work programmes in fisheries in ATSEA region countries
Indonesia-Australia Working Group on Marine Affairs and Fisheries)	Multi-departmental cooperation on shared stocks of fisheries, aquaculture, training, MOU Box Traditional fishing, and IUU fishing

Other regional stakeholders include:

- The scientific and research community – to provide accurate baseline information and analysis for informed policy and management of ATS. In relation to ATSEA this includes CGIAR World Fish Centre and other Asian fisheries research organisations and universities
- fisheries and aquaculture industries
- coastal and marine tourism industry

- shipping and ports industries

All of these regional stakeholders represent significant opportunities for cooperation, coordination, and creating synergies with the ATSEA project, and will be important players under the stakeholder involvement plan to be developed as mandated in the ATSEA Prodoc.

### 5.3.3 National stakeholders

At the national level the primary stakeholders are the national governments and their various ministries, departments and agencies across the relevant sectors of fisheries, environment, climate change, pollution, biodiversity, and forestry (mangroves). National-level stakeholders from the private sector, the scientific community, NGOs, and coastal and Indigenous communities will also play a vital role in the project.

#### Indonesia

In Indonesia although MMAF and Ministry of Environment (KLH) are the major stakeholders other ministries also have responsibility in the marine environment space including BAPEDALDA, Ministry of Public Affairs, Ministry of Home Affairs, Ministry of Energy and Mineral Resources (responsible for Mining and offshore oil and gas), and the Ministry of Transportation (Shipping and Ports).

Table 5: Indonesian national agencies engaged in ATSEA Programme

Stakeholder	Role
Agency for Marine & Fisheries Research and Development (Balitbang KP), MMAF	Hosts regional secretariat of ATSEF and ATSEA Lead agency; manages ATS region fisheries and surveillance, monitoring, marine and coastal research, blue carbon/climate change/new MPAs. In addition to Balitbang KP, MMAF also comprises a Directorate General of Capture Fisheries, a Directorate General of Marine and Fisheries Surveillance, Directorate General of Small Islands, DG of Aquaculture. All DG's have internal and external programmes and activities. MAFF manages Indonesian national fisheries, and divides the country into 11 Fisheries Management Areas (FMAs)
Ministry of Environment (KLH)	Policies and laws relating to coastal and marine environments, including environmental impact assessment and climate change. KLH coordinates a national council on climate change and its working groups established in 2008. The Ministry also has several regional environmental management centres in Nusa Tenggara Timor, Maluku and Papua provinces within ATS region.
Ministry of Forestry	Research agency, policies and laws include coastal and marine environments

Stakeholder	Role
	(mangroves, protected areas, catchment management etc.)
BAPEDALDA/Office of Environment Service	Environmental management at provincial and district level
Indonesian Institute of Sciences (LIPI) (Pusat Penelitian Oseanologi/Research Centre for Oceanology) Lembaga Ilmu Pengetahuan Indonesia	Multi-disciplinary research organisation which undertakes research on fisheries, oceanography, maritime anthropology and marine science.

Indonesia also has a National Agency for Planning and Development (BAPPENAS), which amongst other things is charged with coordinating all international development assistance and technical cooperation activities in the country, and which has a National Policy in Marine Affairs and Fisheries. BAPPENAS is therefore vital national stakeholder in ATSEA. The Agency for Controlling Environmental Impact (BAPEDAL) is also based in the central government.

Several institutions that undertake research on fisheries, natural and social aspects of marine science include the Indonesian Institute of Sciences (Pusat Penelitian Oseanologi/Research Centre for Oceanology) Lembaga Ilmu Pengetahuan Indonesia – P2O/LIPI), Agency for Assessment and Implementing Technology (Badan Pengkajian dan Penerapan Teknologi - BPPT). A number of Universities based in Java and other parts of Indonesia with active marine science and technology research programmes in ATS including IPB- Bogor Agricultural University. In Indonesia several provinces in ATS region have major regional universities such as Nusa Cendana University in Kupang (UNDANA), University of Papua in Manokwari (UNIPA) and Pattimura University in Ambon (UNPATTI) already have existing programmes and partnerships with ATSEF Australian members.

### Timor-Leste

The lead agency for ATSEA activities in Timor-Leste is the National Directorate of Fisheries and Aquaculture (NDFA) within the Ministry of Agriculture and Fisheries (MAF). Building the capacity of NDFA is therefore an important activity for the ATSEA FSP. Also within MAF is the Inspectorate of Fisheries (surveillance, monitoring, VMS systems etc.). The National Directorate of Forestry also has responsibilities by Department of Conservation do Solo e Gestaun de Aqua. for catchment areas and mangroves responsibility by Department of Protection, protected areas by (Department of Protected areas and National Parks), State Secretary of Agriculture and Arboriculture.

The Secretary of State for the Environment sits within the Ministry of Economy and Development. The Ministry of Tourism, Commerce and Industry is an important stakeholder in relation to potential marine eco-tourism in areas where some small scale activity exists such as Arturo Island and Jaco Island within the Nino Konis Santana National Park at the far eastern part of Timor. The Ministry of Infrastructure is in charge of maritime transports and Port Authority of Timor-Leste is independent institute within the Ministry.

There are several autonomous Secretaries of State which do not sit within a particular ministry, answering directly to the Prime Minister. These include the Secretary of State of Natural Resources, and the Secretary of State for Energy Policy.

The National Petroleum Authority (Autoridade Nacional do Petróleo - APN) was established in 2008 and is responsible for managing and regulating the resources of the Joint Petroleum Development Areas – shared between Australia and Timor-Leste –and waters within Timor-Leste exclusive maritime boundaries. The ANP is responsible for establishing and supervising

compliance with the enacted rules and regulations covering the exploration, development, production, transportation and distribution of petroleum and natural gas resources.

The National University of Timor-Leste (UNTL), based in Dili, does not offer any marine/coastal programmes but has strong links with CDU in Darwin and collaborate on development and student exchange programmes, and implementation of ACIAR funded projects. Local NGOs include: Perkumpulan Hak which completed a community-based fisheries survey in 6 districts in 2005, the Haburas Foundation based in Dili is active in environmental management in coastal communities especially in Lautem district, Roman Luan on Arturo Island which has established 2 community-based MPAs and an eco-lodge in association with the Australian Conservation Foundation, and Belum organization works with fishers in various districts on fisheries development.

International NGOs with active coastal programmes include: Oxfam, Concern, World Vision, Caritas, and CARE International. Given the large amount of NRM related development activities, food security and local livelihoods other important stakeholders in ATSEA to generate linkages with ATSEA other international donor agencies such as JICA, GTZ and Portuguese Agency (IPAD), FAO (Regional Fisheries Livelihoods Programme), ADB who are all represented in Dili.

*Table 6: Timor-Leste agencies engaged in ATSEA Programme*

<b>Stakeholder</b>	<b>Role</b>
National Directorate of Fisheries and Aquaculture (NDFA) Ministry of Agriculture, and Fisheries (MAF)	Hosts regional secretariat of ATSEF and ATSEA Lead agency; It currently includes 4 divisions: fisheries resource management, fisheries inspection, fisheries industry and aquaculture with technical operation units in some districts.
National Directorate of Forestry, Ministry of Agriculture and Fisheries (MAF)	Policies and laws include coastal and marine environments (mangroves, protected areas, catchment management etc.), wildlife management
National Directorate of Environmental Services (NDES), State Secretariat for the Environment	Responsible for environmental management and impact assessments
National Directorate of Environmental Issues, State Secretariat for the Environment	
National Directorate for Water and Sanitation	
State Secretary for Natural Resources	Responsible for mineral and natural resources, including oil and gas, as well as related industries

### Australia

The lead agency for ATSEA (and ATSEF and CTI activities) in Australia is the Australian Government Department of Sustainability, Environment, Water, Population and Communities (DSEWPAC). Another Australian Government Department that is very active in the ATSEA region is the Department of Agriculture, Fisheries and Forestry (DAFF), including initiatives in bilateral fisheries management and surveillance arrangements with all three of the other ATS littoral nations, and the broader Regional Action Plan on IUU Fishing. The Australian Agency for International Development (AusAID) is also a key player in the region, with a large proportion of AusAID's support being directed to the three other ATS littoral



nations, including in the areas of sustainable development, enterprise development, environment and fisheries. AusAID is also the GEF Operational Focal Point (OFP) in Australia. The Australian Centre for International Agricultural Research (ACIAR) works with a number of Indonesia, Timor-Leste governments, research organizations and NGOs in areas of fisheries (e.g. snapper, trepang), aquaculture, capacity building and food security.

At the sub-national level, the Northern Territory Government has an active research programme with both Indonesia and Timor-Leste and the Queensland Government is involved in cooperative management fisheries arrangements with PNG through the Torres Strait Treaty and Protected Zone.

A number of research and scientific institutions are also active in the ATS region, including those founding members of ATSEF: the Australian National University, Charles Darwin University (CDU); the Australian Institute of Marine Science (AIMS), the Commonwealth Scientific and Industrial Research Organization (CSIRO). Other Universities from Western Australia and Queensland also have active research programmes operating in Timor-Leste, Indonesia and PNG.

The North Australian Indigenous Land and Sea Management Alliance (NAILSMA) represents indigenous communities across northern Australia (as a member of ATSEF) and implements projects relating to indigenous resource management and enterprise development to improve socioeconomic outcomes.

*Table 7: Australian national agencies engaged in ATSEA Programme*

<b>Stakeholder</b>	<b>Role</b>
Australian Government Department of Sustainability, Environment, Water, Population and Communities (DSEWPAC).	Responsible for environmental and heritage protection in fisheries, oceans, coasts, species protection, marine protected areas, environmental compliance, national environmental legislation and policy and international environmental policy (e.g. CITES, CBD)
Department of Agriculture, Fisheries and Forestry (DAFF)	Fisheries (WGMAF, RPOA and RPOA MCS networks), forestry, bilateral relations, IUU fishing and MOU Box
Australian Agency for International Development (AusAID)	Management of overseas aid programme in areas such as environment, fisheries, forestry, climate change, capacity building, food security
Australian Centre for International Agricultural Research (ACIAR)	Support agricultural research in areas of forestry, fisheries, aquaculture, and agriculture and capacity building
Northern Territory Government: Department of Natural Resources, Environment, the Arts and Sport (NRETAS) and Northern Territory Fisheries Department	Responsibilities for the environmental management of territory and coastal waters off the Northern Territory
Australian Fisheries Management Authority (AFMA)	Commonwealth commercial fisheries management, MOU between Indonesia and Australia on traditional fisheries, capacity building, surveillance, IUU fishing
Western Australian Government	Responsibilities for the environmental management of state and coastal waters off Western Australia.

Stakeholder	Role
Queensland Government	Responsibilities for the environmental management of state and coastal waters off Queensland
North Australian Indigenous Land and Sea Management Alliance (NAISMA)	Represents Indigenous organisations across northern Australia and implements programmes in land and sea management, IPAs, indigenous rangers, traditional ecological knowledge, climate change

## PNG

PNG only became a member of ATSEF and ATSEA in October 2011. The two main national government stakeholders will be the Department of Environment and Conservation (DEC), which is the lead agency for the CTI in PNG, and which is also the GEF OPF, and also the National Fisheries Authority (NFA), which already cooperates closely with Australia, including through the Torres Strait Treaty. The PNG National Maritime Safety Authority (NMSA) is also an important potential government stakeholder, being responsible for the regulation of sea-based sources of marine pollution.

Western Province and South Fly District governments are important stakeholders. The NGOs WWF South Pacific/PNG and Traffic International also operate in the ATS region of PNG and will be an important stakeholder for local level. The ANU also has research programmes underway in the area and could be important stakeholder at the local level and through their links with University of Papua New Guinea.

### 5.3.4 Local stakeholders

Provincial, city and Kabupaten (District) local-level governments exist in the ATS parts of Indonesia, Timor-Leste and PNG, as outlined in Table 8 below, and are also important local-level stakeholders for the ATSEA project. For example there are 12 districts in Indonesia, 1 district in PNG, and 11 districts in Timor-Leste and 3 state/territory governments in Australia.

Coastal and Indigenous communities in these areas will be the Primary Beneficiaries of the ATSEA project and are therefore a significant stakeholder group. However, there are also local stakeholder groups who live outside the Arafura Sea region but contribute to or are impacted by transboundary priority environmental concerns. These include fishing populations living in other areas of Indonesia in particular and the Southeast Asian region, the market actors (buyers, sellers, traders, consumers). The goods and services produced in the region also provide benefits to populations living outside of the region (see Stacey *et al* (2011) Socio-economic profile report for ATSEA for more discussion on these stakeholders).

Special consideration of gender issues (e.g. women benefiting from supplementary livelihood activities through increased incomes and new technology allowing men to participate in such activities), and special attention to vulnerable stakeholder groups with high dependence on ATS resources (e.g. landless and migratory fishing populations), including those who have been displaced from fishing activities in ATS region must be considered in the SAP and NAPS and demonstration pilot project design, implementation and monitoring.

Table 8: Provincial and local-level governments in ATS region (excluding Australia)

Country	Provincial Governments in ATS region	District Governments in ATS region
Indonesia	East Nusa Tenggara Province, Kupang City (Provincial Capital outside of ATS)	Rote Ndao Kupang District Timor Tengah Selatan (inside ATS area but limited local fisheries) Belu
	Maluku Province Ambon City (Provincial Capital outside of ATS)	Aru Islands Maluku Tenggara Maluku Tenggara Barat Maluku Barat Daya
	Papua Province Jayapura City (Provincial Capital outside of ATS)	Merauke Mimika Asmat Mappi
Timor-Leste	National level and district level; Capital is Dili	13 administrative districts; 11 of which are coastal (S- south coast, N- north coast): Ainaro (S) Baucau (N) Bobonaro (N) Covalima (S) Dili (N) Lautem (N and S) Liquica (N) Manatuto (N and S) Manufahi (S) Oecusse (N) Viqueque (S) (there are also Aileu and Ermera Districts which are not coastal).
PNG	Western Province National capital in Port Moresby, provincial capital is Daru on Daru Island	South Fly District (There are also Middle and North Fly Districts which are not coastal).

At the local level (Province and District), some central Ministries maintain Technical Implementing Units and therefore act as a representative of the related Ministry in a certain Province or District. For example some of the DGs in MAFF have representatives in Kupang, Tual and Ambon in the ATS region of Indonesia. There are also related Sectoral Services in local government level (Province and District), that administratively come under the Governor (at Province level) or Regent (at District level). Legislations and policies by sector are issued either by central or local government levels in line with their task and where District Governments have responsibility for marine resource management out to 3nm and Provincial Governments have responsibility for marine resource management out to 12nm. These also include various government departments and local sections of main national government departmental stakeholders such as fisheries, forestry, planning, shipping and ports, mining and so on.

## 5.4 Stakeholder Groups According to Priority Environmental Concerns

An assessment of stakeholders according to each priority environmental concern by different types of stakeholders - international, regional, national, local - and by stakeholder category was prepared. The results are summarised below.

### PEC 1: Unsustainable fisheries and decline and loss of living coastal and marine resources

All government agencies responsible for the implementation and enforcement of fisheries regulations are crucial for addressing issues caused by overfishing and destructive fishing techniques.

The main stakeholders to address this primary environmental concern (PEC) will be local communities (including marginalised and remote coastal populations and households, subsistence, small (artisanal) and large scale fisheries businesses and industry including the private sector and market actors (value chain actors – traders and consumers). Governments in all four countries, at all levels (i.e. national, state, territory, provincial, city, and district) across multiple government agencies are key stakeholders. Central government agencies have a strong leadership role to play. In Australia this includes DAFF, AFMA; in Indonesia, MAFF; in Timor-Leste, MAF; and in PNG, the National Fisheries Authority. These agencies have primary responsibilities for fisheries (and aquaculture) management, capacity and licensing, extension, enforcement, IUU fisheries management, fisheries technology and destructive fishing, policies and subsidies, private sector and industry regulation. Government and university fisheries and marine research organisations including LIPI, MAFF, UNDANA, UNPATTI (Indonesia); AIMS, ANU, CDU, CSIRO (Australia), and World Fish Centre (regional), are all important stakeholders.

International and regional stakeholders including ASEAN and bilateral arrangements for fisheries, Indonesia-Australia, Australia-PNG and ATSEF are primary stakeholders. Development organisations such as ACIAR and AusAID in Australia plus multilateral organisations and programmes, such as CTI-CFF (at country and regional levels), are also relevant.

Local level NGOs involved in fisheries development or management programmes such as HABURAS Foundation in Timor-Leste, WWF in eastern Indonesia and NAILSMA in land and sea management programmes in northern Australia, are also key stakeholders.

### PEC 2: Modification, degradation and loss of coastal and marine habitats

Local communities are key stakeholders in regard to this PEC, and are likely to be the group most directly impacted upon by changes to coastal and marine habitats. These local communities rely heavily on exploitation of marine species in mangrove, coral reef and sea grass habitats to sustain livelihoods. Subsistence and artisanal fishers may contribute to habitat degradation through destructive fishing techniques such as blast fishing. Industrial-scale trawl fishers contribute to marine habitat modification through bottom trawling and over fishing.

Governments in all four countries, at all levels (e.g. national, state, territory, provincial, city, and district) across multiple government agencies are also key stakeholders. Various agencies responsible for environmental management will be key to regulating activities that impact on marine and coastal habitats.

This includes national and state and Territory environment departments and agencies responsible for marine biodiversity and fisheries regulation, and forestry (e.g. mangroves) as well as mining and energy, tourism and marine transportation regulation sectors. In Australia this includes SEWPAC, and other agencies with fisheries and responsibilities such as DAFF, AFMA, WA, NT and QLD state and Territory conservation departments; in Indonesia MAFF and Environment; in Timor-Leste MAF and Director of Environment and PNG National Fisheries Authority and the Environment Ministry. Stakeholders from the energy, mining and sea transportation and industrial development sectors are also important stakeholders where pollution and industrial and urban activities can negatively impact marine habitats and associated biodiversity.

Bodies responsible for managing the development of the resource sectors such as mining, oil and gas industries will have an important role in mitigating against the impacts of oil spills and pollution.

Government and university fisheries and marine research organisations active in the area of marine biodiversity include LIPI, MAFF, UNDANA, UNPATTI (Indonesia); AIMS, ANU, CDU, JCU, UQ, CSIRO and WA, NT and QLD State and Territory research agencies (Australia), are all important stakeholders.

International and regional stakeholders including ASEAN and bilateral arrangements for fisheries (e.g. Indonesia-Australia and Australia-PNG, and ATSEF) are primary stakeholders. Development organisations such as AusAID in Australia, as well as multilateral organisations and programmes such as Coral Triangle Initiative (at country and regional levels), are also relevant.

### PEC 3: Marine and land-based pollution (e.g. marine debris, sediments, oil spills)

Industrial and urban development, shipping and planning bodies from all four countries will be key players in minimising marine and land-based pollution. This includes those agricultural and forestry sectors and industries responsible for regulation of land-use planning and catchment management. Local communities engaged in mining and agricultural activities may contribute to sedimentation and run-off through removal of coastal vegetation and excessive use of chemicals.

The fisheries industry is an important stakeholder and is partly responsible for marine debris in the ATS region, particularly industrial scale fisheries who may contribute to general pollution from fishing vessels and loss of large trawl and gill nets. Local programmes such as Ghost Nets Australia are actively engaged in removing marine debris from the ATS region and are a primary stakeholder in dealing with this issue along with Indigenous sea ranger groups across northern Australia who are active in tackling this problem

The large oil and gas sector in the ATS region is a major stakeholder that contributes (or has potential to contribute) to marine pollution and sedimentation through exploration, extraction and transportation of oil and gas products. This contribution increases exponentially if an oil spill occurs.

### PEC 4: Decline and loss of biodiversity and key marine species

Local communities and households – including marginalised and remote coastal populations – in areas where key marine habitats and associated biodiversity (such as dugongs and marine turtles) are of important cultural significance to Indigenous communities, particularly in northern Australia and Papua New Guinea will also be key stakeholders in this PEC. These local communities rely heavily on exploitation of other marine species in coastal, marine, mangrove, coral reef and sea grass habitats to sustain livelihoods.

Key marine species are also affected by large scale fisheries industries (through destructive fishing technology, by-catch and trawling) and where established informal and commercial trade exists, market actors (value chain actors – traders and consumers) are also key stakeholders at local, national and regional levels.

Governments in all four countries at all levels (i.e. national, state, territory, provincial, city, and district) across multiple agencies are key stakeholders for this PEC. This includes national and state and territory environment departments and agencies responsible for marine biodiversity and fisheries regulation, mining and energy, tourism and marine transportation regulation. In Australia this includes SEWPAC, and other sectoral agencies with fisheries and responsibilities such as DAFF, AFMA, WA, NT and QLD state and Territory conservation and fisheries departments; in Indonesia, MAFF and Environment; in Timor-Leste, MAF and Director of Environment; and in PNG National Fisheries Authority and the Environment Ministry.

Stakeholders from the energy, mining and sea transportation and industrial development sectors are also important stakeholders where pollution and industrial and urban activities can negatively impact marine habitats and associated biodiversity.

Conservation of key-stone marine species and associated habitats is often an active area of engagement focal point for local and international conservation organisations in the ATS region such as the Worldwide Fund for Nature (WWF), The Nature Conservancy – Indonesia Marine Programme (TNC-IMP) and Conservation International (CI). These organisations may also play key roles in the development of alternative livelihoods activities for coastal communities to increase resilience and reduce dependence on marine biodiversity at risk (species and habitats). INGOS often work in partnership with national offices and local level NGOs for biodiversity conservation. NAILSMA is a key organisation with an established programme in sea country and biodiversity management in northern Australia.

Government and university ecology, fisheries and marine research organisations include LIPI, MAFF, UNDANA, UNPATTI (Indonesia); AIMS, ANU, CDU, JCU, CSIRO and WA, NT and QLD state and Territory research agencies (Australia), are all important stakeholders.

International and regional stakeholders including ASEAN and bilateral arrangements for fisheries (e.g. Indonesia-Australia and Australia-PNG, and ATSEF) are primary stakeholders. Development organisations such as AusAID in Australia, as well as multilateral organisations and programmes such as Coral Triangle Initiative - with a major focus on coral reefs (at country and regional levels) - are also relevant.

### PEC 5: Impacts of climate change

Coastal areas of the ATS region are relatively sparsely populated and therefore the contribution of these communities to global climate change is viewed as minimal. Causes of climate change are a global issue and need to be addressed at international and national levels. However, communities that fringe the Arafura and Timor Seas may be significantly impacted upon by the predicted impacts of climate change such as changes in sea levels, weather patterns, water temperatures and subsequent changes to ecosystems and biodiversity. Some countries have developed governance and policy arrangements for climate change adaptation and mitigation either through the establishment of a department within environment ministries or as coordinating bodies mandated to develop national mitigation and adaptation measures.

## 5.5 Recommendations

Stakeholder involvement in the SAP will need to ensure greater engagement of international and bilateral stakeholders in order for ATSEA to better link into international governance arrangements.

Improving intersectoral coordination and eliminating overlap between national, provincial and local levels is a key challenge in sustainable marine and coastal management. The engagement of all ministries and sectors in each country through inter-agency committees throughout the life of ATSEA will be required. In Australia the ATSEF umbrella offers some potential draw on existing mechanisms to strengthen involvement. There is also opportunity for ATSEA to be asked to report regularly at other bilateral and regional fora such as APEC, and the Australia-Indonesia Bilateral Working Group on Fisheries.

There is also a need to place emphasis on stronger engagement with the private sector especially in fisheries and transportation and mining sectors considering the links of these industries to drivers of environmental degradation in the ATSEA region.

Given the diverse demographic, social and cultural characteristics of ATSEA stakeholders there will be a need for ATSEA to consider appropriate methods for stakeholder engagement and communication to diverse audiences at all levels through a suite of communication tools and methods (e.g. local language translations, public relations materials, media, visual methods) and in particular at the local government and community level. The use of local NGOs - with experience at grass roots engagement could offer some assistance in this process of engagement.

## 6 OVERALL CONCLUSIONS AND RECOMMENDATIONS

---

### 6.1 Conclusions

In summary, the key challenges and barriers in the ATS region in addressing the priority environmental concerns identified in the TDA can be related to:

- Inter-sectoral coordination and collaboration – the need for better coordination between relevant sectors as well as between central government and local government in all participating countries
- The regulatory framework – the lack of a regulatory and enforcement framework for environmental management in Timor-Leste, as well as weak enforcement of existing laws and regulations in Indonesia and Papua New Guinea
- Lack of land, marginalisation, poverty, and lack of rights for local communities is hampering the development of sustainable environmental management practices and alternative livelihoods
- Multi-stakeholder participation – the need to ensure strong local participation in all countries while also engaging with relevant national and international institutions and processes with a mandate in coastal and marine management to strengthen the regional governance of the ATS.
- Inadequate financial resources, insufficient equipment, trained staff, and environmentally sound technology.

- Lack of information/data/understanding about the biology, ecosystems and resource based industries of the region. In the absence of improved information it will remain difficult to effectively target efforts, convince stakeholders of the need for modification in behaviour and manage adaptively. Research and information needs to be better aligned with, and driven by, management priorities.

Based on these general conclusions, specific actions to remove the barriers to sustainable environmental management of the ATS are further discussed by sector below.

## 6.2 Possible options for priority actions for the Strategic Action Program

This TDA will form the basis for the formulation of a Strategic Action Programme (SAP) for the ATS region and recommended priority actions to bring about sustainable environmental management of the ATS are summarised below. However, these should be seen as preliminary ideas that need further discussion, assessment and analysis during the SAP development process. They do not prejudge the outcomes of SAP development, nor will SAP development consider only the options presented here.

### Possible options for actions in key sectors:

#### 1. Unsustainable fisheries, decline and loss of living coastal and marine resources

- Key direct drivers : lack of effective regulative frameworks, IUU fishing, destructive fishing practices, pollution, loss of habitats and fishing over-capacity, food insecurity and poverty, discretionary spending
- Key indirect drivers: lack of law enforcement, impacts of climate change, perverse subsidies, rising demand for seafood and absence of rights for small-scale fishers and the open access system.
- Strategic Action:
  - Strengthen joint action by member countries in the ATS region through various initiatives, such as RPOA to control IUU fishing and destructive fishing, to reduce fishing over-capacity, and strengthen the legal and regulatory framework and enforcement in the fisheries sector at regional and national levels.
  - In addition, explore options for training and capacity building to be conducted since they are crucial for effective functioning.

#### 2. Modification, degradation and loss of coastal and marine habitats

- Key direct drivers: oil spills and pollution, mining in sensitive areas, and development of infrastructure, such as ports and roads, destructive fishing, practices such as bottom trawling, dynamite and cyanide fishing as well as overharvesting and market demand for marine species, lack of awareness and education to local communities
- Key indirect drivers: lack of regulations and enforcement as well as safety standards, market demand, overlapping mandates between sectors, local development and lack of best practice, lack of livelihood alternatives and poverty
- Strategic Action:
  - Building assessment of the status of critical habitat and nurseries, such as mangrove, coastline, wetland and coral reefs in the ATS region, and on collaborative restoration of degraded habitats.



- Explore market-based approaches, such as supply-chain certification, and fair trade.
- This action could also include awareness raising, increased education and communication regarding current threats affecting coral reefs and the urgent need to protect them, as well as the importance of sustainable fishing practices.
- Actions should involve empowering local communities to manage the coastal ecosystem in a sustainable manner through strengthening of conservation efforts, support for alternative livelihoods and implementation of awareness programmes.

### **3. Marine and land-based pollution**

- Key direct drivers: sand mining, disposal of tailings and chemical contaminants, discarded and lost nets, oil spill and waste, clearing of land, excessive use of fertilizers and pesticides, damming of freshwater sources and conversion of mangroves to aquaculture and seaweed farming.
- Key indirect drivers: lack of regulations, compliance and enforcement, inadequate land-use planning, lack of access to appropriate technology, lack of awareness and population growth. Low education levels and high poverty levels within local communities along with a lack of alternative livelihoods options would also contribute.
- Strategic Action:
  - Building commitment through national and regional public awareness and clean-up campaigns.
  - Explore Regulatory Reform through coordination of policies and legislation across sectors at national and regional levels.
  - Explore the potential for Public Private Partnerships (PPPs) on integrated coastal management (ICM) and exploring the possibility of PPPs to engage the private sector in ICM for activities such as sewage treatment.
  - Where effective customary marine tenure regimes exist, and have local support small-scale fisheries for livelihood, poverty alleviation and food security outcomes through appropriate rights-based schemes for small-scale and coastal fisheries should be supported.

### **4. Decline and loss of biodiversity and key marine species**

- Key direct drivers: destructive fishing, overharvesting, debris and lost and discarded nets that kill marine species, such as turtles, IUU fishing and market demand for marine species, and pollution problems
- Key indirect drivers: lack of regulatory framework and enforcement, lack of livelihood alternatives and poverty, as well as access to markets and technology.
- Strategic Action:
  - Promote regional alignment of national and local plans and actions to conserve biodiversity.
  - Among other things, this could focus on exploring options for the establishment of a regional network of Marine Protected Area (MPAs), which may include natural heritage, cultural heritage and sustainable

production areas. This could include projects to determine the potential for eco-tourism as well as for participatory conservation monitoring in ATS region.

## 5. Impacts of climate change

- Key direct drivers: greenhouse gas emissions from energy generation, oil and gas exploration and fishing vessels, deforestation and changes in land use, and methane emissions from cattle production
- Key indirect drivers: lack of political will and public awareness and lack of regulations.
  - Strategic Action: Development and implementation of ‘no regrets’ adaptation strategies for the ATS region:
    - Ecosystem-based strategies, which aim to promote the adaptive capacity and resilience of ecosystems
    - Community-based strategies which aim to enhance the adaptive capacity of communities most vulnerable to climate change
    - Adaptive co-management strategies which integrate experimentation, monitoring and learning with alternative livelihoods, governance and funding structures..

### Cross-cutting actions:

#### 1. Institutional arrangements and capacity building

- Actions in this cross cutting area could address rebuilding the depleted shared fish stocks, restoring habitats, preventing pollution, conserving marine biodiversity and developing mitigation and adaptation measures at regional scale.
- Regional transboundary fish stocks and ecosystem assessment including environmental changes. The implementation of this action could involve the national focal institutions in all member countries through joint survey and assessments of key and non-targeted species.
- Regional monitoring of economic valuation to support achieving the objectives of recovering and sustaining depleted fisheries; restoring degraded habitats and protecting threatened key marine species, and reducing land and marine based pollution. This valuation may be important to understand the total value of the ecosystem services and their contribution to the livelihoods of the coastal communities in the ATS region.
- A regional network of institutions engaged in community mobilisation and empowerment endeavours to support coastal livelihoods improvement through development of mariculture/aquaculture, fisheries post-harvest technology, training and extension programmes, development of community-based management.

#### 2. Regional level policy and governance frameworks

- A Regional Mariculture policy has potential for expansion of species such as seaweed. It is important to understand the negative impacts of its development and the regional policy framework could assure proper development of mariculture and coordinate national policies of ATS countries to minimise negative economic and environmental impacts.

- Work towards regional coordination of policies and legal framework for biodiversity conservation and on regional priority areas for protection. This could encourage the establishment of Marine Protection Areas and implementation of national policies on designated protected areas and other conservation measures. It could also contribute to common achievable goals related to habitat restoration and conservation of biodiversity and key marine species in the region.
- Benefits from local stewardship should flow to the local communities through strengthening the legal and institutional arrangements.
- Work with ATS members to build on the reports *Framework for Model Fisheries Legislation in South East Asia* (2010) for all ATS countries (reports available at [www.rpoa.sec.kkp.go.id](http://www.rpoa.sec.kkp.go.id)).

## 7 REFERENCES

- ACIL Tasman and Worley Parsons 2005, *Developing the West Kimberley's Resources - Main Report. Regional Minerals Program*. Perth, WA: WA Department of Industry and Resources.
- Allen, GR & Werner, TB 2002, 'Coral Reef Fish Assessment in the 'Coral Triangle' of Southeastern Asia', *Environmental Biology of Fishes*, vol. 65, pp 209-214.
- Alongi, D 2002, Present state and future of the world's mangrove forests, *Environmental Conservation*, vol. 29, pp 331-349.
- Alongi, D (ed.) 2011, *Biophysical Profile of the Arafura Timor Seas*, Jakarta.
- Altman, JC 2007, 'Alleviating poverty in remote Indigenous Australia: The role of the hybrid economy', *Development Bulletin*, vol. 72, pp 47-51.
- Andrew, N, Suan Pheng, K & Phillips, M 2010, Fisheries dependence in Timor-Leste. Penang: World Fish Centre.
- Anon. 2010, Komisi Nasional Pengkajian Stok Sumberdaya Ikan Tahun 2010. Jakarta: Kementerian Kelautan dan Perikanan Badan Litbang Kelautan dan Perikanan. Pusat Penelitian Pengelolaan Perikanan dan Konservasi Sumberdaya Ikan.
- Ariadno, MK 2011, Governance Analysis of the Arafura and Timor Seas (Draft Report). Arafura and Timor Seas Ecosystem Action Programme.
- Arthur, R & Sheriff, N 2008, Fish and the Poor. In: BRIONES, R. & GARCIA, A. (eds.) *Poverty Reduction Through Sustainable Fisheries: Emerging Policy and Governance Issues in Southeast Asia*. Singapore: Institute of Southeast Asian Studies, pp 15-39.
- ASEAN 2005, *ASEAN statistical yearbook 2005*, ASEAN Secretariat, Jakarta.
- ATSEA 2012, *Governance Analysis of the Arafura and Timor Seas*. Jakarta.
- Barlow, C & Gondowarsito, R 2009, Socio-economic conditions and poverty alleviation in Nusa Tenggara Timur. In: RESOSUDARMO, B. P. & JOTZO, F. (eds.) *Working with Nature against Poverty: Development, Resources and the Environment in Eastern Indonesia*. Singapore: Institute for Southeast Asian Studies, pp 94-121.
- Bateman, S & Bergin, A 2011, The maritime interests of Timor-Leste. *A reliable partner: Strengthening Australia - Timor-Leste relations, Special Report 39*. Australian Strategic Policy Institute, pp 44-64.
- Bishop, KA and Forbes, MA 1991, 'The freshwater fishes of Northern Australia', in Haynes, CD, Ridpath, MG and Williams, MAJ (eds). *Monsoonal Australia: Landscape, Ecology and Man in the Northern lowlands*, AA Balkema, Rotterdam
- Blaber, S, Dichmont, C, Buckworth, R, Badrudin, B, Sumiono, B, Nurhakim, S, Iskandar, B, Fegan, B, Ramm, D & Salini, J 2005, 'Shared Stocks of Snappers (Lutjanidae) in Australia and Indonesia: Integrating Biology, Population Dynamics and Socio-Economics to Examine Management Scenarios', *Reviews in Fish Biology and Fisheries*, vol. 15, pp 111-127.
- Boggs, G, Edyvane, K, de Carvalho, N, Penny, S, Rouwenhorst, J, P. Brocklehurst, Cowie, I, Barreto, C, Amaral, A, Smit, N, Monteiro, J, Pinto, P, Mau, R, Amaral, J & Fernandes, L 2009, Marine and Coastal Habitat Mapping in Timor-Leste (North Coast) - Final Report. Ministry of Agriculture and Fisheries, Government of Timor-Leste.
- Borges, L, do Rosario Ferreira, A, Da Silva, D, Williams, R, Andersen, R, Dalley, A, Monaghan, B, Nesbitt, H & Erskine, W 2009, 'Improving food security through agricultural research and development in Timor-Leste: a country emerging from conflict', *Food Security*, vol. 1, pp 403-412.
- Borrini-Feyerabend, G, Pimbert, M, Farvar, MT, Kothari, A & Renard, Y 2007, *Sharing Power: A Global Guide to Collaborative Management of Natural Resources*, Earthscan and the IIED, London.

- Bowe, M *no date*, Community based trans-boundary conservation across one landscape, two lands: The Transfly of southern New Guinea. Unpublished report. Madang, Papua New Guinea: World Wide Fund for Nature South Pacific Program, Pacific Ecoregions Centre.
- BPS Maluku 2010, Maluku Dalam Angka 2009. Badan Pusat Statistik Provinsi Maluku.
- BPS NTT 2009, NTT Dalam Angka 2009. Badan Pusat Statistik, Provinsi NTT.
- BPS Papua 2010, Papua Dalam Angka 2010. (Papua in Figures 2010). Badan Pusat Statistik, Papua Province.
- Brown, K & Skewes, TD 2005, 'A preliminary assessment of the ecology of seagrasses at Ashmore Reef', *The Beagle: Records of the Museums and Art Galleries of the Northern Territory, Supplement 1*, pp 143-152.
- Bruno, JF & Selig, ER 2007, 'Regional Decline of Coral Cover in the Indo-Pacific: Timing, Extent, and Subregional Comparisons', *PLoS ONE*, vol. 2, pp e711.
- Bryant, D, Burke, L, McManus, J & Spalding, M 1998, Reefs at Risk: a Map-based Indicator of the Threats to the World's Coral Reefs. Washington, D.C.: World Resources Institute, International Center for Living Aquatic Resources Management, World Conservation Monitoring Centre, and United Nations Environment Programme.
- Burford, MA & Rothlisberg, PC 1999, 'Factors Limiting Phytoplankton Production in a Tropical Continental Shelf Ecosystem', *Estuarine, Coastal and Shelf Science*, vol. 48, pp 541-549.
- Burke, L, Reyntar, K, Spalding, M & Perry, A 2011, *Reefs at Risk Revisited*, World Resources Institute, Washington DC.
- Cai, W, Hendon, HH & Meyers, G 2005, 'Indian Ocean Dipolelike Variability in the CSIRO Mark 3 Coupled Climate Model', *Journal of Climate*, vol. 18, pp 1449-1468.
- Cargill, CF 2009, Poverty alleviation and food security through improving the sweet potato pig systems in Papua, Indonesia. Final Report (No FR2009-39). Canberra: ACIAR.
- Carpenter, KE, Abrar, M, Aeby, G, Aronson, RB & Banks, S 2008, 'One-third of reef-building corals face elevated extinction risk from climate change and local impacts', *Science* vol. 321, pp 560-563.
- Carson, D, Taylor, A & Campbell, S 2009, Demographic Trends and Likely Features for Australia's Tropical Rivers, Final Report Project 3.3. Darwin: School for Social and Policy Research, Charles Darwin University.
- Clifton, J, Olejnik, M, Boruff, B & Tonts, M 2007a, The Development, Status And Socio-Economic Linkages Of Key Industries Within And Adjacent To The North-West Marine Region. Report Prepared for DEWHA. Perth: The University of WA.
- Clifton, J, Tonts, M & Boruff, B 2007b, A Socio-economic overview of the coastal communities adjacent to the north-west marine region. Perth: The University of WA. Prepared for DEWHA.
- Condie, SA & Dunn, JR 2006, 'Seasonal characteristics of the surface mixed layer in the Australasian region: implications for primary production regimes and biogeography', *Marine and Freshwater Research*, vol. 57, pp 569-590.
- Condie, S.A., Andrewartha, J., Mansbridge, J., Waring, J. (2006) Modelling circulation and connectivity on Australia's North West Shelf. Technical Report No. 6. Final Report - North West Shelf Joint Environmental Management Study. CSIRO.
- Corkeron, PJ, Morissette, NM, Porter, L & Marsh, H 1997, 'Distribution and status of Humpback Dolphins, *Sousa chinensis*, in Australian waters', *Asian Marine Biology*, vol. 14, pp 49-59.
- Dalzell, P & Pauly, D 1990, 'Assessment of the fish resources of southeast Asia, with emphasis of the Banda and Arafura seas', *Netherlands Journal of Sea Research*, vol. 25, pp 641-650.

- De Deckker, P, Tapper, NJ & van der Kaars, S 2003, 'The status of the Indo-Pacific Warm Pool and adjacent land at the Last Glacial Maximum', *Global and Planetary Change*, vol. 35, pp 25-35.
- DEEDI 2010, Annual status report 2010. Gulf of Carpentaria Developmental Fin Fish Trawl Fishery. Queensland: Department of Employment, Economic Development and Innovation.
- Dethmers, KEM, Broderick, D, Moritz, C, Fitzsimmons, NN, Limpus, CJ, Lavery, S, Whiting, S, Guinea, M, Prince, RIT & Kennett, ROD 2006, 'The genetic structure of Australasian green turtles (*Chelonia mydas*): exploring the geographical scale of genetic exchange', *Molecular Ecology*, vol. 15, pp 3931-3946.
- Dethmers, KEM, Chatto, R, Meekan, M, Amaral, A, de Cunha, C, de Carvalho, N & Edyvane, K 2009, Marine megafauna surveys in Timor-Leste: identifying opportunities for potential ecotourism - Final Report. Ministry of Agriculture & Fisheries, Government of Timor-Leste.
- Dethmers, KEM, Jensen, MP, FitzSimmons, NN, Broderick, D, Limpus, CJ & Moritz, C 2010, 'Migration of green turtles (*Chelonia mydas*) from Australasian feeding grounds inferred from genetic analyses', *Marine and Freshwater Research*, vol. 61, pp 1376-1387.
- DEWHA 2008a, The North Marine Bioregional Plan Bioregional Profile: A description of the ecosystems and conservation values and uses of the north-marine region. Canberra: Department of the Environment, Water, Heritage and the Arts.
- DEWHA 2008b, The North West Marine Bioregional Plan Bioregional Profile: A description of the ecosystems and conservation values and uses of the north-west marine region. Canberra: Department of the Environment, Water, Heritage and the Arts.
- Dos Santos Silva, C 2009, Final report on the governance, institution policy frame work and socio-economics of Timor-Leste Arafura and Timor Sea Ecosystem Approach: A regional commitment to the sustainable Management of the Arafura and Timor Sea Marine Ecosystem. Dili: ATSEA.
- Edyvane, K, de Carvalho, N, Penny, S, Fernandes, A, de Cunha, CB, Amaral, A, Mendes, M & Pinto, P 2009a, Conservation Values, Issues and Planning in the Nino Konis Santana Marine Park, Timor-Leste - Final Report. Ministry of Agriculture & Fisheries, Government of Timor-Leste.
- Edyvane, K, McWilliam, A, Quintas, J, Turner, A, Penny, S, Teixeira, I, Pereira, C, Y.Tibirica & Birtles, A 2009b, Coastal & Marine Ecotourism Values, Issues & Opportunities on the North Coast of Timor-Leste - Final Report. Ministry of Agriculture & Fisheries, National Directorate of Tourism, Government of Timor-Leste.
- FAA 118/119 2004, Conservation of Tropical Forest and Biological Diversity in Timor-Leste. Dili, Timor-Leste: Submitted in accordance with Foreign Assistance Act Sections 118/119.
- FAO 2009, The state of world fisheries and aquaculture 2008. Rome: Food and Agriculture Organisation of the United Nations.
- FAO 2010a, 2008 Yearbook: Fishery and Aquaculture Statistics. Rome: Food and Agriculture Organisation of the United Nations.
- FAO 2010b, FAO statistical yearbook 2010. Food and Agriculture Organisation.
- FAO 2011, Fish and animal protein consumption and availability: Survey results, Presentation given in Dili, Timor-Leste, FARCAS RFLP - FAO Timor-Leste, March 2011.
- Fernandes, L & Greiner, R 2010, North Marine Region: Future developments and Implications for Planning. Townsville: Report prepared for the Australian Government Department of the Environment, Water, Heritage and the Arts, River Consulting/Earth to Ocean.

- Field, IC, Meekan, MG, Buckworth, RC & Bradshaw, CJA 2009, 'Protein mining the world's oceans: Australasia as an example of illegal expansion-and-displacement fishing', *Fish and Fisheries*, vol. 10, pp 323-328.
- Fletcher, WJ & Santoro, K (eds.) 2010, *State of the Fisheries and Aquatic Resources Report 2009/20*, Department of Fisheries, Western Australia.
- Fox, JJ 1977, *Harvest of the palm: ecological change in eastern Indonesia*, Harvard University Press Cambridge, Massachusetts.
- Fox, JJ 2005, In a single generation: A lament for the forests and seas of Indonesia. In: BOOMGAARD, P., HENLY, D. & OSSEWIJER, M. (eds.) *Muddied Waters Historical and Contemporary Perspectives on Management of Forests and Fisheries in Island Southeast Asia*. Leiden: KITLV Press, pp 43-60.
- Fox, JJ 2009, Legal and Illegal Indonesian Fishing in Australian Waters. In: CRIBB, R. & FORD, M. (eds.) *Indonesia Beyond the Waters Edge: Managing an Archipelagic State*. Singapore: Institute of Southeast Asian Studies.
- Fox, JJ 2011, Timor-Leste: potential for a prosperous agricultural future. *A reliable partner: Strengthening Australia - Timor-Leste relations, Special Report 39*. Australian Strategic Policy Institute (ASPI), pp 38-43.
- Fox, JJ & Sen, S 2002, A Study of Socio-Economic Issues Facing Traditional Indonesian Fishers who Access the MOU Box: A Report for Environment Australia. Canberra: Research School of Pacific and Asian Studies, Australian National University.
- Gibson, J, Datt, G, Allen, B, Hwang, V, Bourke, M & Parajuli, D 2005, 'Mapping poverty in rural Papua New Guinea', *Pacific Economic Bulletin*, vol. 20, pp 27-43.
- Giri, C, Ochieng, E, Tieszen, LL, Zhu, Z, Singh, A, Loveland, T, Masek, J & Duke, N 2011, 'Status and distribution of mangrove forests of the world using earth observation satellite data.(Report)', *Global Ecology and Biogeography*, vol. 20, pp 154-159.
- GIWA 2002, GIWA (Global International Waters Assessment) Methodology. Detailed Assessment. Causal Chain Analysis. Policy Option Analysis.
- Gordon, AL 2005, 'Oceanography of the Indonesian seas and their throughflow', *Oceanography*, vol. 18, pp 14-27.
- Gordon, AL & Fine, RA 1996, 'Pathways of water between the Pacific and Indian oceans in the Indonesian seas', *Nature* vol. 379, pp 146-149.
- Griffin, D 2008, Pilot investigation of the origins and pathways of marine debris found in the northern Australian marine environment.
- Halpern, BS, Walbridge, S, Selkoe, KA, Kappel, CV & Micheli, F 2008, 'A global map of human impact on marine ecosystems', *Science* vol. 319, pp 948-952.
- Handley, AJ (ed.) 2009, *Fishery Status Reports 2009*, Northern Territory Government Department of Resources, Darwin.
- Harris, PT, Heap, AD, Marshall, JF & McCulloch, M 2008, 'A new coral reef province in the Gulf of Carpentaria, Australia: Colonisation, growth and submergence during the early Holocene', *Marine Geology*, vol. 251, pp 85-97.
- Heyward, A, Pinceratto, E & Smith, L 1997, Big Bank Shoals of the Timor Sea: An Environmental Resource Atlas. BHP Petroleum.
- ILO 2011, Report of the Workshop on Employment Diagnostic Analysis in Maluku Ambon, 11-13 April 2011. Available: [http://www.ilo.org/wcmsp5/groups/public/@ed\\_emp/documents/publication/wcms\\_155814.pdf](http://www.ilo.org/wcmsp5/groups/public/@ed_emp/documents/publication/wcms_155814.pdf).
- Kiessling, I (2003) Finding Solutions. Derelict Fishing Gear and other Marine Debris in Northern Australia, National Oceans Office and Department of the Environment and Heritage

- Kug, J-S, Kirtman, BP & Kang, I-S 2006, 'Interactive Feedback between ENSO and the Indian Ocean in an Interactive Ensemble Coupled Model', *Journal of Climate*, vol. 19, pp 6371-6381.
- Larson, S & Alexandridis, K 2009, Socioeconomic profiling of Tropical Rivers. Canberra: CSIRO, Land and Waters Australia.
- Limpus, CJ & Chatto, R 2004, Marine turtles. *National Oceans Office: Description of key species groups in the Northern Planning Area*. Hobart, Tasmania: National Oceans Office, pp 113-136.
- Lowe, C 2006, *Wild Profusion: Biodiversity Conservation in an Indonesian Archipelago*, Princeton University Press, Princeton.
- MA 2005, Ecosystems and human well-being: current state and trends. Findings of the Conditions and Trends Working Group. In: HASSAN, R., SCHOLE, R. & ASH, N. (eds.). Millenium Ecosystem Assessment (MA), Island Press.
- Marsh, H, Lawler, IR, Kwan, D, Delean, S, Pollock, K & Alldredge, M 2004, 'Aerial surveys and the potential biological removal technique indicate that the Torres Strait dugong fishery is unsustainable', *Animal Conservation*, vol. 7, pp 435-443.
- Marsh, H, Penrose, H, Eros, C & Hughes, J 2001, Dugong - Status Report and Action Plans for Countries and Territories. *Early Warning and Assessment Report Series*. UNEP/DEWA/RS.02-1.
- McWilliam, A 2003, 'Timorese Seascapes. Perspectives on customary marine tenures in Timor-Leste', *The Asia Pacific Journal of Anthropology*, vol. 3, pp 6-32.
- Meyers, G 1996, 'Variation of Indonesian throughflow and the El Niño - Southern Oscillation', *Journal of Geophysical Research*, vol. 101, pp 12,255-12,263.
- Milliman, JD & Farnsworth, KL 2011, *River Discharge to the Coastal Ocean*, Cambridge University Press, Cambridge.
- Milliman, JD, Farnsworth, KL & Albertin, CS 1999, 'Flux and fate of fluvial sediments leaving large islands in the East Indies', *Journal of Sea Research*, vol. 41, pp 97-107.
- Molcard, R, Fieux, M & Syamsudin, F 2001, 'The throughflow within Ombai Strait', *Deep Sea Research Part I: Oceanographic Research Papers*, vol. 48, pp 1237-1253.
- Moore, BR, Buckworth, RC, Moss, H & Lester, RJG 2003, 'Stock discrimination and movements of narrow-barred Spanish mackerel across northern Australia as indicated by parasites', *Journal of Fish Biology*, vol. 63, pp 765-779.
- Morrison, RJ & Delaney, JR 1996, 'Marine pollution in the Arafura and Timor Seas', *Marine Pollution Bulletin*, vol. 32, pp 327-334.
- NRI 2010, Papua New Guinea District and Provincial Profiles. Papua New Guinea: National Research Institute.
- Nugroho, D 2009, Transboundary Biodiversity, Fisheries and Oceanography Issues relating to Timor-Leste. Report to the Arafura Timor Seas Ecosystem Action Program.
- ORASECOM 2008, Orange-Senqu River Basin. Preliminary Transboundary Diagnostic Analysis Adopted by ORASECOM (Orange-Senqu River Basin Commission) in April 2008.
- Ovenden, J, Kashiwagi, T, Broderick, D, Giles, J & Salini, J 2009, 'The extent of population genetic subdivision differs among four co-distributed shark species in the Indo-Australian archipelago', *BMC Evolutionary Biology*, vol. 9, pp 40.
- Phillips, N, Chaplin, J, Morgan, D & Peverell, S 2011, 'Population genetic structure and genetic diversity of three critically endangered *Pristis* sawfishes in Australian waters', *Marine Biology*, vol. 158, pp 903-915.
- Poiner, I.R. and Harris, A.N.H. (1996) Incidental capture, direct mortality and delayed mortality of sea turtles in Australia's Northern Prawn Fishery, *Marine Biology* **125**: 813-825
- Preen, AR and Marsh H 1995, Response of dugongs to large-scale loss of seagrass from Hervey Bay, Queensland, Australia, *Wildlife Research* **22** 507-509.



- RDTL 2011, Timor-Leste Strategic Development Plan 2011-2030. Dili: Democratic Republic of Timor-Leste.
- Resosudarmo, BP, Napitupulu, L & Campbell, D 2009, Illegal Fishing in the Arafura Sea. In: RESOSUDARMO, B. P. & JOTZO, F. (eds.) *Working With Nature against Poverty Development Resources and the Environment in eastern Indonesia*. Singapore: Institute for Southeast Asian Studies, pp 178-200.
- Saalfeld, K & Marsh, H 2004, Dugong. *National Oceans Office, Key Species - A Description of key Species Groups in the Northern Planning Area*. Hobart: National Oceans Office, pp 97-114.
- Salini, JP, Ovenden, JR, Street, R, Pendrey, R, Haryanti & Ngurah 2006, 'Genetic population structure of red snappers (*Lutjanus malabaricus* Bloch & Schneider, 1801 and *Lutjanus erythropterus* Bloch, 1790) in central and eastern Indonesia and northern Australia', *Journal of Fish Biology*, vol. 68, pp 217-234.
- Sea Around Us 2007, Indonesian Sea: LME#38. *A Global Database on Marine Fisheries and Ecosystems*. Vancouver, Canada: Fisheries Centre, University of British Columbia.
- Spalding, MD, Kainuma, M & Collins, L 2010, *World Atlas of Mangroves*, Earthscan, London.
- Stacey, N 2007, Boats to Burn: Bajo Fishing Activity in the Australian Fishing Zone. Canberra: ANU E Press.
- Stacey, Ne, Nurhakim, S, Nugroho, D, Soselisa, H, Resosudarmo, B, Kalis, O, Monteiro, J, Prescott, J, Martin, J & Karam, J 2011, Socio-economic Profile of the Arafura and Timor Seas. Report prepared for the Arafura Timor Seas Ecosystem Action (ATSEA) Program. Jakarta.
- Stevens, JD, West, GJ & McLoughlin, KJ 2000, 'Movements, recapture patterns, and factors affecting the return rate of carcharhinid and other sharks tagged off northern Australia', *Marine and Freshwater Research*, vol. 51, pp 127-141.
- Stoeckl, N, Esparon, M, Stanley, O, Farr, M, Delisle, A & Altai, Z 2011, Socioeconomic activity and water use in Australia's tropical rivers: A case study in the Mitchell and Daly River. Darwin: Charles Darwin University.
- Suharyo, WI, Toyamah, N, Poesoro, A, Sulaksono, B, Usman, S & Febriany, V 2007, Improving the Business Climate in NTT: the Case of Agriculture Trade in West Timor, SMERU Research Report, March 2007. Jakarta: SMERU Research Institute.
- Sulaiman, Z & Ovenden, J 2010, 'Population genetic evidence for the east-west division of the narrow-barred Spanish mackerel (*Scomberomorus commerson*, Perciformes: Teleostei) along Wallace's Line', *Biodiversity and Conservation*, vol. 19, pp 563-574.
- Tomascik, T, Mah, AJ, Nontji, A & Moosa, MK 1997, *The Ecology of the Indonesian Seas*, Periplus, Singapore.
- Torgensen T., Hutchinson, MF, Searle, DE and Nix, HA 1983, 'General Bathymetry of the Gulf of Carpentaria and the Quaternary Physiology of Lake Carpentaria', *Palaeogeography, Palaeoclimatology, Palaeoecology*, 41:207-25
- Tun, K, Chou, LM, Yeemin, T, Phongsuwan, N, Amri, AY, Ho, N, Sour, K, Long, NV, Nanola, C, Lane, DW & Tuti, Y 2008, Status of Coral Reefs in Southeast Asia. In: WILKINSON, C. (ed.) *Status of Coral Reefs of the World: 2008*. Townsville: Global Coral Reef Monitoring Network and Reef and Rainforest Research Center.
- Underwood, JN, Smith, LD, Van Oppen, MJH & Gilmour, J 2009, 'Ecologically relevant dispersal of corals on isolated reefs: implications for managing resilience', *Ecological Applications*, vol. 19, pp 18-29.
- UNDP 2010, The Real Wealth of Nations: Pathways to Human Development. Human Development Report 2010, 20th Anniversary Edition. United Nations Development Program.

- UNDP 2011, Timor-Leste Human Development Report 2011, Managing Natural Resources for Human Development: Developing the Non-Oil Economy to Achieve the MDGs. United Nations Development Program.
- UNEP 2005, Indonesian Seas, GIWA Regional Assessment 57. *In: VANTIER, L., WILKINSON, C., LAWRENCE, D. & SOUTER, D. (eds.)*. Kalmar, Sweden: UNEP, University of Kalmar.
- UNICEF/WFP/FAO 2010, Nutrition Security and Food Security in seven districts in NTT province, Indonesia: status, causes and recommendations for response. Jakarta, Rome.
- Wagey, GA, Nurhakim, S, Nikijuluw, VPH, Badrudin & Pitcher, TJ 2009, A study of Illegal, Unreported and Unregulated (IUU) fishing in the Arafura Sea, Indonesia. Rome: Report to FAO.
- Wells, FE & Allen, GR 2005, 'Marine biodiversity on offshore coral reefs in north-western Australia', *The Beagle: Records of the Museums and Art Galleries of the Northern Territory, Supplement 1*, pp 43-50.
- Whiting, SD & Guinea, ML 2005, 'Dugongs of Ashmore Reef and the Sahul Banks: a review of current knowledge and a distribution of sightings', *The Beagle: Records of the Museums and Art Galleries of the Northern Territory, Supplement 1*, pp 207-210.
- Williams, R, Fontes, L, da Silva, D, Dalley, A & Monaghan, B. Year, Published. Participatory variety selection increases adoption of modern varieties by subsistence farmers in East Timor. *In: UNKOVICH, M., ed. Global Issues. Paddock Action. Proceedings of 14th Agronomy Conference 2008, 2008 Adelaide, South Australia.*
- Woodroffe, CD 1995, 'Response of tide-dominated mangrove shorelines in Northern Australia to anticipated sea-level rise', *Earth Surface Processes and Landforms*, vol. 20, pp 65-85.
- Zhong, A, Hendon, HH & Alves, O 2005, 'Indian Ocean Variability and Its Association with ENSO in a Global Coupled Model', *Journal of Climate*, vol. 18, pp 3634-3649.
- Zijlstra, JJ & Baars, MA 1990, Productivity and fisheries potential of the Banda Sea ecosystem. *In: SHERMAN, K., ALEXANDER, L. M. & GOLD, B. D. (eds.) Large Marine Ecosystems-Patterns, Processes, and Yields*. Washington D.C.: AAAS Publ. No. 90-305, pp 54-65.

## 8 ANNEXES

### Annex 1: Scoring table for prioritization of priority transboundary issues, main sectors and impacts on ecosystem services by country

Key: 0: No known impact      x: Slight impact      xx: Moderate impact      xxx: Severe impact

↑: increased impact      ↓: decreased impact

#### Regional Summary

Priority transboundary issues	Australia	Indonesia	Papua New Guinea	Timor-Leste	Overall Impact score	Priority Rank**
<b>1. Unsustainable fisheries &amp; decline &amp; loss of living coastal &amp; marine resources</b>	5	10	7	6	28	2
Traditional fisheries		x	x	xx	4	
Subsistence fisheries		x	x	x	1	
Artisanal fisheries		x	xxx	xx	6	
Industrial fisheries		xxx	0	x	4	
<b>2. Modification, degradation &amp; loss of coastal &amp; marine habitats</b>	2	11	5	12	30	1
Capture fisheries		xxx	xxx	x	7	
Agriculture/Aquaculture		x	0	x	2	
Mining/Energy		xx	xx	xx	6	
Transportation		x	x	xx	4	
Tourism		x	0	0	1	
<b>3. Marine &amp; land-based pollution (e.g. marine debris, sediments, oil spills)</b>	4	10	5	8	27	3
Agriculture/Forestry		x	x	xxx	5	
Mining		xx	xx	xx	6	
Energy/Oil & Gas		xx	x	xx	5	
Marine Tourism		x	0	0	1	
Urban and industrial Development		xx	0	x	3	
Fishing and Shipping		xxx	x	xx	6	
<b>4. Decline &amp; loss of biodiversity &amp; key marine species</b>	3	12	4	6	25	4
Capture fisheries		xx	xx	xx	6	
Agriculture/Aquaculture		x	0	x	1	
Mining/Energy		x	x	xx	4	
Transportation		x	0	x	2	
Tourism		x	xx	x	4	
<b>5. Impacts of climate change</b>	8	7	2	8	25	4
Energy/ Oil & Gas		x	x	xx	4	
Agriculture/Forestry		x	x	xx	3	
Fisheries		xx	x	x	4	
<b>Total score for PECs by country (Total=75)</b>	<b>24 (32%)</b>	<b>50 (67%)</b>	<b>23 (31%)</b>	<b>40 (53%)</b>		

**\*\* 1 = the highest priority**

**Explanatory notes to accompany Australian prioritisation of transboundary issues**

1. In general, the low scores for most priority transboundary issues within Australian waters are a result of the very low population levels and limited industrial development across the north of Australia.
2. Unsustainable Fisheries - the greatest concern for Australia is the very high cost of its programme to prevent foreign illegal fishing. It is expected that without the program, illegal fishing would increase and have the potential to impact more severely on the provisioning and cultural ecosystem services. This economic impact is recorded under “other impacts”.
3. Modification, degradation and loss of coastal and marine habitats - localised serious impacts when spread across the ATS coastal area were considered to be slight.
4. Impacts of Climate Change
  - a. Unlike the other 4 priority trans-boundary issues the Australian group was looking to the future for its scores of this issue.
  - b. These sectors are difficult to score because climate change is not a result of local energy production or agriculture or fisheries – it is a global issue and will have an impact in the ATS as much as anywhere else.

## **Annex 2: TDA Technical Task Group**

### **(A) TDA Inception Meeting, Darwin (October 2010)**

#### **I. Indonesia**

- Mr. Dede Falahudin, Indonesian Institute of Sciences
- Dr. Subhat Nurhakim, Research Centre for Capture Fisheries
- Mr. Duto Nugroho, Research Centre for Capture Fisheries
- Mr. Bambang Sumiono, Research Centre for Capture Fisheries
- Ms. Restu Nur Afi Ati, Research Centre for Marine Territory & Non-Living Resources
- Dr. Sugiarta Wirasantosa, Research Centre for Marine Territory & Non-Living Resources
- Dr. Bambang Herunadi, Ministry of Marine Affairs and Fisheries
- Ms. Shanti Dewi Hafsanita, Ministry of Marine Affairs and Fisheries
- Ms. Pipit Novita Indriyani, Ministry of Marine Affairs and Fisheries
- Mr. Jotham Siprianus Rehabeam Ninef, University of Nusa Cendana, NTT

#### **II. Timor-Leste**

- Mr. Augusto Fernandes, Director of NDFA, Ministry of Agriculture & Fisheries
- Ms. Maria Odete do Ceu Guterres, Ministry of Agriculture & Fisheries
- Mr. Constancio dos Santos da Silva, Researcher, Ministry of Agriculture & Fisheries
- Mr. Orlando Halek Kalis, Researcher, Ministry of Agriculture & Fisheries
- Mr. Fernando da Silva, Researcher, Ministry of Agriculture & Fisheries
- Mr. Fransisco Xavier Luis Pereira, Researcher, Ministry of Agriculture & Fisheries

#### **II. Australia**

- Dr. Dan Alongi, Researcher, Australian Institute of Marine Sciences
- Dr. Lindsay Trott, Researcher, Australian Institute of Marine Sciences
- Dr. Ian Poiner
- Dr. Frank Tirendi
- Dr. Andrew Heyward
- Mr. Jamie Oliver
- Prof. Robert Wasson
- Dr. Merrilyn Wasson
- Mr. Jim Prescott
- Dr. Ilse Kiessling
- Dr. Rik Buckworth
- Dr. Julie Martin
- Dr. Andria Handley
- Dr. James Butler
- Dr. Karen Edyvane
- Ms. Danielle Thomson
- Ms. Kate Dunkerley
- Dr. Timothy Skewes

### III. PMO

- Dr. Gabriel Antonius Wagey
- Ms. Ivone Viviane Rawis
- Dr. Natasha Stacey (facilitator)

#### (B) First TDA Technical Meeting, Dili (March, 2011)

##### Australia

1. Dr. Dan Alongi, The Australian Institute of Marine Science
2. Dr. Robert Wasson, Charles Darwin University
3. Dr. Natasha Stacey, Charles Darwin University
4. Dr. Jim Prescott, Australian Fisheries Management Authority
5. Dr. Karen Edyvane, Northern Territory Government
6. Ms. Candice Mohan, Department of Sustainability, Environment, Water, Population and Communities
7. Dr. Julie Martin, Northern Territory Fisheries Department of Resources
8. Dr. Frank Tirendi, The Australian Institute of Marine Science
9. Mr. Andrew McWilliam, Australia National University
10. Dr. James Fox, Australia National University

##### Indonesia

1. Dr. Sugiarta Wirasantosa, Senior Researcher
2. Ir. Duto Nugroho, M.Si, Center for Fisheries Management and Fish Conservation
3. Dr. Widodo S. Pranowo, Researcher Center for Marine & Coastal Resources Research & Development
4. Dr. Nevianty Zamani, Bogor Institute of Agriculture
5. Prof. Subhat Nurhakim, Senior Researcher, Center for Fisheries Management and Fish Conservation
6. Dr. Dedi Adhuri, Researcher, Indonesian Institute of Sciences
7. Dr. Budi Reksosudarmo, Researcher, Australian National University
8. Prof. Hermien Sospelisa, Researcher, University of Pattimura
9. Dr. Bambang Sumiono, Center for Marine & Coastal Resources Research & Development

##### Timor-Leste

1. Ms. Maria Odete do Ceu Guterres, Ministry of Agriculture and Fisheries
2. Mr. Orlando Halek Kalis, Ministry of Agriculture and Fisheries
3. Mr. Constancio dos Santos Silva, Ministry of Agriculture and Fisheries
4. Mr. Fernando da Silva, Ministry of Agriculture and Fisheries
5. Mr. Augusto Fernandes, Ministry of Agriculture and Fisheries

##### PMO

1. Dr. Gabriel Antonius Wagey
2. Ms. Ivonne Rawis
3. Dr. Anna Tengberg, International Consultant

**(C) Second TDA Technical Meeting, Bali (October, 2011)****Australia**

1. Dr. Natasha Stacey, Charles Darwin University
2. Ms. Johanna Karam, Charles Darwin University
3. Dr. Dan Alongi, Australian Institute of Marine Sciences
4. Dr. Frank Tirendi, Australian Institute of Marine Sciences
5. Mr. Jim Prescott, Australian Fisheries Management Authority
6. Dr. Julie Martin, Department of Resources, Northern Territory Government

**Indonesia**

1. Prof. Dr. Ety Agoes, University of Padjadjaran, Bandung
2. Prof. Dr. Hermien L. Soselisa, University of Pattimura, Ambon
3. Dr. Sony Koeshendrajana, Agency for Marine & Fisheries Research & Development
4. Dr. Dedi Adhuri, Indonesian Institute of Sciences
5. Ms. Dwi Hindarti, Indonesian Institute of Sciences
6. Mr. Mohammad Billahmar, Indonesian Tuna Fisheries Association
7. Mr. Johannes Subijanto, Coral Triangle Center
8. Dr. Andin Taryoto, Fisheries University, Jakarta
9. Ir. Duto Nugroho, M.Si, Agency for Marine & Fisheries Research & Development
10. Dr. Melda Kamil, University of Indonesia
11. Ms. Lusita, University of Indonesia
12. Ms. Fika Yulialdina Hakim, University of Indonesia

**Timor-Leste**

1. Ms. Maria Odete Do Ceu Guterres, Ministry of Agriculture & Fisheries Timor-Leste
2. Mr. Januario Marcal, Ministry of Agriculture & Fisheries Timor-Leste
3. Mr. Orlando Kalis, Ministry of Agriculture & Fisheries Timor-Leste

**Papua New Guinea**

1. Mr. Andrew Taunega, National Fisheries Authority (NFA)
2. Mr. Ian Liviko, National Fisheries Authority (NFA)
3. Mr. Norman Barnabas, National Fisheries Authority (NFA)
4. Mr. Paul Lokani, Consultant

**UNDP Indonesia**

1. Mr. Iwan Kurniawan, Program Officer, Environment Unit

**PMO**

1. Dr. Tonny Wagey, Regional Project Manager
2. Dr. Anna Tengberg, International Consultant
3. Prof. Subhat Nurhakim, Indonesia National Coordinator
4. Dr. Sugiarta Wirasantosa, ATSEA Indonesia Consultant
5. Mr. Augusto Fernandes, Timor-Leste National Coordinator
6. Mr. Joao Amaral, ATSEA National Consultant
7. Ms. Ivonne Rawis, ATSEA Finance Assistant
8. Mr. Adi Pramudya, ATSEA Admin