Socio-economic profile

of the Arafura Timor Seas

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Socio-economic Profile of the Arafura Timor Seas

Report prepared for the

Transboundary Diagnostic Analysis component of the

Arafura Timor Seas Ecosystem Action Program

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Cover picture: Traditional fishing boat in Tablolong Beach, Kupang, NTT Indonesia (Photo by ATSEA, 2011)

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Forewords

In the process of undertaking a Transboundary Diagnostic Analysis (TDA) to assess the current state of the environment, resources and people in and around the Arafura and Timor Seas, the Arafura and Timor Seas Ecosystem Action (ATSEA) Program requires technical assessment and thematic reports directly related to ATS region such as Biophysical profile, Socio-economic profile, Causal chain analysis and prioritization of environmental concerns, and Governance analysis of drivers and impacts of environmental issues. These reports were used to prepare a separate regional TDA report which outline issues around identification of options to address national and transboundary problems proposed as part of a Strategic Action Program for the ATS region.

TDA forms the basis for the development and agreement of a Regional Strategic Action Program and National Action Plans.

The aim of this report on socio-economic profile of the ATS region is to develop a shared perspective on priority socio-economic and livelihood issues of a transboundary nature in the Arafura and Timor Seas as part of Arafura Timor Seas Ecosystem Action Program.

Prepared by a team of contributors from each of the three participating countries during February – June 2011, the intention of this report is to synthesize material based on existing knowledge and research findings rather than undertake new data or information gathering through qualitative or quantitative research. Considering that, this report is based on a review of existing literature and draws heavily on the collective expertise and knowledge of key ATSEF (Arafura and Timor Seas Expert Forum) members and ATSEA stakeholders from three participating countries. It includes a brief assessment of ATS relevant Papua New Guinea issues. Peer review process has been taken to make sure that the report has adequately captured all key issues and ensure correctness.

This report is structured into two sections. Part A profiles the socio-economic context of the four countries in the ATS region. This includes summaries of demographic characteristics, ethnicity, languages, religion and culture and description of key socio-economic sectors and coastal livelihoods in the region. Part B describes the social, economic and conservation drivers of marine and coastal activity and impacts from environmental degradation. Some key threatening transboundary issues and recommendations are also identified.

ATSEA is eager to share the socio-economic report with the relevant parties, stakeholders, academicians and general public as part of ATSEA obligation to inform public on the ATSEA Program. Regarding this, I hope that the publication of this report serves the mentioned purpose.

Jakarta, February 2012,

Dr. Tonny Wagey
ATSEA Regional Project Manager

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Abbreviations

ACIAR	Australian Centre for International Agricultural Research
AFMA	Australian Fisheries Management Authority
AFZ	Australian Fishing Zone
AIMS	Australian Institute of Marine Science
APEC	Asia Pacific Economic Cooperation
ATS	Arafura & Timor Seas
ATSEA	Arafura & Timor Seas Ecosystem Action Program
ATSEF	Arafura & Timor Seas Expert Forum
ANU	The Australian National University
BRKP	Marine & Fisheries Research Agency (of MMAF – Indonesia)
CDU	Charles Darwin University
CI	Conservation International
CTI	Coral Triangle Initiative
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
IUCN	World Conservation Union
IUU	Illegal, Unregulated and Unreported (fishing)
IWP	International Waters Programme
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
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
NRM	Natural Resource Management
NT	Northern Territory
PNG	Papua New Guinea
PPG	Project Preparation Grant
QLD	Queensland (Australia)
SLA	Sustainable Livelihoods Analysis
SAP	Strategic Action Programme
TDA	Transboundary Diagnostic Analysis
TNC	The Nature Conservancy
TRaCK	Tropical Rivers and Coastal Knowledge Programme
UNDP	United Nations Development Programme
WA	Western Australia
WGMAF	Working Group Marine Affairs and Fisheries
WWF	World Wide Fund for Nature

Glossary

Aboriginal traditional owner	"Local descent group of Aboriginals who have common spiritual affiliations to a site on the land…and are entitled by Aboriginal tradition to forage as of right over that land" (Aboriginal Land Rights Act NT 1976).
Bugis	Ethnic group originating from the Indonesian province of South Sulawesi but residing in settlements across Indonesia.
Butonese	Ethnic group originating from the Indonesian province of Southeast Sulawesi but residing in settlements across eastern Indonesian islands.
caring for country	The complex spiritual affiliation encompassing the rights and responsibilities Aboriginal Australians have with their land and sea. It includes their custodial responsibilities for keeping the environment healthy. The practice of 'caring for country' occurs across northern Australia through customary practice and Indigenous Ranger Programs for NRM.
country	For Aboriginal people 'country' refers to their ancestral lands for which they are responsible and phrases such as 'on country' are used to refer to activities on such land or sea (sometimes called 'saltwater' country). There are interrelated beliefs, rights, obligations, economic dependence and identity that link particular groups or clans to particular areas of land and sea (after NOO 2004).
ecosystem services	The benefits people obtain from active or passive use of ecosystems to produce human wellbeing.
food security	Exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy lifestyle (World Food Summit 1996 - cited in AusAID 2004). Food security is comprised of three pillars: *availability* of consistent and sufficient quantities of food; *access* or the capacity to obtain appropriate and sufficient foods, and; *consumption* or appropriate use of basic nutrition and food preparation (World Health Organisation 2010).
livelihoods	A Livelihood comprises the capabilities, assets (including both material and social resources) and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stresses and shocks and maintain its capabilities and assets both now and in the future, while not undermining the natural resource base (Carney 1998).
Madurese	Ethnic group from region of Madura in east Java who travel over Indonesia for livelihood purposes.
Makassarese	Ethnic group originating from the Indonesian province of South Sulawesi but who reside in settlements across Indonesia.
merantau	Practice of voluntary migration – often long-range seafaring journeys – in search of livelihoods.
outstation/homelands	Small settlements occupied by Aboriginal traditional owners or those people with a direct link to the traditional owner of the land for short

	or permanent occupation periods.
patron-client relationship	A mutually obligatory arrangement between an individual who has authority, social status, wealth, (the patron) and another person who benefits from his or her support or influence (the client)[1].
Sama Bajo	Indonesian maritime population (often referred to as 'sea-nomads') found residing in settlements across eastern Indonesian region.
socio-economic	Information providing an understanding of the social, cultural, economic and political characteristics and conditions of people, households, community groups and institutions.
transboundary	Transboundary environmental concerns are defined as any form of anthropogenic[2] degradation in the natural state of a water body that concerns more than one country, an environmental problem originating in, or contributed by, one country and affecting (or impacting) another. The impact may be damage to the natural environment and/or damage to human welfare (IW Learn 2005).
Transboundary Diagnostic Analysis	A Transboundary Diagnostic Analysis (TDA) is a scientific and technical assessment, through which the water-related environmental issues and problems of a region are identified and quantified, their causes analysed and their impacts, both environmental and economic, assessed. The analysis involves an identification of causes and impacts at national, regional and (sometimes) global levels, and the socio-economic, political and institutional context within which they occur. The identification of causes can specify sources, locations, and sectors

[1] http://www.termwiki.com/EN:patron_client_relationship

[2] Anthropogenic means caused by the activities of people rather than natural phenomena.

Executive Summary

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, Maluku, and Papua) have districts (*kabupaten*) within the ATS area, whilst in Timor-Leste, 11 out of the country's 13 districts have coast line 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 falls within the government regions of one territory and two states (Northern Territory, Western Australia and Queensland) and one offshore territory (Ashmore and Cartier Islands).

Fishers, vessels and markets originating from across Indonesia and other Southeast and mainland Asian countries are active in the region thus the transboundary area of relevance actually extends beyond those districts immediately adjacent to the Arafura and Timor Seas.

This profile characterises the socio-economic context of the Arafura and Timor Seas region with a focus on sectors and livelihoods which relate to identified transboundary environmental concerns regarding:

- Unsustainable fisheries and decline and loss of living coastal and marine resources;
- Decline and loss of biodiversity and key marine species;
- Modification, degradation and loss of coastal and marine habitats;
- Marine and land-based pollution, and
- Impacts of climate change (Alongi 2011).

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, mobility and migration, and shared use and management of marine resources.

Socio-Economic Characteristics

Demography

There are approximately 4.1 million people living in the Arafura Timor Sea region, of which approximately 2.8 million people are in Indonesia, 1 million in Timor-Leste, 310,000 in Australia and 46,000 in PNG.

Ethnicity, 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. Fatuluku and Bunak languages) or 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).

Religions practiced throughout the region include Christianity, Catholicism, and Islam as well as a range of 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.

Some indigenous communities in the region (e.g. Aboriginal communities of northern Australia, ethno-linguistic groups in Maluku Province, Indonesia and Timor-Leste) hold customary rights to land and sea areas. Cultural and spiritual activities and interests of people in the ATS region often extend into offshore waters.

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.

In Australia, Indonesia, Timor-Leste and PNG, poverty[3] 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. Over 30 percent of Indonesians are considered 'poor' based on the national classification system (living on less than Rp. 126,000 per month or US 1.25$ per day).

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 108th, Timor-Leste was 120th and Papua New Guinea came 137th (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, West Papua, East Nusa Tenggara (NTT) and Papua were amongst the lowest scoring provinces for HDI in Indonesia ranking 30th, 31st and 33rd respectively out of 33 provinces[4].

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).

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[5] 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).

[3] 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.

[4] http://www.bps.go.id/tab_sub/view.php?tabel=1&daftar=1&id_subyek=26&notab=2 [accessed 14/07/2011]

[5] It should be noted that until 2008, Maluku Tenggara Barat included Maluku Barat Daya

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*. 2004).

Of the nations within the ATS, only Australia is classed as a 'developed country'. Australia has been able to apply a social safety net program, and so the portion of people living below the poverty line has been relatively small. 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 the 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).

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.

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 are limited by the fact that only 48% of the adult population having completed primary school with around 72% of the population never going beyond primary school. 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 2007). 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 and 80% of employment in Timor-Leste (FAA, 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 Indonesian island populations. 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.

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[6].

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.

[6] http://whc.unesco.org/en/tentativelists/5062/ - accessed 1/08/2011

Median weekly incomes vary immensely with the highest median incomes found in urban areas and mining towns (Darwin, Broome, Gove, 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 resource-based industries providing direct employment for Indigenous people have increased in the last few years but employment levels are still low.

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 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 all 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 (nd) 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 nd).

Socio-economic Sectors and Livelihoods

The oceanic, coastal and catchment areas of the ATS region support a wide range of economic sectors, from subsistence and recreational fishing to artisanal and industrial fisheries. Other marine resource uses, 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 protein 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.

CAPTURE FISHERIES

Fisheries in the region are extremely diverse with multiple sectors, differing target species, gear types, motivations to fish and socio-cultural background of the actors.

Fisheries in the ATS are very much multi-sectoral, involving subsistence, artisanal, and various scales of commercial/industrial fishing. The way these sectors interact in terms of fish production, environmental effects of fishing, social and economic dimensions is relatively un-studied and poorly understood. Some interactions have the potential to be extremely important for understanding the drivers for fisheries activities and their consequences. For example, the effect that large scale trawl fisheries have on artisanal fishers is currently impossible to quantify and it is therefore not possible for governments to make informed policy choices about this or other such critical fishery issues in the ATS.

Reliable fisheries data are not always available with estimates of catch, consumption and statistics varying greatly between the literature. One of the serious fisheries issues in the ATS is the degree of unreported fishing which, of course, compromises the accuracy of many of the statistics produced and conclusions drawn from the information. However, we believe that the important messages in the "broad brush" description of the fisheries situation in the ATS that we present are robust to the uncertainties inherent to the information sources.

It is estimated that more than 2.7 million Indonesians are directly employed as fishermen in capture fisheries (DGCF 2010). 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 some coastal and small island communities, women collect marine products from tidal areas, and children under the official working age also involved in fishing activities.

In 2003 the capture fisheries sector accounted for nearly two percent of the nation's GDP, reflecting the high per capita fish consumption in Indonesia (ASEAN 2005). Annual consumption of capture fish across Indonesia in 2005 was estimated at 19 kg per capita (FAO 2010a). It is highly likely that the figure is greater in the Indonesian coastal communities within the ATS. In Timor-Leste, annual per capita fish consumption is far lower at an average of 6.1 kg (FAO 2011). 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[7].

In 2008, production from capture fisheries in Indonesia 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 are approximately 4.1 and 0.01 percent of the Indonesian production respectively.

The differences in national scales of dependency on, and production of, fisheries products has led to some important differences in the ways these resources are viewed by the public and their governments. Fisheries management in Indonesia tends to have a strong emphasis on development and expansion of the sector, while in Australia there is greater emphasis on conservation of fisheries resources and biodiversity. Timor-Leste lies somewhere between the two points of emphasis, and is to some degree a product of that country's recent independence and development phase.

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 (Table 3). 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).

Table 3: 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	2016.96
	Papua Barat	34,742	106,089	113.6 M	1070.80
	Total	**247,277**	**793,410**	**689.5 M**	**1012.09**
Timor-Leste		6,360	3,066	5.3 M	1140.00
Nth Australia		625+	13,340	110.3 M	8271.81

**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 and Santoro 2010) and Timor-Leste (dos Santos Silva 2009a; Nugroho 2009, NDFA-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.

Along the international boundaries some fish stocks, notably several species of commercially valuable snappers, are confirmed as genetically shared stocks (Blaber *et al*. 2005, Salini *et al*. 2006). Many other fish and invertebrates of ecological or commercial importance that straddle the international borders are also likely to be shared, though studies to confirm this have not been

[7] Need to check these percentages

carried out. Catches of migratory species such as the several species of turtles moving throughout the ATS are probably not recorded as their capture is illegal.

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 exempt from licensing), contributing to declining habitats and reef resources in some areas.

The most mobile and specialised of all seafaring groups are the Sama-Bajo – frequently referred to as 'sea nomads' in the academic and popular literature (Lowe 2006, Stacey 2007, Fox 2005). This group are 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).

Communities in Maluku are highly dependent on marine products for their livelihoods, particularly those living on small islands where access to agricultural land is limited. In 2009, almost 10% of the population in the ATS region of Maluku was employed in the fisheries sector (Maluku Dalam Angka 2009). In practice, 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 engage in small scale coastal fishing, working as labourers and trading. Along the eastern Arafura coast, there are a number of local fishermen who originate from elsewhere, predominantly the Bugis and Butonese, particularly in Mimika district. Very few indigenous people of Papuan descent live on this coast.

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. Indonesians can legally fish in certain areas 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 active at any one time and probably numbers between 1,000 and 2,000 (2010) but may have been higher in previous years prior to border control.

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*). The MOU Box fisheries are 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).

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 and Sen 2002).

In Papua, the port towns of Sorong, Kaimana and Merauke 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).

IUU FISHING

The ATS is a hotspot for illegal, unreported and unregulated (IUU) fishing which is largely due to the region's comparative remoteness and exploitation history. In the Arafura Timor Seas region, various fishing operations from Indonesia and countries to the north (e.g. Thailand, Taiwan, South Korea, China, the Philippines) illegally target various species of high commercial value in Australian and Indonesian waters (e.g. snapper, trepang, shark fin) (Fox *et al.* 2009, Stacey 2007, Resosudarmo *et al.* 2009).

The very fact that IUU fishing is illegal, unreported and unregulated means that quantifying the activity is problematic. In Indonesian waters alone in the Arafura Sea hundreds of vessels may be operating illegally. 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). Wagey *et al*. (2009) estimate that IUU catch in the Indonesian Arafura Sea waters was most likely to have been more than one million tonnes per year during the period 1984 to 2005 with an estimated loss of revenue of $US 2 billion. Equivalent estimates have not been made for Australian or Timor-Leste waters but it is widely accepted that IUU fishing has been a significant source of mortality for some species and probably exceeded, and may still exceed, that from some legal fisheries in Australia and Timor-Leste.

Indonesia claims that it has made inroads into reducing the numbers of illegal vessels in its area of jurisdiction since 2000 (Wagey *et al*., 2009, Purwanto 2010, Purwanto 2011) but data suggest that there may still be a significant number of illegal fishing vessels in Indonesia's area of the ATS (ATSEA, 2010).

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.

IUU fishing also occurs in PNG waters but again, the capacity to halt these activities is limited though some illegally operating fishers from Indonesia have been caught. Incidents have also been reported

in coastal river areas around the PNG-Papua border inside the Tonda Wildlife Management Area (SPC 2006 Regional Marine Information Bulletin Issue 37).

Indonesian fishermen have visited northern Australian coastal areas since at least the 18th century for the purposes of fishing (Macknight 1976, Stacey 2007), most notably for trepang. These visits went beyond simple fishing expeditions to cultural associations and blood relations with Australian Aborigines. In the years since this historical fishing activity was brought to an end, Indonesian fishers have frequented the coast primarily, to illegally harvest trochus shells along the Kimberley Coast.

The species targeted by IUU fishing changes and is driven by economic opportunity. Within Australia's area of jurisdiction in the ATS, illegal fishing, predominantly of Indonesian origins, reached levels that triggered a strong response by the Australian government in 2005. Whether or not due to increased resources for patrolling Australia's northern waters, illegal activity in the region reduced significantly but IUU fishing continues. Consequences of reducing IUU fishing in Australian waters are poorly understood in terms of the flow on effects to other parts of the ATS. It is unknown what role other social and economic forces in Indonesia, such as rising fuel prices, may have had in reducing illegal activity.

Rising affluence and demand, primarily in China, has fuelled a dramatic increase in shark fishing in countries such as Indonesia (Tull 2009). Indonesian shark boats then expanded their operations into northern Australian waters.

In Indonesia's Arafura Sea Fisheries management area – one of the most heavily exploited regions in Indonesian waters – inappropriate and destructive activity in the marine environment is undertaken by industrial scale fishing fleets (Wagey *et al.* 2008, Fox *et al.* 2009). Some of these are Indonesian and others are from countries to the north such as Taiwan and China who operate using fish trawls, shrimp trawls and bottom long lines. Priority concerns regarding fishing in the Arafura Sea are unrecorded catch – which includes catch that is thrown away (by-catch, discards), catch which is not reported, misreported catch and illegal fishing activities. Furthermore, it is estimated that more than 80% of demersal fish, mostly Red Snapper (*Lutjanus* sp) harvested between 1980 and 2005 from the Arafura Sea using Bottom Long Line, was unreported (Wagey *et al.* 2008). Illegally caught fish may also be trans-shipped from the fishing vessel to a foreign carrier vessel for transport to country of origin. Thus official fisheries statistics for the Arafura Sea and actual real catch and effort are likely to be starkly different.

Other types of illegal fishing, such as blast and cyanide fishing are usually missing from calculations of losses due to IUU fishing because these activities are generally discussed under the topic of 'destructive fishing.' A lack of data means the impacts of these activities on fisheries species and habitats is not fully understood.

Marine pollution presents another insidious trans-boundary issue affecting fisheries in the ATS. Marine debris, including ghost fishing nets, have been a focus of attention in Australia but less so in the other ATS countries. Identifying prints or marks on plastic items suggest that much of the debris appearing in Australian waters is of Southeast Asian origin (White 2006). Many of these ghost nets may be lost or cast off from IUU fishing vessels.

Despite large gaps in information regarding the nature and extent of IUU fishing and data on catch levels, management actions must commence, particularly in relation to industrial IUU fishery.

AQUACULTURE

Although not significant as a direct trans-boundary issue, aquaculture is a major industry in some locations in the ATS region, particularly in Indonesia and it has been suggested that aquaculture represents the world's fastest growing food production sector (Andrew *et al*. 2010). 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 unlikely to force people back to capture fisheries to maintain their supplies of food and income.

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. There are gold and copper mines on Wetar and Sumbawa islands in NTT.

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. There is a large Freeport mining operation near Timika (copper/gold/silver) but sediments and tailings ponds are fairly well contained. 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 BHP Billiton and has been the subject of litigation by traditional landowners both in respect of environmental degradation and disputes over royalties[8].

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.[9] Oil production has declined since the 1990s and production cannot keep up with increasing domestic demands. [10]

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). Several new projects are under development, including Masela LNG Terminal, Donggi Sulawesi LNG Terminal and Abadi LNG Terminal (in the Timor Sea southwest of Tanimbar Islands) which will be important energy sources for the country.[11]

The growth in the GDP in Timor-Leste since 2004 is attributed to the petroleum sector, with real petroleum GDP growth of 991% 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 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 18th largest producer of natural gas, the seventh largest exporter of LNG in the world and the third-largest LNG 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[12].

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

[8] http://en.wikipedia.org/wiki/Western_Province_(Papua_New_Guinea) – accessed 29/7/2011

[9] http://www.globserver.com/en/press/indonesia-told-hunt-oil-eastern-regions- accessed 2/8/2011

[10] http://en.wikipedia.org/wiki/Economy_of_Indonesia#Hydrocarbons – accessed 2/8/2011

[11] http://oil-and-gaspost.blogspot.com/2011/05/indonesian-govt-to-hunt-for-more-oil-in.html; http://abarrelfull.wikidot.com/indonesia-oil-gas-profile - accessed 2/8/2011

[12] http://www.austrade.gov.au/Oil-Gas-overview/default.aspx - accessed 29/7/2011

volume of those in the Carnarvon Basin off the Pilbara coast (ACIL Tasman Pty Ltd and Worley Parsons 2005, Clifton *et al.* 2007a).

The exploration, extraction and transport of hydrocarbons are also major industries in the ATS region. Oil spill events, such as that which occurred from the Montara Wellhead in the Timor Sea in August 2009 have shown that this is not without risk to marine habitats, biota and fishing activity throughout the region.

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 Indonesian's. In some islands of 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,) 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 & 2008b).

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 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 where it could deliver social and economic benefits through employment. Some ecotourism, including cultural tourism in coastal areas, interaction with marine wildlife (dolphins, whales) fishing competitions and diving outfits already exist, however further development of these industries would require 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 mammal 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).

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[13]).

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).

Across much of eastern Indonesia, farmers are reliant on a single crop, produced on arid land. The economy is largely subsistence based with many not able to achieve self-sufficiency through their farming activities due to lack of resources, water shortages and degraded environments (Rural Poverty Portal[14]).

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). For coastal communities the lontar palm is extremely important (Fox 1977). 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.

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).

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[13] http://go.worldbank.org/RHGAAY6GY0, accessed 28/7/2011

[14] http://www.ruralpovertyportal.org/web/guest/country/home/tags/indonesia accessed 29/7/2011

The majority of Timor-Leste is mountainous leaving only a very small area of land suitable for cultivated crops. However, agriculture is the main form of livelihoods in the country with involving approximately 80**% of** the population. Approximately one third of households rely on subsistence agriculture exclusively (World Bank Report [15]), 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. 2007b). Around 5% of land within the TRaCK region of northern Australia is used for intensive agriculture (Stoeckl *et al.* 2010) but a much larger area is used for livestock grazing based on unchanged land (Larson & Alexandridis 2009).

Rainfall is concentrated in a period of 3-5 month wet season but is inconsistent, thereby restricting non-irrigated crops. 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).

The Australian agricultural industry's main interaction with coastal areas is as service centres and for export of products and commodities such as livestock through ports (DEWHA 2008b, Clifton *et al.* 2007a). In 2005-6, for example, the Port of Broome exported 22,306 tonnes of livestock to destinations in South-east Asia, one of the largest livestock exporting ports in Australia (Clifton *et al.* 2007a).

Drivers of Marine and Coastal Activity

Stark gradients exist across international boundaries in the ATS in terms of human population, resource health, economic opportunity and strength of governance arrangements. These gradients are strong drivers of trans-boundary activities, where a 'driver' is defined as any factor that changes an aspect of an ecosystem (Millennium Ecosystem Assessment 2005). It is crucial to understand the direct and indirect drivers of changes in ecosystems and ecosystem services to design interventions that capture positive impacts and minimize negative ones.

Marine and coastal activity and associated environmental degradation in the ATS region are affected by a range of interconnected drivers and processes operating at the global, national, regional and local scales. These different scales are often difficult to separate.

Global drivers include:

- World population demand for seafood and fisheries development and increasing trend towards settlement in urban coastal areas;
- International macro-economic trends (world economic growth, trade patterns, commodity prices, energy prices, exchange rates, interest rates and demand); and
- International politics and policies (such as industry protection, development policy, and geopolitical instability).

National drivers include:

[15] http://go.worldbank.org/GN0Z5BCHB0 accessed 28/7/2011

- National macro-economic conditions (including economic growth, consumption patterns, and labour markets);
- Domestic politics and policies, and regulation (including taxation, industry protection, environmental policy, industry assistance and development); and
- Region specific trends including land supply, land rights claims, views on the environment, regional development policy, demographic and labour market change (Clifton *et al.* 2007b).

Priority environmental concerns in the ATS region comprise of depletion and loss of fisheries and coastal resources and biodiversity, habitat modification, degradation and loss, pollution and impacts of climate change. Key drivers for these concerns include:

- High consumer demand (local and export) for fish, especially 'prestige' products and other marine and coastal resources, due to population growth and per capita demand for goods from growing economies and high prices[16];
- Workforce availability – both for fisheries and the minerals sector;
- Poverty of resource users resulting in difficulties for livelihood diversification and alternatives to fisheries and other marine industries;
- Increasingly efficient fishing effort and technological changes (e.g. GPS, sounders, fish finders);[17]
- Weak fisheries and environmental governance.

Direct users of coastal and marine resources include the owners and crews of fishing enterprises and transport vessels, hunters and collectors, coral and sand miners, salt makers and mangrove cutters.

Indirect users of resources which include those dependant on raw production – fish processors, transporters, traders, including women who perform these roles, and other associated industries and consumers. Then there are also those who benefit from the goods and services provided by the ATS region.

Economic Drivers

In general, global capture fisheries production has plateaued and consumption is stable (FAO 2010). Nevertheless, as the human population continues to grow in most parts of Southeast Asia, aquaculture will be needed to maintain current per capita levels of fish consumption.

Supply of many of the products of economic importance in the ATS region such as shark fin, sea cucumbers and valuable fish species like red snappers is not likely to be provided from aquaculture. It is reasonable to conclude that the supply side for these products is likely to lead to higher prices at some or all points in the value chain. Growing affluence, particularly in China, is likely to put upward pressure on demand for marine products with perceived or real health benefits or prestige.

Higher prices paid for species with diminishing supply allows fishers to maintain the profitability of their operations even though catches are diminished. Fishers will continue to exploit a resource (virtually to extinction) provided that scarcity raises prices as supply dwindles (Fox 2009).

The ATS region is not the sole source of supply for these species but the trends in the ATS are often reflected much more broadly beyond the region. Indonesian fishers using the MOU box have

[16] According to Garcia and Rosenberg (2010) the demand for seafood has been rising at more than 2.5% per year in both the developed and developing worlds. In highly populated countries such as China and India this is likely to be rise more strongly.

[17] Technological developments also have negative impacts from automation with subsequent reductions in labour (Garcia & Rosenberg 2010).

commented that their catches have declined but they continue to fish because prices for sea cucumber and shark fin catches continue to increase (Fox 2009).

Patron-client relationships are deeply ingrained in ATS coastal communities, producing entangled social relationships and fishing practices which can be difficult to change. Conversely, poor market access by fishers results in low prices for many pelagic and demersal species, limiting income earning opportunities.

As local communities become more connected to distant markets, particularly through market intermediaries – middle men, traders and producers – exploitation of marine resources may increase, thereby creating stronger links between market demand and patterns of exploitation in the ATS region.

Economic impacts of IUU fishing include loss of revenue, which are extremely high for Timor-Leste, Indonesia and Australia.

Confiscation or destruction of vessels caught – or suspected of – engaging in IUU fishing and incarceration of suspects for extended periods, can contribute to increased indebtedness of the fishers to the boat owner/patrons. This can drive increases in fishing effort and the taking of greater risks to repay debt.

Market Access and Value Chains

There is a diverse range of markets for ATS fisheries products. Subsistence and artisanal fishers generally have very few options in regard to processing and marketing of their products. Salting and drying fish remains the principle method of preservation for this sector. Whilst artisanal fishers may be able to produce high quality and nutritious fish products using simple technology however this limits their markets and results in much lower value than is possible with refrigerated (iced, chilled or frozen) product.

In contrast, industrial scale fisheries refrigerate their fish catches and have many marketing options, including export to other parts of Southeast Asia and beyond. Because of the relative remoteness of the ATS, being able to chill or freeze the catch is a strong advantage that overcomes a lack of local infrastructure and a constrained market for high value species.

Few fishers anywhere are able to market their catches directly to end markets/consumers. However, whilst this may be where the highest prices are paid, it is not always the most efficient or profitable strategy. Many fishers, including those in Australia, are able to access open markets where competition between multiple buyers maintains competitive prices. This is not the case among many artisanal fishers in the ATS as many are enmeshed in a patron-client relationship which forces them to sell to the person(s) providing the financial backing for the fishing operation. Under this effective monopolistic arrangement, prices achieved by the fishers are a much lower proportion of final prices.

Subsidies

In regard to fisheries, subsidies "*are government actions or inactions that are specific to the fisheries industry and that modifies – by increasing or decreasing – the potential profits by the industry in the short-, medium- or long-term*" (FAO 2003). There are essentially two general forms of subsidies: i) the direct transfer of monies or ii) the provision of services. Fisheries subsidies can distort trade and importantly, may influence fishing capacity and the patterns and intensity of fisheries exploitation.

Obvious fisheries subsidies in the region include subsidies for fuel and fishing equipment. Less obvious are subsidies for the full costs of management, including research, management planning and implementation and monitoring, control and surveillance (MCS) activities. Also, rarely considered are infrastructure inputs like fishing costs associated with port facilities which are often not fully recovered from the fisheries utilising them.

Subsidies can contribute to improved management where costs of management might otherwise not be met, but they more often have a negative impact on fisheries through supporting over-capacity and over-exploitation.

Fisheries subsidies are a feature, to a lesser or greater extent, of the fisheries of all four ATS countries. One of the better known fisheries subsidies in the ATS is the fuel subsidy available to motorised fishing vessels in Indonesia. Although general fuel subsidies in Indonesia have been decreased nationally, the subsidy for fishing boats has remained. The subsidy is thought to have attracted some foreign fishing to the ATS as fuel could be purchased in Indonesia cheaper than in flag states. This has been curtailed but a subsidy remains which 'joint venture' foreign boats can access.

Australia does not have a direct fuel subsidy, however it does rebate the excise tax on diesel fuel when it is used for commercial fisheries. This in effect increases the profits from fishing and would, in the absence of sustainable management systems, promote overfishing.

Subsidies also exist in Timor-Leste where the focus has been on helping fishermen's groups acquire motors for their boats and other fishing gear. This assistance comes from numerous sources including from different levels of government as well as from national and international NGOs (FAO, 2011). In the case of Timor-Leste where the coastal fisheries are rebuilding after independence these subsidies are probably favourable, however, like all fisheries subsidies, their effects will need to be monitored to ensure that they do not impact negatively on sustainability.

Weak fisheries and environmental governance

Weak governance of fisheries is a key factor driving overfishing and stock decline (Garcia & Rosenberg 2010). Fisheries systems are complex and governance of these systems must take into account the natural resource and the ecological systems that support them, trading system that engage people at local to global scales, and the human systems, comprising the institutions and capabilities of individuals, households, communities and states. Governing fishery systems must therefore involve subsets of governing the environment, trade and economy, and society (Allison & Kelling 2009).

In the ATS region one specific governance issue affecting coral reefs and associated fish populations and habitats, is the availability and lack of control around the use of chemical products (potassium cyanide) and explosives (e.g. fertilisers) for illegal fishing – as opposed to the former, traditional use of fish poisons.

Depletion of fisheries resources also drives expansion of fishing activities into species that would not ordinarily be targeted but which are available to meet demand (e.g. bumphead parrotfish). This then puts further pressure on the whole system.

Compared to the western part of the country, eastern Indonesia suffers from a shortage of skilled fisheries scientists with who are able to inform decision-makers when developing policies to address increasingly complex development issues (Dutton *et al.* 2009).

Social Drivers

A range of social drivers contribute to the depletion of fish stocks, marine biodiversity and habitat degradation in the ATS region, particularly among coastal communities and fishing populations. One such example is the demand for prestige marine products (e.g. shark fin, snapper, sea cucumbers). The value of these products is driven by special *social demands* based on perceived value rather than for daily nutritional dietary protein. As such, the value of these products cannot be substituted for in the same way as other regular fish and marine products.

Other social drivers affecting fisheries include the lack of rights and tenure and existence of common property regimes plus the associated vulnerabilities caused by poverty, poor education, seasonality

of activities, marginalisation and limited diversification options. Marginalised socially, weak and landless coastal fishing populations, such as the Sama-Bajo, immigrant Buginese, Butonese and Makassarese plus those living further from centres of power such as in remote regions of Maluku and Papuan provinces, have a higher dependence on exploitation of coastal and marine resources and consequently have limited power and influence over access and management of resources through political channels and decision-making. Conflicts with between different fishing communities may arise when fisheries stocks become depleted.

Other drivers of fishing practices include impacts from conservation initiatives such as the declaration of MPAs, tourism (e.g. in Wakatobi), infrastructure and mining developments and associated pollution and environmental impacts in the coastal zone (Clifton 2010, Lowe 2006, Majors 2008), seasonal climatic and food security issues when men spend large periods of time away on boats (Fox *et al.* 2009, Stacey 2007) and cultural traditions – such as the practice of *merantau* (Stacey 2007).

Patron-client relations represent another important key social driver of fishing among many artisanal fishing groups in the ATS region. These relationships are often long-standing across generations and very complex. For fishers such relationships operate as a survival strategy, where patrons provide financial support to fishers and their families in times of need. However, these ties of dependence can result in high short or long term debt to patrons, potentially pushing fishers to undertake coastal or distant shore fishing ventures for highly sought after and highly valuable products to be 'sold' to their patron or 'boss' to clear their debts.

Increase in fishing effort due to increasing populations may also contribute to depletion of fisheries resources (Fernandes & Greiner 2010). However, population increase does not always drive overfishing, such as when fish prices increase and become too expensive compared to other protein sources and thus unaffordable for some groups such as rural poor (Hassan *et al*. 2005). Interconnected drivers such as promotion of fishery resources as important sources of protein, vitamins and micronutrients may also affect fish consumption by changing food preferences among some populations who can afford it (Hassan *et al.* 2005).

Increasing numbers of motorised vessels and increased engine capacity of fishing vessels across the region increase the range which is accessible to fishers and may therefore place greater pressure on fisheries stocks which had thus far avoided over-exploitation.

High demand for products, habitat degradation and over-investment in the fisheries sector are also important drivers. However, addressing these issues usually involves costs for those involved in exploitation through reduced incomes from catches as well as loss of work for those involved in handling and marketing, from producers to consumers. Among poor communities short term concerns for survival generally take precedence over longer term resource sustainability. Unless alternatives are provided for producers in the face of high market demand there is little incentive to accept costs (Townsley 2004).

In some areas another social driver may come in the form of changes in resource use patterns and diminishing, or loss of, skills and local environmental resource knowledge (traditional ecological knowledge, indigenous knowledge or local knowledge) and consequent disruption to traditional livelihood patterns. This is particularly prevalent among communities with non-transferable skills used by many artisanal fishers.

Changes in use of technology from fisheries based on specialised knowledge and skill, to more mechanised modes of production, has allowed less or non-specialised groups who have less knowledge and concern for longer term resource sustainability to enter fishery domains. For example, destructive fishing gear and methods such as cyanide – most notably for live fish and aquarium trade – are generally more expensive but simpler to use than more sustainable practices which may require more skill (Townsley 2004). Such issues have resulted in increased competition

and can be seen amongst groups engaging in transboundary fishing activity in the ATS region and in particular, the north Australian region (Fox 2009, Stacey 2007).

Research in Southeast Asia indicates that small-scale fishermen like their occupations and are bound to it by indebtedness hence only a minority would change (Pollnac *et al.* 2001) or leave fishing for an alternative (Crawford 2002). Alternative livelihoods activities may inherently involve major changes to lifestyle (e.g. terrestrial-based, static lifestyle) which may or may not be preferable to communities and individuals. Many fishers have a personal preference for their occupation and their identities are intimately connected to such occupations.

The key environmental concerns across the ATS region also have potentially severe social impacts for coastal communities. Overfishing and habitat degradation lead to reduced capacity to meet basic human needs, decreased food security and loss of income. However the extent of these social impacts remains largely unquantified at the local level.

Some local populations in the ATS region (especially those marginal groups who do not have access to or ownership of land and are migratory in nature) are heavily dependent on fish for food and it is likely this pattern is undergoing change in some areas of the ATS (Darwin ATSEA Workshop Proceedings 2008).

Overall there are limited baseline data on the socio-economic dependence of communities in the ATS region and the more 'stressed' communities in the ATS region making it important for us to ask which communities are close to 'tipping point'?

Social impacts of pollution (from sewerage, industry, debris, agriculture) especially in urban areas relate to increased risks to human health and increased health costs. Other impacts of polluted marine environments include losses in tourism, recreational or aesthetic values and negative effects on artisanal and subsistence fishing communities and aquaculture production from sedimentation.

Social impacts of climate change leading to losses in marine productivity (e.g. through disruption of the food chain, or increased acidification of oceans, and ecological changes to marine habitats) will be particularly severe in demographically vulnerable coastal communities, including low lying areas and 'floating' coastal villages. These will impact on well-being, food availability and reduced income (Garcia & Rosenberg 2010).

CONSERVATION DRIVERS

Indonesia, Timor-Leste, northern Australia and Papua New Guinea are centres of high marine biodiversity. Indonesia particularly is known to have the most biologically diverse coral reefs on earth (Glaser *et al*. 2010). There is a growing effort to protect these valuable assets from the effects of fishing and other destructive practices through creating and managing marine protected areas (MPAs). It is hoped MPAs will also provide local employment and eco-tourism enterprise opportunities. There are claims that MPAs may bolster fisheries by increasing reproductive capacity by allowing fish to grow to large and highly fecund adult sizes and may also export recruits directly to the fisheries bordering them.

While such positive impacts are all helpful in producing positive human wellbeing outcomes, they may come at a cost. Improved habitat and the accompanying fisheries benefits will not come instantaneously and there is a risk that the positive impacts from the MPA will be negated by impacts on displaced fishers forced to concentrate their fishing in an area made smaller by the creation of the MPA.

Among the nations in the ATS region, only Australia has broadly dealt with the issue of displacement and there is a diversity of opinion about the success of Australia's approach (MPA News, 2011[18]).

[18] http://depts.washington.edu/mpanews/MPA119.htm - accessed 7/08/2011

Opportunities to manage displaced fishing effort are directly related to available livelihood alternatives and potentially the willingness of the fishers to adopt new livelihoods. Many people are fishers by choice and want to remain fishers (Fauzi & Anna 2010) thus adding to the difficulty of making these shifts.

Managers must be aware that whilst a useful management tool, MPAs may also push fishers from a regulated area to an alternative unregulated area unless there are accompanying programs to prevent this. To date this has not been the case outside of Australia.

Priority Transboundary Problems

The fisheries resources of the ATS region are vitally important to many of the people who live in the regions bordering these seas. Many of the human populations are highly vulnerable to any declines or collapses that could come about as a result of governance failures. In the short term even the application of good governance, that may necessitate politically, culturally and practically difficult decisions about making large reductions fishing capacity or in catch, may have severe impacts on human wellbeing.

Growing human populations will add more pressure to the system unless it is possible to re-direct more people to other sustainable or non-extractive activities. Participation in fishing goes beyond meeting nutritional and income needs. While fishing is often considered an occupation of last resort due to a lack of alternatives, the socio-economic and cultural situation in the ATS is infinitely more complex in relation to issues such as tenure, access, rights, identity, and so on. Many fishers identify themselves with the occupation and, given a choice, even with lower returns, would continue to fish. Thus changes in fisheries in the region can have serious impacts on the society, health and culture of the human populations.

Natural systems are at risk of severe degradation because of fishing and pollution, risks exacerbated by many social and economic factors concerning activities, resources and ecological systems.

Marine debris and pollution is likely to worsen unless measures are successfully introduced to cut the rate at which pollutants and debris are discharged or lost into the marine environment. In the ATS region there are a number of regions proposed to undergo major development and expansion of urban centres. Sectors such as the tourism, mining and petroleum sectors can adversely impact on the environment and marine species through sewage treatment and dispersal, urban run-off and litter. Discarded or 'ghost' fishing gear presents a great risk in transboundary waters as it often continues to 'fish' for extended periods further depleting stocks.

Severe impacts from industrial accidents or oil spills, and increases in shipping activity, oil, gas and mining are also likely to have major impacts in the Arafura-Timor Seas.

Island communities in the Arafura Sea have also been affected by illegal fishing (including foreign fishing) and over exploitation of Arafura Sea stocks.

KNOWLEDGE GAPS

Improvements in addressing environmental concerns in the ATS region resulting from sectoral activity will depend on a range of international, national and local governance arrangements. Improved welfare of the people throughout the region should be the primary objective of governments. It is this common goal that provides the foundation for governments in the Arafura Timor Seas to cooperate to improve the management of those seas. Nevertheless, management challenges are immense partly due to huge differences in the social, economic, cultural and political conditions of each country in the region.

Limited detailed baseline information is available through the literature regarding the socio-economic dependence of communities who are affected or impacted by transboundary

environmental concerns in the ATS. In particular less is known concerning communities in the Arafura Sea regions of Papua, Indonesia and the PNG than coastal communities in the Provinces of NTT and Maluku, Timor-Leste and northern Australia.

Available fisheries data are generally poor (incomplete or inaccurate) or perhaps absent all together (such as gender disaggregated data) which makes the assessment of stock status unreliable if not impossible. In turn, the lack of robust assessments and scientific advice may compromise timely decision making, resulting in a negative feedback loop.

Few studies are available on many important issues which affect fisheries in the region including:

- Nutritional dependence and personal choices among dependent communities in the ATS region;
- Status of resources versus livelihood strategies;
- Poverty, income and wealth distribution in more remote regions of ATS;
- Climate change impacts on local livelihoods and food security for marine dependent communities;
- Patron-client relations and markets and value chains for various fisheries in the ATS region;
- Policies supporting and working against livelihood improvements and development policies relating to drivers of resource depletion;
- Local institutions and institutional analysis in particular at regional vs. district levels; and
- Drivers, trends and characteristics of IUU fishing.

The impact of recent decentralisation and governance on fisheries and marine management in Indonesia creates a new operating environment and accompanying uncertainty in relation to how this will affect marine and coastal resource management in the short, medium and long term. There is a clear need to identify the drivers and impacts of IUU fishing on local livelihoods in key coastal areas in NTT, Papua and Maluku.

Decision makers must observe caution when determining fisheries policy as uncertainty exists amongst available scientific information. Some resource estimates state that stocks are badly depleted as a result of overfishing, but this may not have actually been proven. Whilst reasonable information on shared genetic species exists, more work needs to be done at a biological level. Various collaborative research projects have been undertaken on potentially shared stocks (e.g. snapper, tuna and sharks), but these projects and activities should be reviewed as part of the ATSEA TDA. Baseline information on MOU Box fisheries is currently being reviewed and expanded to improve management of traditional fisheries in the area.

ENHANCEMENT AND DIVERSIFICATION OF LIVELIHOODS

The links between livelihood enhancement, food security, conservation and biodiversity management are complex and challenging particularly within the complex social, economic and political arena of the ATS region.

Peer reviewed literature argues that leaving aside the 'luxury' items, it is near impossible to address global food security with the projected increases in human population and food requirements for protein – a required increase of approximately 50% by 2050 – to be sought from fish or agricultural staples. Like fisheries, agricultural production is likely to continue to decrease, thereby increasing difficulties in sourcing protein (Rice & Garcia 2011). How will poor rural and remote ATS communities survive globalisation and higher local/regional demands on basic fish products?

There are major social, economic and cultural challenges, not only in sustaining current fisheries or marine based livelihoods but also in developing new activities outside of traditional or established activities for local coastal populations.

Piloted projects such as the aquaculture projects led by the ANU with local communities in Rote and Kupang in NTT, Indonesia offer some promise for replication in areas of the ATS region. Caution must be observed however. Livelihoods diversification to seaweed cultivation for example, has potential to supply a regular, recurrent (seasonally dependant) income, but comes with a high risk of failure due to disease, resulting in potentially long breaks in production. Seaweed production may supplement other livelihood strategies but could also lower stockpiles of agricultural-based food sources to be used during the 'hungry seasons' in some mixed fishing/farming communities (e.g. Sabu). Essential elements for any alternative livelihood scheme in these communities include i) the need for land-based projects for women, ii) provision of micro-credit and iii) funds for children's education (Fox 2010 ATSEA meeting presentation).

Other trials are underway through the FAO Regional Fisheries Livelihoods Programme (RFLP) in Indonesia (NTT) and Timor-Leste. There are also lessons to be learned which are relevant to the northern Australian indigenous situation regarding enterprise development success factors and opportunities and constraints, especially with regard to livelihood development based on coastal bush products or aquaculture.

No single scheme will fit all communities in the ATS region. In order to improve food security and incomes, a suite of livelihood enhancement and diversification activities must be considered such as improving existing or developing new, maritime related opportunities. Prerequisites include providing secure tenure, improving local market access and infrastructure, providing access to micro-credit schemes, opportunities for women, tailored education for particular social groups and a sound understanding of the social, economic, cultural and political contexts.

Recommendations

Any plan to better manage the ATS should include programs to combat poverty and address food security. Poverty has been relatively persistent in the area and therefore combating poverty while managing environmental quality in the area presents a huge challenge. Improving human capital quality in the ATS area certainly needs attention.

Priority transboundary environmental concerns in the ATS region may be addressed through effort at local, national and regional levels in the following areas:

- Improved information and knowledge to communities and decision makers
- Reduction in fishing pressure – in areas where there are clear links to depletion and overfishing (e.g. Illegal activities in Arafura sea)
- Improved policy and management (e.g. access, monitoring, surveillance, compliance, policy)
- Improved access to services, post-harvest technology, infrastructure and market access
- People-centred approaches and pathways to maintain food security and incomes and strengthening coastal community livelihoods for coastal communities reliant on ATS resources using a Sustainable Livelihoods Approach framework

Approaches which put people at the centre, such as a Sustainable Livelihoods Approach (SLA) consider not just natural assets that people draw on for their livelihoods, but other assets and their relationships, to consider the way livelihoods are determined and how they may be improved. New and innovative approaches are required that focus on building on existing capital assets of local communities, reducing vulnerabilities and facilitating market access rather than a top down technology approach driven by external agents that deliver little or no benefit to local people. As Allison and Ellis (2001:387) have identified:

> *"The key to sustainable fisheries management and development is to facilitate small-scale fisherfolk to find their own routes out of poverty by building on their existing capital and capabilities".*

We recommend development of a Livelihoods, Poverty and Vulnerability Profile of fishing communities in the ATS. This would identify the communities most at risk, most poor and most dependent on coastal or marine livelihoods and those in needs under the ATSEA goal of improved, sustainable socio-economic conditions and opportunities for coastal peoples in the Arafura and Timor Seas region.

1 Introduction

The ATSEA Program will undertake a Transboundary Diagnostic Analysis (TDA) to assess the current state of the environment, resources and people in and around the Arafura and Timor Seas, including pressures, threats, drivers and impacts from over-exploitation and global climate change. Once completed, the TDA will form the basis for the development and agreement of a Regional Strategic Action Program and National Action Plans. These will outline regional and national actions to be taken in response to the findings of the TDA.

The TDA component requires technical assessment and reports comprising:

- Biophysical profile of ATS region
- Socio-economic profile of ATS region (including resource user groups, market networks, productive value chains, and market access opportunities in parallel to the above and economic and social drivers of marine and coastal activity)
- Causal chain analysis and prioritisation of environmental concerns in the ATS region
- Governance analysis of drivers and impacts of environmental issues

These reports will be used to prepare a separate regional TDA report which will outline issues around identification of options to address national and transboundary problems proposed as part of a Strategic Action Program for the ATS region.

1.1 Scope of this Report

The aim of this report is to develop a shared perspective on priority socio-economic and livelihood issues of a transboundary nature in the Arafura and Timor Seas (ATS) as part of Arafura Timor Seas Ecosystem Action Program.

The intention is to synthesize material based on existing knowledge and research findings rather than undertake new data or information gathering through qualitative or quantitative research. As such, it is based on a review of existing literature and draws heavily on the collective expertise and knowledge of key ATSEF members and ATSEA stakeholders from three participating countries. It includes a brief assessment of ATS relevant Papua New Guinea issues even though PNG are not yet officially participating in ATSEA[19]. We have taken on a peer review process to make sure we have adequately captured all key issues and ensure correctness. We have also tended to give slightly more focus to Timor-Leste and Indonesia than northern Australia given much of the actions to be carried out under the ATSEA program will involve on-ground activities in these two countries.

The profile descriptions and discussions are aligned to the key priority environmental concerns and issues identified during the start-up phase of ATSEA in 2009 (See Stacey 2009) and reviewed and updated as part of the ATSEA Biophysical Profile report in 2011 (Alongi 2011).

Five priority environmental concerns were identified:

- Unsustainable fisheries and decline and loss of living coastal and marine resources;
- Decline and loss of biodiversity and key marine species

[19] It should be noted that within the project area, only Indonesia, Timor-Leste and PNG are eligible for GEF funding support. PNG is expected to join ATSEA officially in late 2011.

- Modification, degradation and loss of coastal and marine habitats;
- Marine and land-based pollution (e.g. marine debris, sediments, oil spills)
- Impacts of climate change (Alongi 2011).

The socio-economic profile report will provide baseline information based on our current state of knowledge of the socio-economic and livelihood aspects of the ATS region in relation to these environmental concerns.

This report is structured into two sections. Part A profiles the socio-economic context of the four countries in the ATS region. This includes summaries of demographic characteristics, ethnicity, languages, religion and culture and description of key socio-economic sectors and coastal livelihoods in the region. Part B describes the social, economic and conservation drivers of marine and coastal activity and impacts from environmental degradation. Some key threatening transboundary issues and recommendations are also identified.

1.2 Information Sources

This report was prepared by a team of contributors from each of the three participating countries (see page ii) during February – June 2011.

A regional consultation was held in Bogor, Indonesia in October 2010. The socio-economic and livelihoods focus group discussion (FGD) workshop had three main objectives:

a) To identify and discuss key priority socio-economic and livelihood issues relating to ATS region and the ATSEA Program,

b) To produce a list of key socio-economic and livelihood issues of the ATS region that will be used as basis for the profile report

c) To identify possible lead people and teams for written contributions.

The Bogor FGD was the first meeting to bring together experts on socio-economics and livelihoods to develop a shared perspective on priority socio-economic issues as part of the Arafura Timor Seas Ecosystem Action (ATSEA) program. During workshop sessions participants made key presentations and identified perceived topics and problems from transboundary perspectives.

Figure 1: Participants discussing key cultural (left) and economic (right) topics for inclusion in a profile report.

A second workshop was held in Dili, Timor-Leste with report contributors and resource experts in March 2011, to further define and discuss draft contents and gather additional information to 'populate' the report. These discussions were held in conjunction with the biophysical profile team to ensure complementarity across the reports.

This report is based on:

- Existing ATSEA Program documentation and reports such as Indonesian and Timor-Leste national consultant status reports (see references) in regards to current state of knowledge, trends and gaps with regard to the Arafura and Timor Seas region on biodiversity, socio-economics and governance issues in the ATS region;
- Compilations of material by nominated contributors drawing on their own research and expert knowledge of key socio-economic issues;
- Additional published and unpublished information on socio-economic concerns and issues in the ATS region; and
- Peer review by ATSEF partners.

Some Key Questions also guided the content of the Profile:

- What are key socio-economic characteristics of the ATS region (e.g. demographics, ethnicity, culture, settlement patterns, migration and poverty)?
- What socio-economic activities occur in the ATS region?
- What are the economic drivers and market networks, value chains, and market access opportunities for fisheries and biodiversity resources? (i.e. value chains of key priority species identified)
- What are the social drivers of environmental degradation and impacts on livelihoods?
- What is the current status of coastal and marine livelihoods and food security in the ATS region? What are key vulnerabilities of target communities? What are the coping strategies?
- What are the shared/common and transboundary issues relating to coastal and marine livelihoods and food security in the ATS region?

This report draws on important sources of publicly available information about the populations and economies of people living in the ATS region. It uses national census data and surveys, published scientific literature and reports. While we have tried to cover most of the key socio-economic aspects we recognise that inevitably some gaps will remain.

In Australia we have relied on previous reports prepared for two initiatives. The first is "Tropical Rivers and Coastal Knowledge (TRaCK)" and the second, Bioregional planning initiative of the Federal Department of the Environment (Northern and Northwest Planning regions). Both have completed very detailed socio-economic profiles of northern Australia (Carson *et al. 2009,* DEWHA 2008a 2008b)

Information in the fisheries section of the report has been compiled from various sources including international and Australian fisheries status reports; Indonesian and Timor-Leste ATSEA national reports, census material, government supplied statistics and development project reports prepared for the government which are not necessarily all available to the general public. For PNG we have relied on publically available literature.

Where possible we have tried to standardise data for broad comparative purposes although there are some limitations. In some instances we can only approximate data under particular social or economic indicators due to aggregation of available data in ways which do not coincide with our project delineations. For instance, northern Australian regional planning data incorporates all of Cape York and Torres Strait, and the north-west region extends well past the Broome region coast. The area covered under TRaCK extends further inland as it includes catchment areas rather than just coastal areas. Whilst we do recognise the direct links between catchments, coastal processes and

economic activities, it is not defined which catchment areas are officially included in the ATSEA region. For the province of Papua in Indonesia we have contained our discussion largely to the Merauke area.

We reviewed various frameworks to provide a baseline for the profile of the socio-economic situation in the ATS region prior to implementation of planned interventions through ATSEA Phase 1 (and later Phases). This included socio-economic profiles from other GEF IWP programs. We have focused specifically on fisheries because attempting to cover all areas would have been unrealistic given the available time and resources. A lack of consistent data across the four participating countries also makes it difficult to ensure standard data types are reported for the region and the quantity and detail of information for some sections will vary greatly between countries.

Photo: N. Stacey

PART A:

SOCIO-ECONOMIC CONTEXT

2 Boundary and General Characteristics of the ATS Region

The area that we refer to as the Arafura Timor Seas (ATS) region incorporates four nation states and specific coastal and marine areas within those countries. The system boundary for the project is the ATSEA Region as depicted in Figure 2, broadly encompasses:

- The Timor Sea spanning the Island of Timor (comprising Timor-Leste and West Timor – part of the Indonesian Province of East Nusa Tenggara) and the northwest coast of Australia (from Broome in Western Australia to the Northern Territory border) and
- The Arafura Sea spanning parts of the Indonesian Provinces of Maluku and Papua, the north coast of Australia, from the Tiwi Islands in the NT to the west coast of Cape York in Queensland and including a small area of south coast of Papua New Guinea (but excluding the Torres Strait).

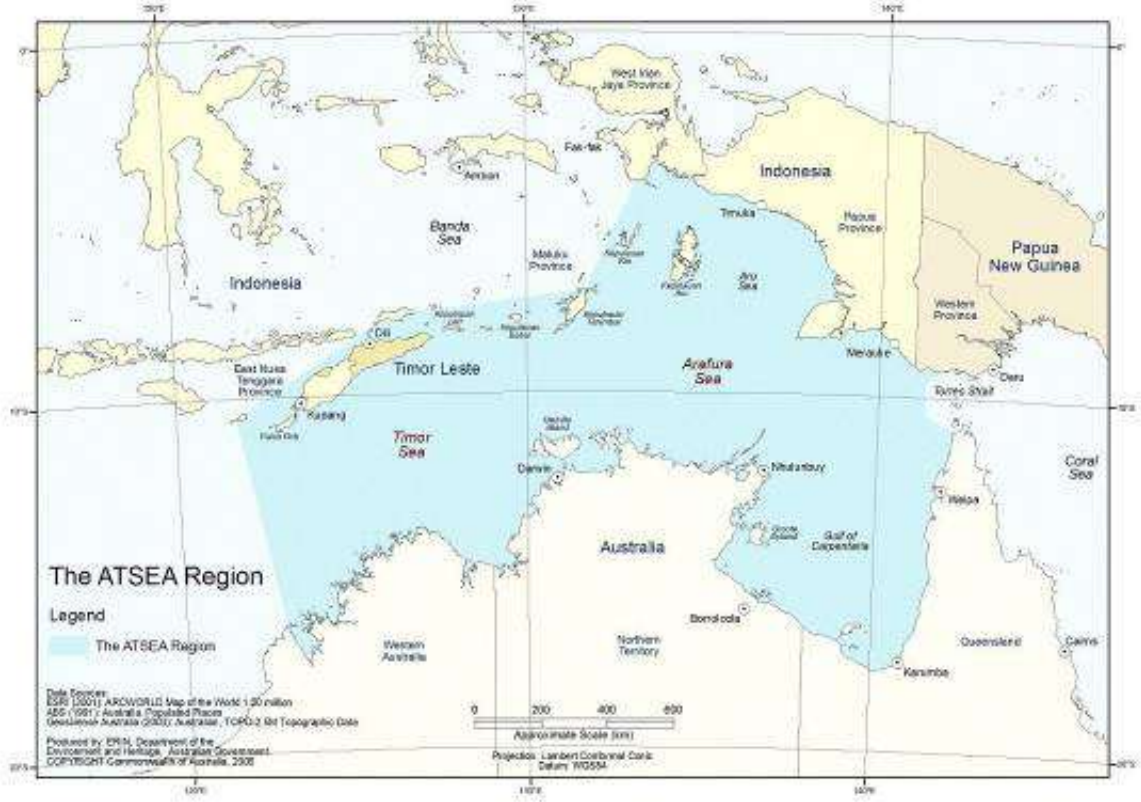

Figure 2: The Arafura and Timor Seas region, showing provinces in Indonesia and State boundaries, including the MOU box, in northern Australia.

The system boundary for the project includes these two Seas, all islands within these Seas including parts of the Aru and Sawu Seas and Gulf of Carpentaria region as well as the adjacent coastlines and hydrological catchments. The Arafura and Timor Seas are considered to be semi enclosed seas under Part IX of the United Nations Convention on the Law of the Sea, which places an obligation on countries bordering enclosed and semi enclosed seas to cooperate in resource management, the protection of the marine environment and marine scientific research.

The ATS region encompasses a diverse marine environment ranging from extensive shallow continental shelves to deep oceanic regions with trenches exceeding three kilometres in depth.

To the north, the islands of Indonesia and Timor-Leste form part of the Coral Triangle and are fringed by highly diverse coral reef communities, while the southern coastal waters of the Island of New Guinea (encompassing both Indonesian and Papua New Guinea territory) and northern Australia are characterised by shallow seas, significant river inputs and extensive mangrove systems which are a major source of primary productivity within the region. The marine biota of the ATS reflects this diversity in primary productivity, bathymetry, and other physical oceanographic features.

3 Socio-economic Characteristics of the Arafura Timor Sea Region

This section aims to provide understanding about the people and the economy in the Arafura Timor Seas region. We present information on government administration and sovereign boundaries, profile the people and demography and some of the social and economic indicators and economies in the regions.

3.1 ATS Region and Government Administration

The Arafura Timor Seas encompasses waters under the jurisdiction of four countries: Indonesia, Timor-Leste, Australia and Papua New Guinea. Within Australian territory, there is one territory and two state governments (Northern Territory, Western Australia and Queensland but excluding the Torres Strait region) and one offshore territory (Ashmore and Cartier Islands). On the Indonesian side, the ATS area includes three provinces, (East Nusa Tenggara, Maluku and Papua) including 13 districts (*kabupaten*) and two municipalities. In Timor-Leste, there are 11 coastal districts (out of a total of 13 nationwide); while in Papua New Guinea, there is one district – the South Fly district of Western Province which borders the Arafura Sea.

As well as encompassing the national boundaries, the transboundary area of relevance to the ATS covers a wide area within Indonesia and other South East and Mainland Asia countries to the east and north from where fishers, boats and markets originate.

Further detail of the administrative regions for each of the four countries is given in Table 1.

Table 1: Countries, Provinces, Districts and administrative arrangements in the ATS region

Country	Provincial Governments in ATS region	City/District Governments in ATS region
Indonesia (capital Jakarta in Java)	East Nusa Tenggara Province *(capital Kupang in West Timor)*	· Rote Ndao · Kupang City (municipality) · Kupang District · Timor Tengah Selatan (inside ATS area but limited local fisheries) · Timor Tengah Utara (limited coastal populations) · Belu (limited coastal populations)
	Maluku Province *(Ambon City, Provincial capital outside of ATS region)*	· Aru Islands · Maluku Tenggara Barat · Maluku Tenggara · Maluku Barat Daya · Kota Tual (municipality)
	Papua Province *(Kota Jaya Pura Provincial capital outside of ATS region)*	· Merauke · Mimika · Asmat · Mappi
Timor-Leste (Capital Dili)	Timor-Leste does not have provinces but is divided into 13 Districts, 11 of which have coastline and are therefore included in the ATS region	· Aileu (non-coastal) · Ainaro · Baucau · Bobonaro · Covalima · Dili · Ermera (non-coastal) · Lautem · Liquica · Manatuto · Manufahi · Oecusse · Viqueque
Australia (capital Canberra)	Western Australia *(capital is Perth)*	Kimberley region coastal areas (Broome to NT border) and offshore islands and reefs (e.g. Scott Reef, Browse Island)
	Northern Territory *(capital is Darwin)*	Top End coastal areas including Tiwi Islands
	Queensland *(capital is Brisbane)*	Gulf of Carpentaria and Cape York (western and northern)
	Commonwealth government *(Canberra, ACT)*	Territory of Ashmore and Cartier Islands (Timor Sea)
PNG (capital Port Moresby)	Western Province *(Provincial capital is Daru on Daru Island on the east coast)*	South Fly District (LLG area is Morehead)

INDONESIA

The Republic of Indonesia consists of around 17,500 islands and 33 provinces. Of these, three provinces have districts that fall within the ATS region (Figure 3).

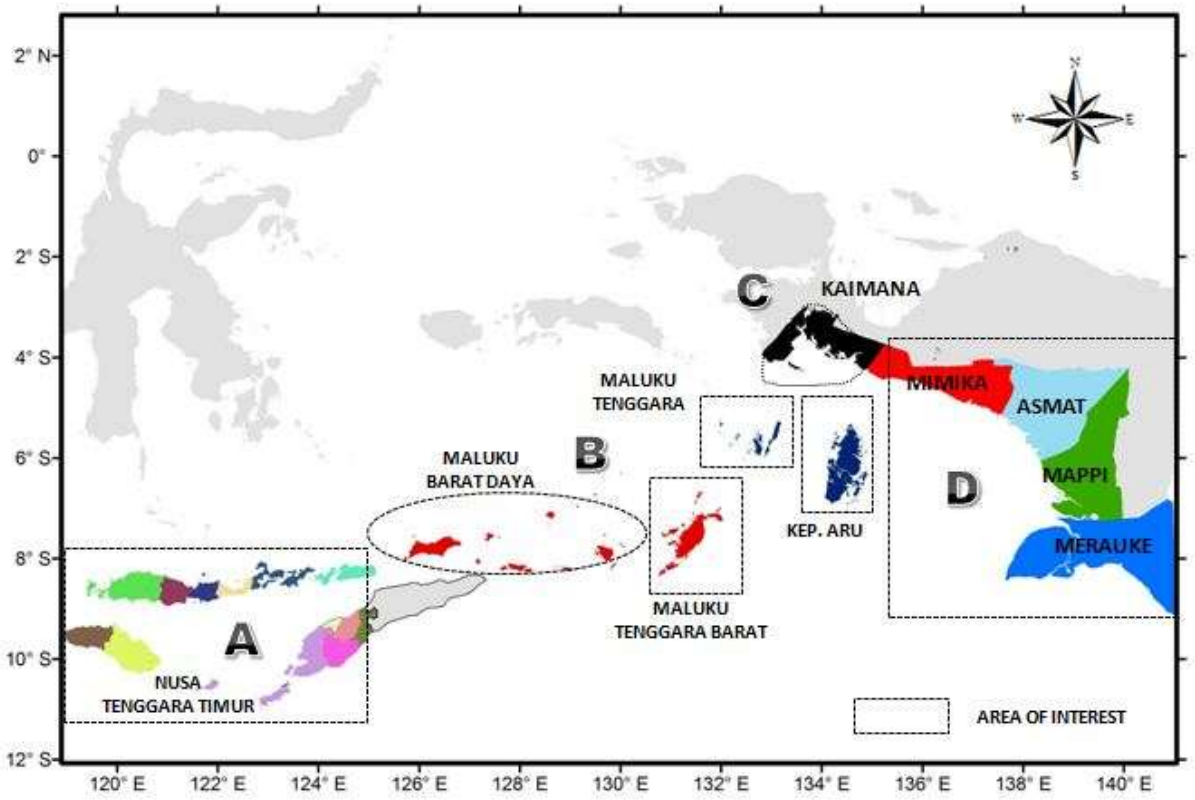

Figure 3: Districts and Provinces involved with the ATSEA Interest Area

A: Kupang, Timor Tengah Selatan, Timor Tengah Utara, Belu, Sabu Raijua and Rote Ndao, EAST NUSA TENGGARA
B: Maluku Tenggara, Maluku Tenggara Barat, Maluku Barat Daya, Aru, Kota Tual, MALUKU PROVINCE
D: Mimika, Asmat, Mappi, Merauke, PAPUA PROVINCE
(Note: Map to be revised as Kaimana, West Papua is no longer being included in the ATSEA program)

Maluku

The Maluku province is divided into 9 districts and two municipalities spread across hundreds of small islands. The actual number of islands is unclear and varies greatly according to different government data sets. Data from the Maluku provincial government puts the number at 559 of which around 84% are uninhabited. Over ninety percent of the area of Maluku province is sea[20].

Physical landscapes of the islands in the region vary. The islands of Wetar, Romang, and Damar consist of high mountains. While Kisar, Leti, Lakor and the Sermata Islands are flat and dry with limited sources of water. The Tanimbar set of islands and Kei Besar have relatively rich forests, while the terrain of Aru is flatland and swamp with rich mangrove forests. The region experiences two distinct seasons: the easterly (dry) season and the westerly (rainy) season. Between these two seasons, there is a transitional period. Some areas to the west (e.g. Kisar) experience longer dry seasons which extend over more than half of the year (approximately 8 months dry).

[20] http://maluku.bps.go.id – accessed 2/08/2011

Maluku has 18 outer islands which share borders with Australia (12 islands: 8 in Kepulauan Aru, 4 in Maluku Tenggara Barat) and Timor-Leste (6 islands: all in Maluku Barat Daya). Approximately half of these outer islands are uninhabited.

Four districts and one municipality fall within the ATS region of Maluku. They are (1) Maluku Tenggara, (2) Maluku Tenggara Barat, (3) Kepulauan Aru, (4) Maluku Barat Daya, and (5) Tual municipality. These districts cover approximately 207,600 km^2 including land and sea territory, of which about 85% is sea. This region accounts for approximately 35.7% of the total area of the province (581,376 km^2).

Table 2: Government Administrative Areas of Maluku within the ATS region (2009)

District/municipality	District Capital	Land Area (km^2)	Sea Area (km^2)	Total area (km^2)
Maluku Tenggara	Langgur	4,676 [59.5%]	3,181 [40.5%]	7,857
Maluku Tenggara Barat	Saumlaki	10,103 [19.1%]	42,892 [80.9%]	52,995
Kepulauan Aru	Dobo	6,426 [11.6%]	48,844 [88.4%]	55,270
Maluku Barat Daya	Kisar	8,648 [11.9%]	63,779 [88.1%]	72,427
Tual city	Tual	352 [1.8%]	18,736 [98.2%]	19,088
Total		**30,205** [14.5%]	**177,433** [85.5%]	**207,638**

Source: BPS Maluku 2010

Within these districts there are 37 subdistricts consisting of 419 villages and 7 *kelurahan* [suburban villages] (Table 3). The population is distributed over a large area with a tendency for concentration around settlements on coastal areas (97%). This distribution relates to the availability of land in the flat lowlands of the coastal areas and accessibility to social and economic infrastructure.

Table 3: Administrative details of the ATS Region of Maluku by District

District/ municipality	Subdistricts	Villages	Urban 'villages' [*kelurahan*]
Maluku Tenggara	6	86	1
Maluku Tenggara Barat	9	70	1
Kepulauan Aru	10	120	2
Maluku Barat Daya	8	117	0
Tual municipality	4	26	3
Total	**37**	**419**	**7**

Source: DEPDAGRI 2010

Nusa Tenggara Timur

East Nusa Tenggara province consists of 20 districts and one municipality, the capital Kupang. The following twelve districts have coastline: Kupang City, Kupang District, Belu, Rote, Sabu Raijua, Alor, Lembata, Adonara, Flores Timur, Sikka, Ende, Sumba Timur. Seven of these fall within the ATS region as shown in Table 1. Most of the population of NTT live in coastal areas.

The province contains 566 islands, with a coastline of 5,700 km^2 and includes 200,000 km^2 of open water and 808 coastal villages, 34,229 fisher households and 20,446 people engaged in seaweed cultivation (L. Pellu 2010 *Presentation to ATSEA FGD, Bogor*). But only a proportion of these households are engaged in ATS region transboundary activity or impacted by transboundary activity.

Table 4: Administrative regions in ATS region of NTT

District/ municipality	No. of Subdistricts	No. of Villages	No. of urban 'villages' [*kelurahan*]
Kupang	24	160	17
Timor Tengah Selatan	32	221	12
Timor Tengah Utara	24	140	34
Belu	24	196	12
Rote Ndao	8	73	7
Kupang City	4	0	51
Total	**116**	**790**	**133**

Source: DEPDAGRI 2010

Papua

The province of Papua is the largest in Indonesia and is located in the western half of the island of New Guinea. The entire province consists of 28 districts and one municipality, the capital Jayapura on the northern coast close to the PNG boarder. Until 2003, the entire Indonesian part of New Guinea Island was named Irian Jaya. In 2003 the Indonesian government divided Irian Jaya into two provinces Papua and West Papua which covers mainly the 'birds head' area of the island.

Four of the districts of Papua fall within the ATS region; they are Merauke, Mappi, Asmat and Mimika which border the Arafura Sea. These districts are made up of 49 subdistricts, 517 villages and 15 *kelurahan* (Table 5).

The geography of the area includes high mountain ranges, lowland areas, tropical rainforest, wetland, extensive stands of mangroves and shallow coastal waters.

Table 5: Administrative regions in ATS region of Papua

District/ municipality	No. of Subdistricts	No. of Villages	No. of urban 'villages' [*kelurahan*]
Merauke	20	162	8
Mimika	12	80	6
Mappi	10	136	1
Asmat	7	139	0
Total	**49**	**517**	**15**

Source: DEPDAGRI 2010

TIMOR-LESTE

Timor-Leste covers half of the island of Timor and is part of the Lesser Sunda island chain. The nation has approximately 706 km of coast line, a total land area of 15,000 km^2, and a marine jurisdiction of approximately 75,000 km^2. The republic is divided into 13 administrative districts (Figure 4), of which 11 have some coastline including the district of Oecusse the exclave surrounded by Indonesian West Timor. Forty two percent of all villages in Timor-Leste have a coastal border (McWilliam 2003). There are two offshore islands – Atauro which is part of Dili district and Jaco Island located off the northern east coast. The average national population density of Timor-Leste is 71.5 people/km^2, though across the 11 coastal districts included in the ATS region the density is 67.6 people/km^2.

Figure 4: Timor-Leste showing districts (from ASPI 2011)

AUSTRALIA

The northern portions of two states (Queensland and Western Australia) and one territory (Northern Territory) are considered to fall within the ATS region. The ATS region of northern Australia – stretching from Broome in the Kimberley region of Western Australia, across the Top End of the Northern Territory to the coastal gulf region of Queensland –includes all the catchments areas (Figure 5).

Figure 5: Northern Australia showing state boundaries (from Carson et al. *2009)*

PAPUA NEW GUINEA

The Western Province which borders with Arafura Sea is divided into three districts including South Fly district which borders the Arafura Sea and includes a number of offshore islands. South Fly consists of 4 local government areas, including the provincial capital of Daru on Daru Island.

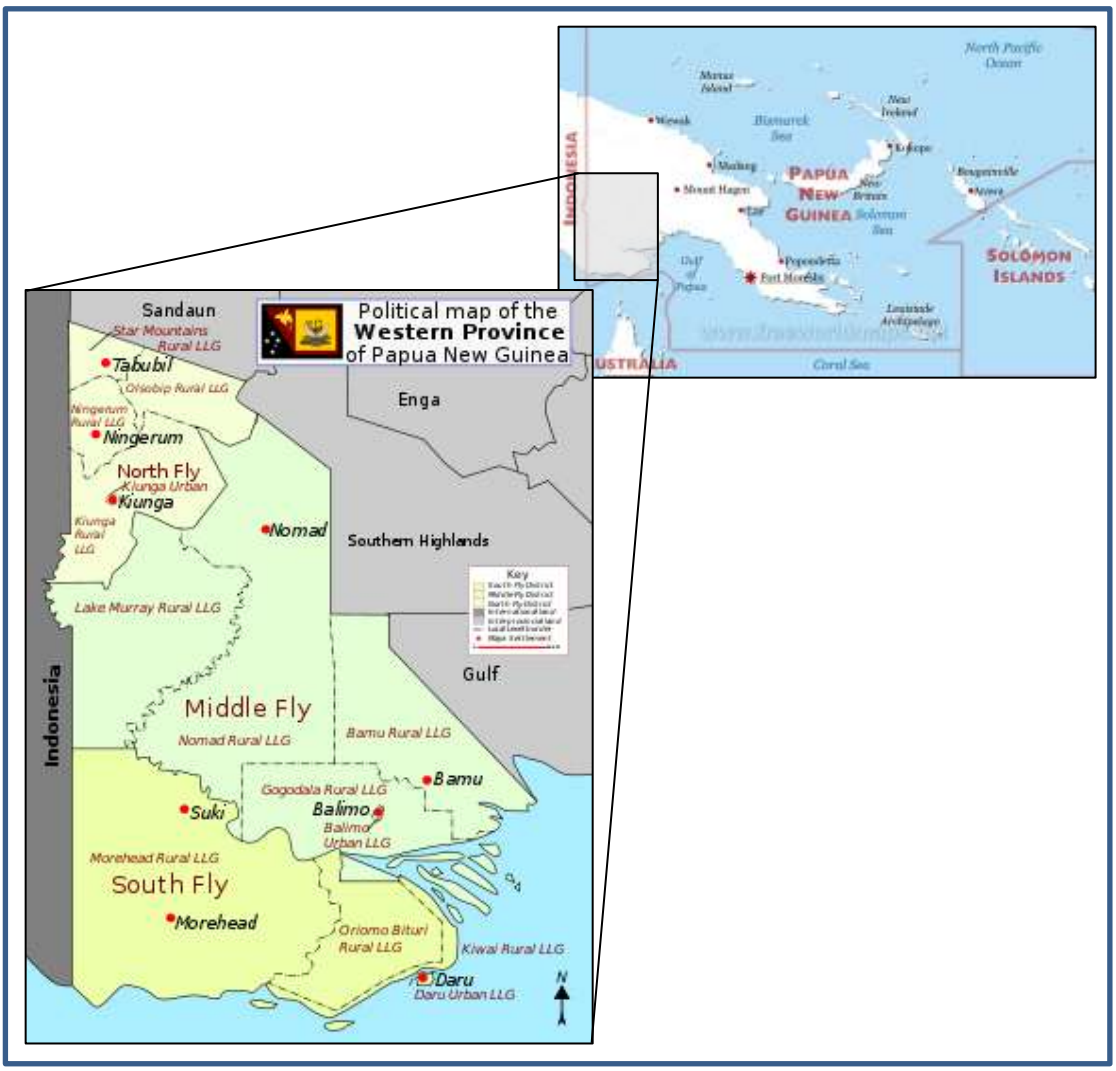

Figure 6: South Fly District of PNG bordering the Arafura Sea showing Local government groups and capital of Province at Daru Island[21,22]

[21] http://en.wikipedia.org/wiki/South_Fly_District,_Western_Province; accessed 12/4/2011

[22] National PNG map http://www.freeworldmaps.net/oceania/papua-new-guinea/political-map.html - accessed 9/08/2011

3.2 Demography

There are approximately 4 million people living in the Arafura Timor Sea region, of which approximately 2.8 million people are in Indonesia. Timor-Leste, contributes around 900,000 people, Australia approximately 310,000 people and PNG approximately 46,000 (Table 6).

Table 6: Province/state, population and approximate land area which fall within the ATS

Country	Provinces/districts/state in ATS region	Population	Land Area (km^2)	Population Density (pop/km^2)
Indonesia	Maluku (Maluku Tenggara, Maluku Tenggara Barat, Kepulauan Aru, Maluku Barat Daya, City Tual)	405,974[23]	30,205	13.4
	East Nusa Tenggara[24] (Kupang City, TTS, TTU, Belu, Kupang District, Rote Ndao)	1,781,767	16,418	108.5
	Papua[25] (Merauke, Mimika, Mappi, Asmat)	538,044	121,806	4.4
Timor-Leste[26]	11 Districts	906,435	13,414	67.6
PNG[27]	South Fly district	46,537	31,864	1.5
Australia	Western Australia Northern Territory Queensland	310,000	1.3 million (TraCK region)	0.2

[23] BPS Maluku 2010

[24] BPS NTT 2010

[25] BPS Papua 2010

[26] From 2010 Timor-Leste National Census

[27] NRI 2010

INDONESIA

Many villages are isolated due to limited public transport options and little access to health and education services. This structure of small island communities raises many issues associated with isolation, community capacity for effective social and economic productivity and movement of people, ideas and products, and their exchange and interdependence.

Maluku

In 2009, the total population of the ATS region of Maluku was almost 406,000, which accounts for approximately 28% of the total population of the province (BPS Maluku 2010).

Table 7: Population in the ATS Region of Maluku by District, Gender and Population Density

District/municipality	Land Area (km2)	Population by gender		Population 2009	Pop. Density
		male	female		
Maluku Tenggara	4,676	51,728	53,353	105,081	22.5
Maluku Tenggara Barat	10,103	46,604	47,766	94,370	9.3
Kepulauan Aru	6,426	42,369	39,337	81,706	12.7
Maluku Barat Daya	8,648	35,193	35,219	70,412	8.1
Tual city	352	27,403	27,002	54,405	154.6
Total	**30,205**	**203,297**	**202,677**	**405,974**	**13.4**

Source: BPS Maluku 2010

(Population Density in people/km^2)

Populations across Maluku are concentrated in urban areas and near the centre of governance and economic activities, in the major district and subdistrict cities. Islands with limited access to transportation and communication tend to have low populations.

The average population density is relatively low at 13 persons per km^2, compared with the population density of 27 people per km^2 across the province (which is far below the population density in other provinces in Java such as Central Java with a population density over 900 people/km^2). The lowest population density is in the islands of Maluku Barat Daya (8 people per km^2) where populated areas are scattered and generally small. The sparseness of the population is also caused by migration of school and work age groups who often migrate to find education and employment outside their village. Conversely, the highest population density figure, far exceeding the average density of the province is in the Municipality of Tual. Tual is the primary capital city of the ATS region of Maluku, attracting migration to the island where the capital is located. Tual City was declared a municipality in 2007 and the population increased rapidly over the subsequent two-year period.

Nusa Tenggara Timur (NTT)

Based on the results of the 2010 National Census, NTT has a population of 4.68 million people. Of these 1.78 million – approximately 38% of the population – reside in the districts within the ATS region (Table 8). Timor Tengah Selatan (TTS) has the largest portion of the population accounting for approximately 9.4% of the population. Belu and Kupang City are the next two most populous districts with 7.4% and 7.2% of the population respectively (BPS NTT 2010).

The average population density across the ATS districts of NTT is 108.5 people/km^2 which is above the provincial average of 94 people/km^2.

Table 8: Population in the ATS Region of NTT by District, Gender and Population Density

District/municipality	Land Area (km^2)	Population by gender		Population 2010	Pop. Density
		male	female		
Kupang	5,898	155,808	148,190	303,998	51.5
Timor Tengah Selatan	3,947	218,015	222,455	440,470	111.6
Timor Tengah Utara	2,670	113,926	115,677	229,603	86.0
Belu	2,446	174,143	178,257	352,400	144.1
Rote Ndao	1,280	61,147	58,564	119,711	93.5
Kupang City	160	172,077	163,508	335,585	2,093.5
Total	**16,418**	**895,116**	**886,651**	**1,781,767**	**108.5**

Source: Population data from BPS NTT 2010, Land Area from BPS NTT 2009 (Population Density in people/km^2)

As would be expected, the highest population density can be found in the capital city of Kupang where there are around 1,860 people per square kilometre. There appears to have been a movement into provincial capital over the past decade, with Kupang City experiencing an annual growth of 3.56%, well above the provincial average growth of 2.33% per year (BPS NTT 2010).

Papua

Papua has the biggest land area of all the provinces of Indonesia but is also the most sparsely populated, with a population density of approximately 9 people per square kilometre. According to figures from the 2010 National Census, Papua had a total population of approximately 2.85 million people. Of these, 538,044 (or 18.9%) were located in the four districts which fall with the ATS region (2010 Census BPS). The population comprises Papuans and transmigrants from Java and Sulawesi.

The gender make-up of the province is skewed towards males with a male to female sex ratio of 1.13. This is most extreme in Mimika where the ratio is 1.3.

Table 9: Population in the ATS Region of Papua by District, Gender and Population Density

District	Land Area (km^2)	Population by gender		Population 2010	Pop. Density
		male	female		
Merauke	44,071	90,632	85,834	176,466	4.4
Mimika	21,633	81,415	66,604	148,019	8.5
Mappi	24,118	36,207	35,670	71,877	3.4
Asmat	31,984	36,633	32,581	69,214	2.4
Total	**121,806**	**289,354**	**248,690**	**538,044**	**4.4**

Source: Population data BPS Papua 2010, Land Area data from DEPDAGRI 2010 (Population Density in people/km^2),

TIMOR-LESTE

Based on the 2010 National Census, the population of Timor-Leste is almost 1,070,000 people. The total number of males in the country is slightly higher than females with percentages of 50.7% and 49.3% respectively and the average household consists of 5.8 people. The majority of the population resides in the three districts of Dili, Baucau and Ermera which account for approximately 43 percent of the nation's people. Approximately 70% of the population resides in rural areas and there are great differences in density across districts with larger concentrations of population in western half of the country, and 22% of population residing in Dili and surrounding districts (Table 10).

The average population density across the 11 coastal districts (i.e. excluding the non-coastal districts of Aileu and Ermera) is 67.6 people/km^2, slightly lower than the average national density of 71.5 people/km^2.

Table 10: Population of Timor-Leste separated by District (Data from National Census 2010)

District	Population	%	Area (km2)	Population Density
Aileu	45,512	4.27	737	61.8
Ainaro	59,382	5.57	804	73.9
Baucau	111,484	10.45	1,506	74.0
Bobonaro	89,787	8.42	1,376	65.3
Covalima	60,063	5.63	1,203	49.9
Dili	234,331	21.97	367	638.5
Ermera	114,635	10.75	768	149.3
Lautem	60,218	5.65	1,813	33.2
Liquica	63,329	5.94	549	115.4
Manatuto	43,246	4.05	1,782	24.3
Manufahi	48,894	4.58	1,323	37.0
Oecusse	65,524	6.14	814	80.5
Viqueque	70,177	6.58	1,877	37.4
Total	**1,066,582**	**100.00**	**14,919**	**71.5**

Note: Shaded districts of Aileu and Ermera are non-coastal

Around 29.6 percent of the country's population live in urban areas[28], the majority of which are in the capital Dili. There are approximately 8,000 people on Atauro island, a subdistrict of Dili District, 25km north of Dili city in the Wetar Strait (105 km^2). The majority of this population are fishers. The nearest island is the Indonesian island of Liran, 12 km to the northeast which hosts a small population of Wetarese[29].

Timor-Leste has experienced an average annual growth rate of 2.41% over the six years since the previous census conducted in 2004 which is one of the highest rates in the Asia-Pacific region. In the three years preceding the 2004 census the population exhibited and annual growth rate of 3.2% with returning refugees contributing to this high rate. At the time of writing, only preliminary census results were available so it is unclear to what extent changes in birth rate are contributing to changes in population growth. However, the 15-29 year age group represents about 40% of the population (Bateman & Bergin 2011).

AUSTRALIA

The ATS region of northern Australia (stretching from Broome in the Kimberley region of Western Australia, across the Top End of the Northern Territory to the coastal gulf region of Queensland) is less populated than Australia's northern neighbours with a population density of around 4 people per square kilometre. Its 310,000 people make up around 2% of Australia's population (Carson *et al.*

[28] Urban areas are defined as district capitals or towns where the population and social amenities are sufficient for the area to be considered urban. Besides the 13 district capitals only Maubisse in Ainaro District was classified as urban.

[29] http://en.wikipedia.org/wiki/Atauro_Island accessed 21/6/2011

2009) with approximately a quarter of the population (80,000) being Indigenous[30]. Approximately two-thirds live in urban centres and towns (Figure 7), thus most of the region has low population densities. Darwin is the largest population centre with a population of around 100,000 within the Greater Darwin area. Only Mt Isa and Broome have more than 10,000 residents (20,000 and 12,000 respectively) (Carson *et al*. 2009).

The majority of the population in the Australian segment of the ATS region lives in the towns of Broome, Derby, Kununurra, Wadeye, Darwin, Bathurst-Melville (Tiwi) islands, Maningrida and Nhulunbuy. Smaller populations are located in resource dependant service and port towns, tourism centres, government administrative and community centres and surrounding regions (e.g. Groote Island, Roper River and Borroloola areas, Normanton, Kowanyama, Weipa, Karumba and the east coast of Cape York).

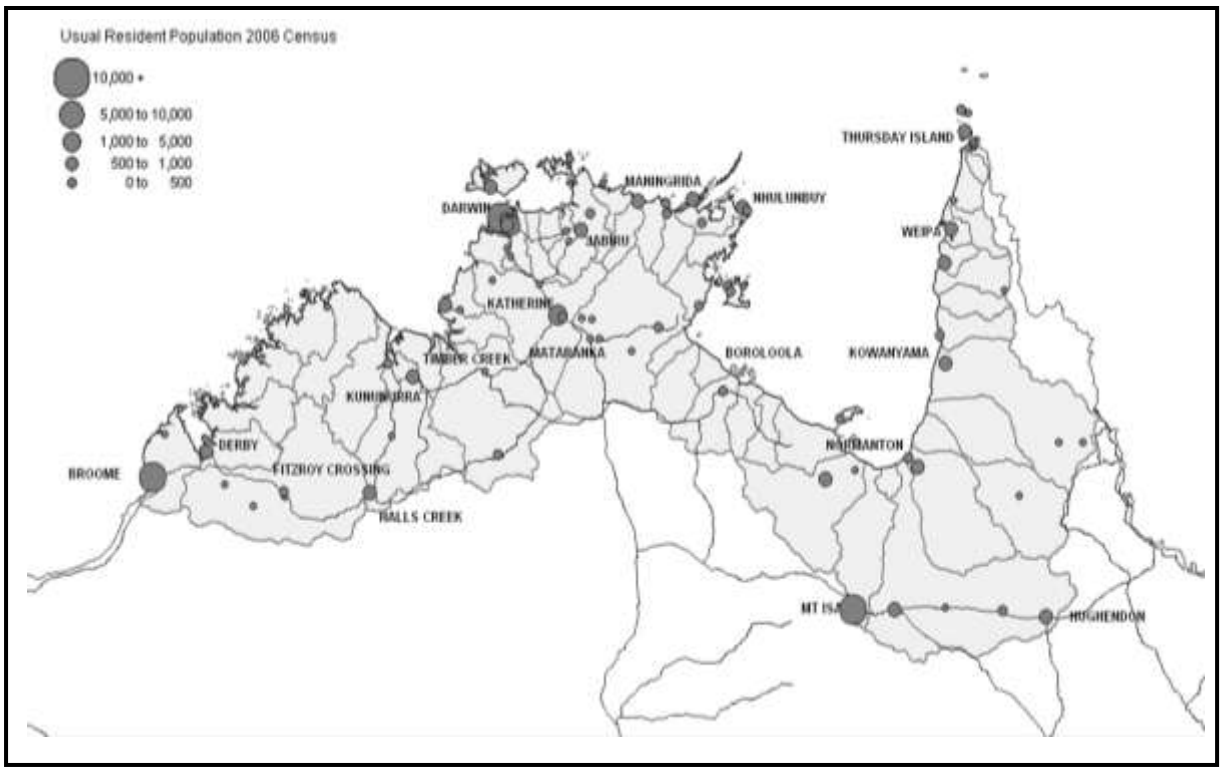

Figure 7: Populations of Urban Centres and Localities as Recorded at the 2006 Census (from Stoeckl et al. *2011 after Carson* et al. *2009) based on ABS 2006 Census.*

The population is divided into 3 distinct groups: i) the Indigenous population experiencing high birth rates, who have permanence and high demand for services such as welfare, health, and education; ii) an ageing, resident, non-indigenous population who reside outside of major urban settlements and are associated with mining and agricultural activities; and iii) highly mobile urban residents who stay for shorter periods in the region. The TraCK region as a whole has a population turnover rate which is the same as the national median (Table 11). However, population turnover is not evenly spread

[30] The TRaCK region covers catchments from Brome in WA to Cape York in Qld draining into the either the Timor Sea or Gulf of Carpentaria. The area includes 54 river catchments (list in Larson & Alexandridis 2009) and covers an area of more than 1.3 million km^2. Demographically the TRaCK region includes 39 collection districts from 2006 Census (Carson *et al.* 2009).The Population of TRaCK includes the Torres Strait which is not officially part of ATS region and townships in catchments inland such as Mt Isa in Qld and Halls Creek in WA and Katherine in the NT.

across the region with centres such as Darwin, Jabiru, Nhulunbuy, Weipa, Cloncurry and Broome experiencing high turnover due to their role as providers of short term employment opportunities for non-Indigenous people from other parts of Australia (NOO 2004). This mix is in contrast to the rest of Australia (Carson *et al.* 2009).

Table 11: Demographic profiles of TraCK region of Australia based on ABS 2006 Census

	Average across TraCK Region	National Average
Population density (people/km^2)	0.2	2.7
Median Age	33	37
Percentage of population who are Indigenous	25%	2%
Sex ration (m:f)	1.07	0.97
Median population turnover rate (2001-2006)	64%	64%

(from Carson et al*. 2009)*

It should be noted that given that the Indigenous population is far greater in the TraCK region compared to the national average these demographic rates partially, but by no means entirely, capture differences in Indigenous and non-Indigenous circumstances. Considerable variation exists for example, in housing arrangements across the region with indigenous populations generally having much higher numbers of people per household than non-indigenous (i.e. up to 16 per household in Arnhem Land) and higher than Aboriginal communities in Cape York and some parts of the Kimberley (Larson & Alexandridis 2009). The turnover rate of the population in remote Indigenous communities between 2001 and 2006 across the TraCK region was close to zero (Carson *et al.* 2009).

While Aboriginal people also reside in the major towns and cities, a considerable proportion reside in settlements or smaller towns which have grown from former missions. Aboriginal populations also reside in several hundred outstations or homelands located around the coast (see Figure 8).[31]

[31] These towns include NT: Wadeye, Belyeun, Bagot, Tiwi Islands (Nguyu, Pirlangimpi, Milikarpati), Cobourg Peninsula and Minjilang,Arnhem Land- Warrum, Maningrida, Milingimpi, Galuwinku, and in NE Arnhem Land Yirrakal; Milyakburra, Umbakumba, Angurugu, Numbulwar); QLD: Gulf of Carpentaria: Weipa; Western Cape York :Kowanyama, Pormpuraaw, and Aurukun: Arafura Sea:, Napranum, Mapoon, New Mapoon, Injinoo Umagio, Bamaga, Kaurareg; WA: Broome, Derby, Wyndham, Kunanurra, four largest predominantly indigenous Australian settlements Bardi (also known as One Arm Point), Beagle Bay, Kalumburu and La Grange. Also covers Fitzroy crossing and Halls creek (as part of TRaCK catchments) (Carson *et al.* 2009).

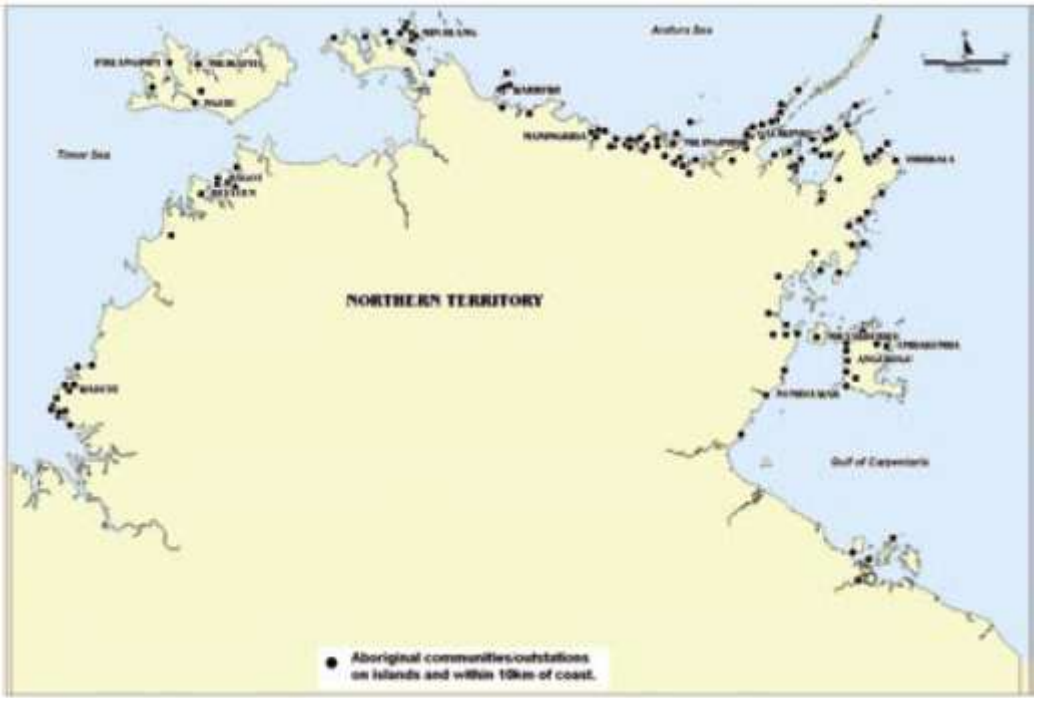

Figure 8: Location of coastal NT Aboriginal communities and outstations (NOO 2004).

In 2006, the population in these areas was estimated at more than 25,000 with approximately 70% Indigenous (NOO 2004). At this time approximately 10,000 Indigenous people resided in the Kimberley region.

The Indigenous population had rapidly increased since the 1980s with high fertility rates compared to non-indigenous population. The median age is 22 years compared to the region's population as a whole (33 years and 37 for rest of Australia) (Carson *et al.* 2009). Population projections in the northern ATS region of Australia estimate an annual average growth rate of 1.83% to around 450,000 by 2026 (Carson *et al.* 2009) (see Table 12).

Table 12: Summary of population projection results, 2006 to 2026

	2006	2026	Growth 2006 to 2026	Av. Annual growth rate 2006 to 2026
	Indigenous			
TraCK region	80,287	119,091	39.4%	1.97%
Northern Territory TraCK area	38,498	59,063	42.8%	2.14%
Queensland TraCK area	27,526	36,649	28.6%	1.43%
Western Australia TraCK area	12,933	15,568	16.5%	0.83%
	Non-Indigenous			
TraCK region	229,853	327,938	35.5%	1.78%
Northern Territory TraCK area	111,089	134,906	19.4%	0.97%
Queensland TraCK area	104,722	119,419	13.1%	0.66%
Western Australia TraCK area	15,365	23,522	42.6%	2.13%
	Total persons			
TraCK region	310,410	447,019	36.6%	1.83%
Northern Territory TraCK area	149,587	193,968	26.0%	1.30%
Queensland TraCK area	132,248	156,068	16.6%	0.83%
Western Australia TraCK area	28,298	39,090	32.3%	1.62%

(from Carson et al. 2009)

The indigenous population of the region is characterised by low rates of migration to urban areas or interstate with high local mobility and migration from homelands/outstations to local community centres/towns (e.g. Maningrida in NT) travelling over 'country' to and from remote homelands, for purposes such as hunting, ceremonies, and visiting kin. Seasonal movement from communities to dry season outstations is also common (NOO 2004).

In contrast, the non-Indigenous population of northern Australia exhibits exceptionally high levels of migration into and out of the region due to the temporary nature of many of the major employment sectors in the region.

PAPUA NEW GUINEA

The South Fly district has a population of approximately 46,000 people (NRI 2010) out of the 150,000 of the Western Province. The population density of South Fly is only 1.5 people/km^2 well below the crude national average of around 11 people/km^2. The population is sparse with the majority in 3-4 main towns along coastal areas bordering Arafura Sea (Bowe *nd*). The approximate population of the capital, Daru is 12,000 (Bowe *nd*). Annual population growth in the South Fly between 1980 and 2000 was 3.3% compared to the national average of 2.7%.

All population data available are based on the most recent national census conducted in 2000.

3.3 Ethnicity, Languages, Religion, Culture and Social Structure

INDONESIA

The most populous ethnic group in West Timor, the ATS region of NTT, are the Atoin Meto or Dawan people who speak the indigenous language Uab Meto. Tetun, the national language of Timor-Leste, is also widely spoken, particularly by people from Belu. Other ethnic/language groups include Sabu, Rote (Rotinese) and Semau (Helong), Ndaonese (Ndao Island) and Kemak. All belong to the Austronesian family of languages. The Papuan language Bunak is also spoken in the central highlands of the island of Timor, spanning the international boundary between Indonesia and Timor-Leste.

A large number of migrants from all over Indonesia, particularly Java, Bugis, Butonese and Makassarese as well as ethnic Chinese also reside throughout NTT.

Most of the population in NTT is fluent in Bahasa Indonesia. Timorese social relationships revolve around clan kinships groups and traditional livelihoods are governed by *adat* (customary laws) in relation to land, marriage, burial, inheritance, labour exchange, environmental management.

The population of NTT comprises approximately 54% Roman Catholic, 35% Protestant, 8% Islam and 3% other. However, more specifically, within West Timor, and on Rote and Sabu islands, protestants out-number Catholics. Indigenous beliefs and practices continue to have a major influence on peoples' lives.

The area of Maluku in the ATS region is highly diverse. There are approximately 45 local languages identified within the region (3 in Kei, 5 in Tanimbar, 14 in Aru, 11 in south-western islands, 12 in Babar Islands). One of them – Oirata language in Kisar – is a non-Austronesian language related to the language of Fataluku in Timor-Leste.

Christians, both Catholic and Protestants, are dominant throughout the ATS region of Maluku, though Muslims also account for around 40% of the population in Maluku Tenggara and Kepulauan Aru and are also prominent in the city of Tual. The vast majority (almost 97%) of the population of Maluku Barat Daya are Protestants as a result of Dutch colonisers and local missionaries from Ambon.

Many communities recognise strict social stratification/boundaries (Kei, Kisar, Romang, Letti) with some communities revolving around patrilineal social structures, while others are matrilineal. There are also communities who practice both as socio-cultural changes occur.

Traditionally, villages are separated based on genealogical, territorial, and religious ties (expect for Aru where some villages consist of more than one religion). The basic societal group in indigenous rural communities is clan (*mata rumah*). Each customary coastal village has its own domain (*petuanan*), covering land and sea and in addition to this each local clan has its own land.

In the province of Papua the population is ethnically different from the other provinces of the ATS region with indigenous ethnic groups residing in the region belonging to the following: Papuan, Melanesian (including Aitinyo, Aefak, Asmat, Agast, Dani, Ayamaru, Mandacan Biak, Serui), Non-indigenous (including Javanese, Bugis, Bajo, Butonese, Mandar, Minangkabau, Batak, Minahasan, Chinese.) The majority of indigenous Papuans are Protestant (51.2%), Roman Catholic (25.42%), Islam (23%), others (2.5%). Indonesian is the official language but 269 indigenous Papuan and Austronesian languages are spoken in the province[32]. Kanum is a Papuan language of the extreme south-east of Indonesian New Guinea. It is spoken by the Kanum people (around 250 in number) in the areas of (south-) east of Merauke, close to Indonesia's border with Papua New Guinea.

The ATS region of Indonesia is also home to settlements of maritime populations of Sama-Bajo, Bugis, Butonese, Makassarese, plus a number of smaller populations such as Lamaholot speaking populations on Pantar and Alor (Alorese) (Fox 2000a; Fox 2009; Stacey 2007). Each of these populations has its own language, cultural traditions and belief systems (see section 4.2).

TIMOR-LESTE

The two official languages of Timor-Leste are Tetun (a Malayo-Polynesian language and the lingua franca) and Portuguese. Bahasa Indonesia is still widely spoken and along with English is classified as an official working language. Tetum has a central role in Timor-Leste as it is the common language used for communication between different communities across the nation, even though many communities have their own language (JSMP 2004). There are 15 distinct languages spoken throughout the country (see Figure 9)[33] including Fatuluku, a Papuan language spoken by approximately 30,000 people around the eastern tip of Timor. In 2004 it was estimated that 60 to 80% of Timorese use Tetun, 40% to 20% Indonesian, 5% Portuguese and English 3% (JSMP 2004).

[32] http://en.wikipedia.org/wiki/Papua_(province) – accessed 29/7/2011

[33] Fifteen indigenous languages spoken are : Bekais, Bunak, Dawan (Uab Meto), Fatuluku, Galoli, Habun, Idalaka, Kawaimina (actually four dialects: Kairui`, `Waimaha`, `Midiki`, and `Naueti), Kemak, Lovaia, Makalero, Makasai, Mambai, Tokodede, and Wetarese.

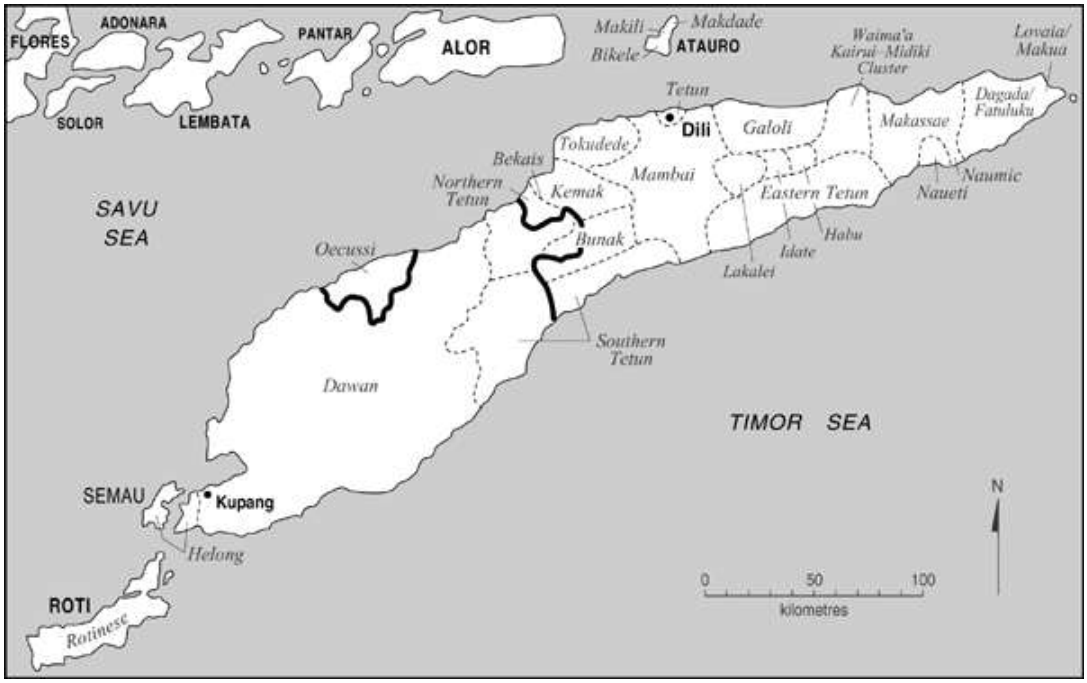

Figure 9: Map of the languages of Timor Island (Fox 2000b)

The majority of the population of Timor-Leste are of Malay-Polynesian and Papua origin. As is the case in other former Portuguese colonies where interracial marriage was widespread, there is also a smaller population of people of mixed Timorese and Portuguese origin, known in Portuguese as Mestiço. There is also a small Chinese (Hakka) population.

The largest Malayo-Polynesian ethnic groups of Timor-Leste are the Tetun (or Tetum) (100,000), who live primarily on the north coast and around the capital Dili. The Mambae (80,000), live in the mountains of central Timor-Leste, the Tukudede (63,170), the area around Maubere and Liquica. The Galoli (50,000) inhabit the area between the Mambae and Makasae and the Kemak (50,000) are in north-central Timor Island. The Atoin Meto (or Baikeno) as in Indonesian West Timor (20,000), live in the exclave Oecusse[34].

The main ethnic groups speaking Papuan languages are the Bunak (50,000) living in central inland Timor Island, the Fatuluku (30,000) living in the eastern tip of Timor-Leste around Los Palos, and the Makasae living in the eastern end of the island.

The population is predominantly Roman Catholic (90%), (as are people residing in Flores) a legacy of Portuguese colonial rule). Timor-Leste also has sizable Muslim (5%) and Protestant (3%) minorities. Smaller Hindu, Buddhist and minorities practising indigenous beliefs make up the remainder. The Roman Catholic Church is a dominant institution in the daily life of Timorese. However Timorese still practice indigenous spiritual belief systems expressed through customary cultural ritual practices, (as in other parts of West Timor and the eastern Indonesian archipelago).

These systems include Indigenous belief and practices in relation to coastal waters and surrounding seas. Some Timorese identify spirits who can manifest themselves in various forms including sea-based creatures such as sharks, turtles and dolphins (McWilliam 2003). Local Timorese origin mythology represents the island of Timor as a half-submerged crocodile (McWilliam 2003) with its head to the east and tail to the west. Here the crocodile appears in various manifestations as origin

[34] Taken from http://www.easttimorgovernment.com/demographics.htm (accessed 24 March 2011)

ancestor for local rulers, creator of the island or a deity 'providing bounty, fertility and wealth in return for sacrifice and worship' (McWilliam 2003)

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 forms of what is generally referred to as customary marine tenure and symbolic and ritual practices associated with seascapes and indigenous mythological practices continue in some areas (McWilliam 2003).

AUSTRALIA

Around 70% of the remote coastline of northern Australia is owned by Indigenous peoples from hundreds of distinct language groups. The Australian region of the ATS is one of the most linguistically diverse areas of Australia with an estimated to 29 plus languages spoken throughout northern Australia. Nine out of the 10 major language 'families' recognised from throughout Australia are represented in the Top End (Smyth 2007). For most Aboriginal people, English is not usually the first language spoken and members of clans may speak up to two or three different Aboriginal languages.

The basic social unit in Aboriginal groups is the extended family or 'clan' and membership is either through paternal or maternal lines. Each clan has its own estate or country in which coastal areas include estuaries, beaches, offshore reefs and coastal waters and ocean (Smyth 2007) Christianity is the most common religion (57%) and second is people reported as not being religious (22%) (Larson & Alexandridis 2009).

Since European colonisation, Aboriginal and Torres Strait Islander people have faced significant disempowerment, social displacement and struggle for land rights as a result of various government policies. Aboriginal communities in the Arafura Sea region were subject to greater dislocation than in many other areas where communities have maintained relative stability and people continue to live on their traditional lands (NOO 2004).

Indigenous people in Australia have had a close relationship with the coastal and ocean areas in ATS region for thousands of years from human settlement to the present day. Aboriginal people have had social and economic interactions with Makassans and other groups from the Arafura and Timor Seas region of Indonesia, since at least the mid- 1700s, prior to arrival of Europeans. This interaction continued until the introduction of maritime jurisdiction boundaries between Australia and Indonesia. Indeed Makassan trepang fisheries were the first commercial industry operating in Australia in the early 1700s (Macknight 1976).

Aboriginal interests in the coasts and seas extended across sounds and gulf and island archipelagos in some areas (e.g. NW) with some communities undertaking extensive sea journeys, previously in rafts and canoes and now in modern powered vessels. In other communities activity was more confined to coastal areas and intertidal zones (Smyth 2007).

Aboriginal occupation of Australia goes back to at least 60,000 years. Indigenous people view the seas and coastal environments as part of their 'sea country' or 'saltwater country'. Complex cultural, spiritual, ceremonial, territorial and economic connections exist among Aboriginal coastal communities. Some of the important features of this relationship relate to identity, ownership of traditional clan estates and marine resources under traditional law and state, territory and commonwealth legislation (e.g. NT Land Rights Act 1976 (Cmwlth); Native Title Act 1993(Cmwlth). The application of traditional laws and practices for access and use of the sea and land, spiritual belief systems and cultural sites of significance are fundamental to Aboriginal systems of creation, ceremony and religion and continuing cultural traditions over the distant past (NOO 2004).

Aboriginal people maintain close connections with their 'country' through occupation, resource utilisation, subsistence hunting, and cultural and social practices. People's health and wellbeing is

very much determined by social, cultural and economic relationships to their country (e.g. healthy people and healthy country).

The saltwater peoples of the region today continue to rely on coastal and marine environments and resources of the region for their cultural identity, health and wellbeing, and their domestic and commercial economies. Despite the severe impacts of colonisation, which have reduced Aboriginal people's ability to maintain their cultural connections and obligations to their sea country, these connections have remained strong throughout much of the region (Smyth 2007).

A network of indigenous sea-ranger groups has been established in recent years with support from both government and non-government groups. Indigenous rangers are playing an increasingly important role in biodiversity monitoring, marine management, and surveillance.

PAPUA NEW GUINEA

The three official languages of Papua New Guinea are English, Hiri Motu, and Tok Pisin. There are non-Austronesian language families spoken in the southern PNG region, Marind, Marori, Morehead and Maro River. The Marind and Marori families are only found in Indonesia, whereas the Morehead and Upper Maro River language is spoken in PNG and Indonesia Cultural beliefs and practices generally remain strong (Bowe *nd*). However a new project to investigate the languages of the Southern New Guinea region (PNG and Indonesia) suggests around 35 languages in 9 families in the region (see Figure 10). And in the coastal areas of the Arafura Sea, South-Central Papuan, Marind, Tonda and Nambu languages are spoken by coastal peoples. The culture is Melanesian and Christianity and traditional animism is practiced in the region.

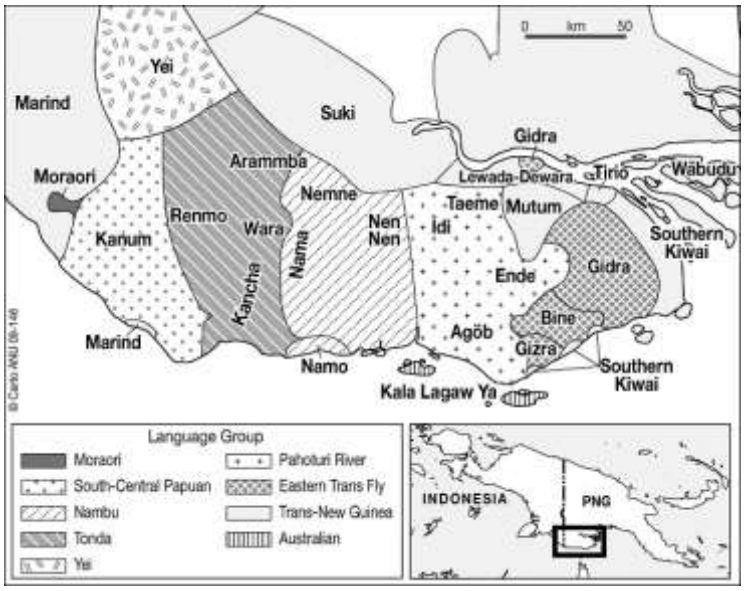

Figure 10: Languages of southern PNG and southeast Papuan Province, Indonesia[35]

3.4 Social and Economic Indicators

The economic status of people living in the ATS area varies greatly, as can be seen in Table 13. These figures show that the levels of economic development in northern Australia are much higher than those in Indonesia, Timor-Leste and PNG. The average annual GDPs per capita in Northern and

[35] http://rspas.anu.edu.au/linguistics/projects/sng_project/index.php *[accessed 20 May 2011]*

Western Australia are more than US$30,000 and more than US$20,000 per capita in Queensland. As a peripheral resource rich region the wealth generated generally accrues initially to national or multinational companies and second to the nation often by passing the regions resident population (Greiner *et al.* 2006).

Meanwhile, 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. The lowest GDP can be found in Belu district where in 2008 the per capita GDP was estimated to be at around US$212. Those regions in Indonesia with a relatively higher per capita GDPs are Mimika (approximately US$ 8,959 in 2007), due to its mining resources, and the two largest cities in the area: Kupang (approximately US$785 in 2008) and Merauke (approximately US$854 in 2007).

Table 13: Gross Domestic Product in regions of the ATS

	GDP		Annual Growth		GDP per Capita	
	2000 US$* million	(Year)	(%)	(Period)	2000 US$*	(Year)
INDONESIA**						
EAST NUSA TENGGARA[1]	***1,338***	***2008***	***4.77***	***(2001-08)***	***295***	***2008***
Rote Ndao	37.3	2008	5.03	(2001-08)	311	2008
Kupang City	233.2	2008	6.04	(2001-08)	686	2008
Kupang District	128.5	2008	4.11	(2001-08)	312	2008
Timor Tengah Selatan	105.7	2008	4.18	(2001-08)	237	2008
Timor Tengah Utara	52.8	2008	na		235	2008
Belu	99.5	2008	na		212	2008
MALUKU	***426***	***2007***	***3.97***	***(2001-07)***	***300***	***2007***
Aru Islands	21	2007	4.96	(2001-07)	261	2007
Maluku Tenggara	37	2007	3.96	(2001-07)	243	2007
Maluku Tenggara Barat	48	2007	3.62	(2001-07)	296	2007
Maluku Barat Daya						
Kota Tual						
PAPUA	***2,246***	***2007***	***2.1***	***(2001-07)***	***1,114***	***2007***
Merauke	144	2007	7.19	(2001-07)	854	2007
Mimika	1,246	2007	1.23	(2001-07)	8,959	2007
Asmat	21	2007	10.16	(2001-07)	318	2007
Mappi	25	2007	9.97	(2001-07)	358	2007
TIMOR-LESTE						
	367	*2009*	*1.9*	*(2001-09)*	*325*	*2009*
PAPUA NEW GUINEA						
	4,681	*2009*	*3.2*	*(2001-09)*	*695*	*2009*
AUSTRALIA (Local government areas which fall within the ATS only)						
Northern Territory	7,738	(2009-10)	3.8	(2006-10)	33,643	(2009-10)
Western Australia	85,993	(2009-10)	4.3	(2006-10)	37,453	(2009-10)
Queensland	116,581	(2009-10)	1.6	(2006-10)	21,017	(2009-10)

** Indicates that values are given according to US$ constant price for 2000*

***Data for Indonesia are from 'District in Figures' reports from provincial statistics bureaus*

1. NTT Dalam Angka 2009 (BPS NTT 2009)

Information on the size of economy and GDP per capita separated by district for Timor-Leste and PNG is not yet available, but there is also likely to be wide variation between the districts.

Growth rates of these economies are varied. Asmat and Mappi, the two relatively new districts in Papua had annual growth rates of around 10 percent between 2001 and 2007. Districts in East Nusa Tenggara also performed quite well and grew more than 4 percent per annum from 2001 to 2008. However, most regions in the ATS have most likely experienced annual growth at a rate below 4 percent, including those regions in the Australian territories. Whilst the district of Mimika maintained the highest per capita GDP outside of Australia, it had the lowest growth rate with annual growth at 1.23% over the period 2001-2007.

Hence it is not only the level of development in the ATS which varies widely between regions but also the size of the economies of local government and growth rates of these economies.

In Indonesia, Timor-Leste and PNG, poverty is a significant issue. Over 30 percent of Indonesians are considered 'poor' based on the national classification system. The portion of people living in poverty in Kupang is comparatively small but in most areas within the ATS region of Indonesia the rate is above 30 percent. In Maluku Tenggara Barat the proportion of poor people in 2007 was estimated to be 46 percent (Table 14).

Table 14: Population and Poverty in the ATS region

	Population		**Poor People**		
	(thousand)	(Year)	(%)	(Year)	(Poverty Line)
EAST NUSA TENGGARA					
Rote Ndao	114	2008	27.8	2007	
Kupang City	293	2008	8.7	2007	
Kupang District	384	2008	33.8	2007	
Timor Tengah Selatan	418	2008	39.9	2007	
Belu	441	2008	20.7	2007	
MALUKU					
Aru Islands	80	2008	38.5	2007	Rp 126 thousand per month (~ US $0.50/day)
Maluku Tenggara	103	2008	37.8	2007	
Maluku Tenggara Barat	94	2008	46.3	2007	
Maluku Tengah	369	2008	38.2	2007	
PAPUA					
Merauke	172	2008	32.2	2007	
Mimika	143	2008	34.1	2007	
Asmat	68	2008	33.8	2007	
Mappi	71	2008	34.0	2007	
TIMOR-LESTE			37.2	2007	US $1.25 a day
Ainaro	59	2010			
Baucau	111	2010			
Bobonaro (Maliana)	90	2010			
Cova-Lima (Suai)	60	2010			
Dili	234	2010			
Lautern (Los Palos)	60	2010			
Liquica	63	2010			
Manatuto	43	2010			
Manufahi (Same)	49	2010			
Qecussi (Ambeno)	66	2010			
Viqueque	70	2010			
WESTERN PROVINCE					K552 per year
South Fly District*	46	2000	54	2000	(~ US $0.50/day)**

** Gibson et al 2004. ** Based on Dec 2000 exchange rate of K1=US$0.33)*

Poverty levels in Maluku are still considered high by national poverty measures, though they have fallen slightly from the level of 31.14% in 2007 to 27.74% in 2010 (Maluku Provincial Statistics 2010). The highest levels of poverty are generally found in rural areas.

As one of newest democracies in the world, and one of the least developed, Timor-Leste faces significant threats and challenges. Approximately 42% of the country's estimated population of 1.1 million are below the national poverty line (based on a poverty standard of US$1.25 a day). In rural areas where poverty is greatest, approximately 75-80% of people live subsistence lifestyles. Many people in Timor-Leste live in a situation of chronic food insecurity (Andrew *et al*. 2010) and an estimated 44% of people in Timor-Leste are malnourished. Youth unemployment (among 15-29 year age group) is a major social and economic problem currently facing Timor-Leste, with particularly high levels in Dili and Bacau districts. There is high population growth (e.g. approximately 17% increase in population during 2001-2004 and a further 15.5% increase from 2004-2010) and Timor-Leste's Human Development Index is one of the lowest in the world.

Based on a national poverty standard, it is estimated that 54 percent of people in Papua New Guinea's South Fly District, are poor (Gibson *et al*., 2005).

Of the nations within the ATS, only Australia is classed as a 'developed country' according to the United Nations. Australia has been able to apply a good social safety net program, and so the portion of people living below the poverty line has been relatively small. It should be noted however that there are vast differences between the economic status of Indigenous and non-Indigenous Australians in northern Australia. 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. Reliance on the state is particularly high on Aboriginal-owned land due to the relative absence of commercially viable enterprises due to the remoteness of the localities (Altman 2001).

The relatively low quality of human capital is probably one of the challenges in combating poverty in the area. Literacy rates in some of the Papua's district, such as in Asmat and Mappi districts, are very low (Table 15) with more than half of people in their productive age not able to read. In some districts of Timor-Leste, the literacy rates are also low. In Maluku and East Nusa Tenggara (NTT), literacy rates are good in comparison and relatively close to the levels in Java. Rates of literacy indicate that levels of education of the people in the ATS are generally relatively low.

Another measure of human capital is life expectancy. Whilst there are differences, the Indonesia, Timor-Leste and Papua New Guinea regions of the ATS experience life expectancies of somewhere between 60 and 70 years. In the city of Kupang, life expectancy is above 70 and in several other districts they are close to 70. This is an improvement compared the situation 10 to 20 years ago, but levels are not yet equal to those in Java. The general health status across the ATS, whilst improving in recent years, is still relatively low.

The overall human capital quality parameter, the human development index (HDI), in many ATS areas of Indonesia is well below the average HDI for the whole of Indonesia (0.71), particularly in Mappi and Asmat districts in Papua where the HDI were 0.49 and 0.50 respectively (Table 15). Improving human capital quality in the ATS areas is an issue that needs to be addressed. Data from Indonesia's national statistics body show that in 2009 NTT and Papua were amongst the lowest scoring provinces for HDI in Indonesia ranking 31st and 33rd respectively out of 33 provinces[36].

[36] http://www.bps.go.id/tab_sub/view.php?tabel=1&daftar=1&id_subyek=26&notab=2 [accessed 14/07/2011]

Table 15: Comparison of Literacy Rates, Life Expectancies and Human Development Index for Regions of the ATS

	Literacy Rate		Life Expectancy		HDI	
	(%)	(Year)	(years)	(Year)		(Year)
INDONESIA[+]					0.71	2008
EAST NUSA TENGGARA					0.66	2008
Rote Ndao	90.1	2008	67	2007	0.65	2008
Kupang City	99.3	2008	72	2007	0.77	2008
Kupang District	89.0	2008	65	2007	0.65	2008
Timor Tengah Selatan	87.2	2008	66	2007	0.65	2008
Belu	82.2	2008	65	2007	0.63	2008
MALUKU					0.70	2008
Aru Islands	99.1	2007	67	2007	0.67	2007
Maluku Tenggara	99.4	2007	67	2007	0.71	2007
Maluku Tenggara Barat	99.3	2007	64	2007	0.67	2007
Maluku Tengah	99	2007	65	2007	0.69	2007
PAPUA					0.64	2008
Merauke	87.1	2007	62	2007	0.64	2007
Mimika	86.9	2007	69	2007	0.68	2007
Asmat	31	2007	66	2007	0.50	2007
Mappi	31.3	2007	66	2007	0.49	2007
TIMOR-LESTE*	85**	2010	62.1	2010	0.50	2010
Ainaro	60.9	2010				
Baucau	72.4	2010				
Bobonaro (Maliana)	62.8	2010				
Cova-Lima (Suai)	75.9	2010				
Dili	89.8	2010				
Lautern (Los Palos)	80.8	2010				
Liquica	65.9	2010				
Manatuto	75.5	2010				
Manufahi (Same)	71.4	2010				
Qecussi (Ambeno)	52.5	2010				
Viqueque	70.6	2010				
PAPUA NEW GUINEA*	59.6	2010	61.6	2010	0.43	2010
WESTERN PROVINCE			54	2000	0.47	1996
South Fly District	82.8	2000				
AUSTRALIA*	**100**	**2006**	**82**	**2010**	**0.94**	**2010**

+ Indonesia data from 'Districts in Figures' reports from provincial statistics bureaus.

** UNDP 2010; **UNDP 2011*

In Timor-Leste wellbeing measures show regression in life expectancy from birth since 1999, but child and infant mortality rates have improved along with school enrolment rates and marginal improvements in GDP. Access to electricity, clean water and sanitation varies, with improvement in some areas but deterioration in others (Harris 2011). Significant challenges lay ahead with education over the next decade as it is estimated that by 2020 one-sixth of the population will be primary school aged. Approximately 40% of the population is illiterate in some areas with lower literacy rates

among women compared to men and amongst younger adult males and youth (Harris 2011). Meeting the health and education needs of the population and to satisfy demand and future growth will be a significant challenge in the coming years. Unemployment is high with up to 40% unemployment among youth and around 16,000 young people entering the labour market each year chasing 400 new formal sector jobs[37]. The secondary school enrolment rate of 39% is dramatically below the Indonesian average (80.49% in 2003/04, according to UNESCO). Lack of clean drinking water, sanitation, and health facilities mean that child malnutrition (32%) and child mortality (71 per 1,000) are higher than in most of Indonesia. In comparison, the recorded infant mortality rate in the neighbouring Indonesian province of NTT was 13 per 1,000 live births (Dinkes NTT 2007).

In 2010 UNDP HDI estimates for Timor-Leste were 0.502 with an increase of 0.005 from 2009, putting it into the 'medium human development group' of countries at 120. With a HDI score of 0.937 based on health, education and income, Australia was ranked the second highest of the 169 nations with sufficient data for comparison (but this does largely exclude the Indigenous population). Indonesia was ranked 108th, Timor-Leste was 120th and Papua New Guinea came 137th (UNDP 2010).

3.5 Economy, Employment and Income

INDONESIA

NTT is the poorest province in Indonesia. Currently approximately 30% of the population is below the poverty line compared with 18% for Indonesia. Experts suggest rural poverty is worsening rather than improving particularly in Sumba, Rote, West Timor and Savu islands and that over a million people require food aid. This is partly a result of deteriorating productivity due to environmental degradation (Fox 2011).

Approximately 69% of the working population of NTT is employed in some form of agriculture, with the service sector being the next biggest employer accounting for 9% of the province's workforce (BPS NTT 2009). Employment opportunities are also limited by the fact that only 48% of the adult population having completed primary school with around 72% of the population never going beyond primary school.

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 2007).

The agricultural sector employs approximately 59% of working people in Maluku with the next biggest employer being the services sector which employs around 35% of the working population, predominantly women (ILO 2011). Productivity across the province is considered to be low as an estimated third of employed people live below the poverty line (ILO 2011).

TIMOR-LESTE

Seventy-five percent of Timor-Leste's population live in rural areas – where poverty is most prevalent – and depend on natural resources to meet their basic needs. Eighty percent of employment is natural resource-related, and 98 percent of households use wood as their primary fuel (FAA, 2004). Despite large offshore oil and gas reserves worth an estimated £2.8bn, food security, employment and sustainable livelihoods remain important priorities for Timor-Leste.

The livelihoods of most rural Timorese tend to be focused inland and to the mountains rather than to the sea. The majority of Timorese having a high dependence on rural agricultural livelihoods strategies (McWilliam 2003) and as such do not engage in fishing or undertake the *merantau* (long-

[37] http://www.ausaid.gov.au/country/country.cfm?CountryID=911&Region=EastAsia – accessed 2/8/2011

range seafaring in search of livelihoods) traditions of Indonesian island populations. However a small percentage of Timorese communities are dependent on fishing (see Timor-Leste Fisheries profile below).

AUSTRALIA

The 'far north' of Australia has largely been developed and affected by economic factors and opportunities as a result of dominant industries such as mining and agriculture (Carson *et al.* 2009). Despite its low and sparse population, the region accounted for 30% of the nation's exports and over one third of Australia's export growth over the past 30 years (Stoeckl *et al.* 2011)

Key employment sectors in the ATS regions of Australia are agriculture, fisheries, construction, mining, retail, utilities (water, electricity and gas) and government services (education, health and public services) with majority of people (25%) employed in government services (Larson & Alexandridis 2009). Northern Australia does have a different economic structure from that of the rest of Australia (Stoeckl *et al.* 2011)

A number of dichotomies are present in the northern region of Australia and in particular the NT and Gulf area of QLD in relation to population, employment and economic trends.

- Despite being rich in natural resources, the area is sparsely populated but the majority of the resident population is dependent on government funded employment and welfare payments (indigenous population).
- Fisheries are diverse and valuable but accrue little socio-economic benefit to the region and only 1% of the workforce is employed in marine related industries (and the indigenous population is not engaged in commercial fishing),
- Mining within the northern region generates $2 billion per year and but employs less than 10% of the workforce. Benefits to indigenous people are localized to existing mine sites and royalty payments and the size and distribution of benefits is unknown
- Marine tourism is a small industry (recreational fishing is important but not well integrated into fisheries management) and Indigenous people are not well engaged in the industry. Tourism generates local employment and income and employs less than 10% of workforce.
- Indigenous people own vast areas of land and sea especially in the NT area but are not engaged in mainstream economic activity. They are the most disadvantaged group in Australia with the majority of employment through CDEP program.
- Most direct employment for Indigenous people is in natural resource based industries which has increased in the last few years through the Caring for Country Program – community-based land and sea and ranger programs – but is still low. Greater investment in human and social capital is required. Subsistence activities contribute significantly to Indigenous health and wellbeing and non-market economies (quoted from Greiner *et al.* 2006)

Median weekly incomes vary immensely between different areas of northern Australia (from $150 per person per week to $700). The highest median incomes are found in urban areas and mining towns (Darwin, Broome, Gove, Weipa etc.) (Larson & Alexandridis 2009). In the Kimberley region mean individual annual income was approximately $43,000 (2004-2005 Taxation office data) (Clifton *et al.* 2007:52). Employment opportunities are extremely limited outside these major population centres and may pose the most significant barrier to development across the region (Larson & Alexandridis 2009).

PAPUA NEW GUINEA

South Fly comprises extensive lowland swamps, savannah woodland and monsoon forest between the lowland reaches of the Fly River and the border between Papua New Guinea and Indonesia. The capital of Western Province is Daru located on island of same name at the mouth of the Fly River.

The Arafura Sea region of PNG, which encompasses all of the Tonda Wildlife Management Area – managed by WWF South Pacific (Figure 11) – is 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. Most information about this region comes from WWF, who has established a cross border conservation corridor[38]. This region is sparsely populated, with a local economy that is largely subsistence-based with hunting and gathering of forest resources, fishing and small-scale shifting yam (and sago) cultivation[39]. Freshwater turtles are regularly harvested as an important source of protein (Georges *et al.* 2006).

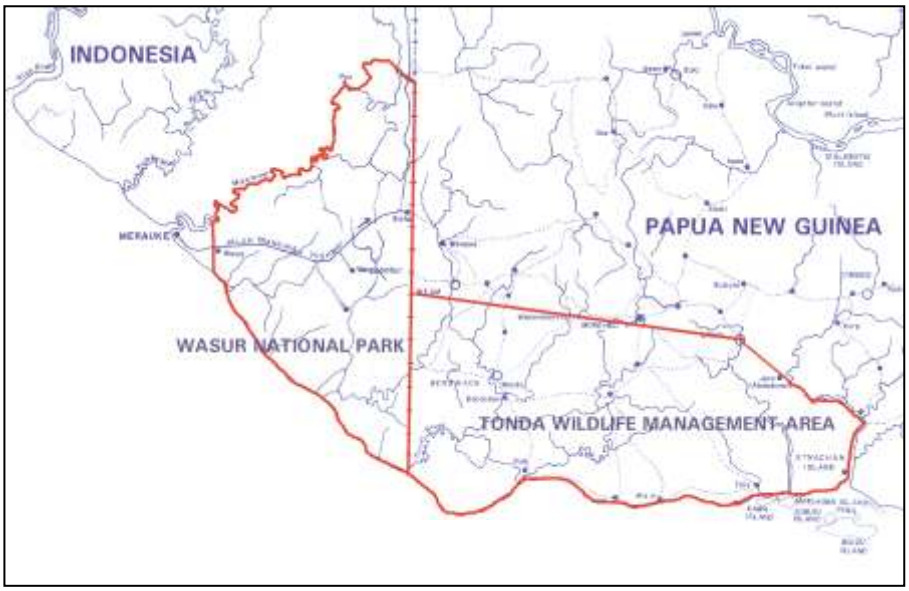

Figure 11: Wasur National Park and Tonda Wildlife management area (from Bowe nd)

Bowe (*nd*) reported that local communities in the Tonda Wildlife Management Area has aspirations to increase trade in wildlife and forest products especially given the presence of local species with a potentially high economic value, including deer meat, crocodile skins, candlenut (*Aleurites sp*), saratoga fingerlings (*Sclerophages sp*), barramundi (*Lates calcarifer*) and *Asteromyrtus*. Great distances from domestic markets within PNG mean that local people look to cross-border marketing opportunities through increased trade into Papua via the border trade post at Sota in Indonesia to the much nearer Merauke (Bowe *nd*). Whilst there has been a range of local income-generating projects such as deer and crocodile farms, these projects have all failed and development activities in the area are virtually non-existent. (Bowe *nd*) WWF reports there is increasing demand for cash income amongst the communities of the Trans-Fly and Tonda Wildlife Management Area and that unsustainable wildlife harvest of certain species is occurring, particularly of Saratoga fish which are

[38] Tonda WMA was first gazetted in 1975. It is the largest of the WMAs in PNG, covering some 590,000 ha with habitats similar to those described for Wasur in Papua. Tonda was designated as PNG's first Ramsar site in 1993 (Bowe nd).

[39] http://whc.unesco.org/en/tentativelists/5062/ - accessed 1/08/2011

traded into Indonesia. WWF is working with Traffic and local landowners to develop management plans for key species of commercial value[40].

3.6 Infrastructure and Services

The ATS region of Indonesia consists of hundreds of islands with many groups of settlements far from administrative and economic centres with poor infrastructure and services outside of the main municipal areas. The recent changes in Indonesian under regional decentralisation with *pemekaran* ("blossoming" of new administrative and budgetary units to create new districts - *Kabupaten*) is aimed at reducing some of these gaps between rural poor, markets and access to centres of commerce, industry and influence (McWilliam 2011).

NTT has some of the poorest roads systems in the country especially in the interior where many roads are unsealed, poorly maintained and closed for periods during wet season. The situation is similar throughout Timor-Leste. The highway between Kupang and Atambua town on the East Timorese border is well maintained (Barlow & Gondowarsito 2009). The main port within the Indonesian part of the ATS region is located in Kupang and besides Atapupu and Ende on Flores all other ports in NTT are 'barely developed'. Kupang is the largest port but it is poorly equipped to handle containers, though new facilities are under construction. These ports also service passenger ferries with nearly 2 million people travelling on inter-island and national ferries in 2005 (Barlow & Gondowarsito 2009). It is expected these numbers will decline with more reliance on cheaper domestic air travel. 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. There are no slip or shipping repair facilities and the two naval patrol boats acquired from China in 2010 have to travel to Java for maintenance. However improvements in maritime, road and air transport have the potential to deliver significant social and economic benefits to Timor-Leste (Bateman & Bergin 2011). The main port in Dili is being refurbished with assistance from Japan and a new multi-purpose port is planned for Tibar to the west of Dili, including an oil terminal, ship repair and maintenance facilities and cruise ship berthing facilities. A new port is also planned for Suai on the south coast of the island to service the petroleum industry and as a naval base (Bateman & Bergin 2011).

Electricity and water supply outside the capital Dili are unreliable and often non-existent outside district capitals.

Northern Australia shares similar characteristics to Timor-Leste and Indonesia in being located a long way from core markets and supplies (mostly located in the southeast of Australia) but operates its own 'cores and peripheries' 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. Indeed some towns in the north are largely considered as service towns and are significant employers in the region.

[40] http://whc.unesco.org/en/tentativelists/5062/ - accessed 18/05/2011

Infrastructure in the northern Australian region is considered to be 'limited' with a restricted all-weather road transport network and very few ports. Services are also limited to a few rural regional centres in each state or territory. For example one third of the 54 catchments in the TRaCK region do not have any education facilities (Larson & Alexandridis 2009). 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 very limited transport and services. The landscape has prevented the development of services, the provision of which is currently poor. Roads are in poor condition throughout the dry season and impassable in the wet. Bowe (*nd*) reports there no banking or credit 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 *nd*).

4 Socio-economic Sectors and Coastal Livelihoods

The ATS region is extremely rich in living and non-living marine resources. The oceanic, coastal and catchment areas support a wide range of economic sectors, from subsistence and recreational fishing to industrial commercial fisheries and other marine resource uses, such as multi-billion dollar mineral, oil and gas production industries, aquaculture, marine tourism, shipping/ports and inter-island trading, transport and defence related activities. Some sectors are highly developed, such as fisheries and mining, and others are not, reflecting the lower level of socio-economic development in parts of the region.

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. The seas provide livelihoods and food security for millions of people. The seas also support social and customary activities and values among many different language groups and cultures.

Key socio-economic 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, however their impacts are considered minimal.

There are major contrasts between the maritime economies and sectors of the different sections of the ATS region with offshore oil and gas, shipping, fisheries and marine tourism still in its infancy in Timor-Leste compared to Australia and Indonesia (Bateman & Bergin 2011).

In this report, although we focus on resources, sectors, production markets or particular sets of issues, we also recognise that livelihoods are about people – the individuals, households and groups – and the importance of understanding their capacities and potential, not just their problems (Cattermoul *et al.* 2010).

A livelihood comprises the capabilities, assets (including material and social resources) and activities required for a means of living. To be considered sustainable, a livelihood should be able to cope with and recover from stresses and shocks, maintaining its capabilities and assets both now and in the future, while not undermining the natural resource base (DFID 1998). Thus income-generating

activities are but one – though often the most important – part of a people's livelihood. Livelihoods are made up of a complex of factors, assets and relationships which determine the diverse ways in which people respond to different situations (Cattermoul *et al.* 2010)[41] .

The strategies and responses to fluctuating resource availability employed by individuals, households and communities in the ATS region include saving resources for times of scarcity, diverse occupational strategies, household division of labour, species target switching, reduced spending and mobilisation of cheap assistance (Allison and Ellis 2001). The capital assets available to different sectors of the community vary greatly. For example, local fishers have access to land, but immigrants do not. However, both have local impacts on resources. It should be also noted that fisheries in Indonesia ATS are dominated by immigrant ethic groups with some coming from small island ecologies such as Raas and Tonduk Islands in Madura, Eastern Java (Fox & Sen 2002, Fox 2009). It is likely migration is at least partially driven by ecological overexploitation or limited access to local resources in their place of origin.

It is outside of the scope of this socio-economic profile report to conduct a detailed Sustainable Livelihoods Analysis of the livelihoods of coastal people in the ATS region. We suggest a separate study is required drawing on the results of this socio-economic characterisation (see recommendations in Section 0).

4.1 Capture Fisheries: Regional Overview

Fisheries in the ATS are very much multi-sectoral, involving subsistence, artisanal, and various scales of commercial/industrial fishing. The way these sectors interact in terms of fish production, environmental effects of fishing, social and economic dimensions is relatively un-studied and poorly known. Some interactions have the potential to be extremely important for understanding the drivers for fisheries activities and their consequences, but in the scope of this report we can only suggest some of the possibilities. To illustrate the dilemma, a frequently asked and important question is "how does industrial fish trawling in the Arafura Sea affect subsistence or artisanal fishers

Fishing boats in Pepela, Rote Island [Photo: N. Stacey]

[41] Natural assets – are the natural resource stock or environmental services provided for livelihoods; human assets – skills & knowledge, capacity to work, education and health, access to food; social assets- networks of relationships, patronage and obligations within households and communities; physical assets – infrastructure, technology, tools and equipment; financial assets – wages, savings, remittances, access to credit; political assets – extent represented in community and role in decision-making (Townsley 2004).

in the bordering communities?" It is, in fact, impossible today to quantify these affects and is therefore not possible for governments to make informed policy choices about this or other such critical fishery issues in the ATS.

Set against the diverse marine features that characterise the ATS are subsistence, artisanal and large, industrial scale, commercial fisheries. Given the social, cultural and economic differences among the ATS nations, fisheries in the region are extremely diverse with multiple sectors, target species and gear types, motivations to fish, and socio-cultural background of the actors.

Many of the data that follow should be considered as indicative only. Estimates of catch, consumption and statistics based on these are reported variously in the literature. One of the serious fisheries issues in the ATS is the degree of unreported fishing which, of course, compromises the accuracy of many of the statistics produced and conclusions drawn from the information. However, we believe that the important messages in the "broad brush" description of the fisheries situation in the ATS that we present are robust to the uncertainties inherent to the information sources.

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. Per capita fish consumption of capture fish across Indonesia in 2005 was 19 kg (FAO 2010a). It is highly likely that this will be greater in the Indonesian coastal communities within the ATS. In Timor-Leste, annual per capita fish consumption is far lower at an average of a mere 6.1 kg (range 3.9 to 16.9 in non-coastal and coastal communities, respectively) (FAO 2011). 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.

Reflecting the high per capita fish consumption in Indonesia, the capture fisheries sector contributed nearly two percent of the nation's GDP. Indonesian fisheries exports ranked third among agricultural exports behind palm oil and raw rubber in 2003 (ASEAN 2005).

Production from capture fisheries in Indonesia in 2008 was nearly 5 million tonnes, making it the world's third largest capture fisheries producer (FAO 2009). It is therefore logical that the following section describing Indonesian capture fisheries is far more detailed than the sections covering fisheries of the other participating nations. Total capture fish production in Australia and Timor-Leste is approximately 4.1 and 0.01 percent of the Indonesian production respectively. The differences in national scales of dependency on, and production of, fisheries products has led to some important differences in the ways these resources are viewed by the public and their governments. Whilst not articulated explicitly, differences in perception can perhaps be best illustrated by the observation that fisheries management in Indonesia has a strong emphasis on development of the sector while in Australia there is greater emphasis on conservation of fisheries resources and biodiversity. Timor-Leste lies somewhere between the two points of emphasis, and is to some degree a product of that country's recent independence and development phase.

Commercial fisheries in the ATS are not only of local, regional and national significance and interest. The Arafura Sea, in particular, has attracted fishing operations from China, Thailand and elsewhere and for decades has been viewed as a commercial fishing frontier. In Australia, after the ratification of the Australian Fishing Zone (AFZ) in 1979, up until 1990 Taiwanese, Thai and Chinese vessels continued to fish areas of the Arafura Sea in the AFZ under Australian licence agreements (McKey and Lloyd 2005). Access to Australian waters by foreign fleets ceased in 1991 and domestic operators took the opportunity to begin exploiting these stocks. It is likely that some of the foreign fishing in Australian waters shifted to the north into Indonesian waters (which at the time included the waters now part of the Timor-Leste EEZ).

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 (**Error! Reference source not found.**). It also contrasts with Indonesia's Commission for Stock Assessment 2010 report that classifies many of the Arafura and Timor Seas fisheries as fully exploited or over exploited (Anon 2010).

Along the international boundaries some fish stocks, notably several species of commercially valuable snappers, are confirmed as genetically shared stocks (Blaber *et al*. 2005, Salini *et al*. 2006). Many other fish and invertebrates of ecological or commercial importance that straddle the international borders are also likely to be shared, though studies to confirm this have not been carried out. Catches of migratory species such as the several species of turtles moving throughout the ATS are probably not recorded as their capture is illegal.

Table 16: Number of fishers, total reported catch and reported value of catches across the ATS (2009)

		Fishers	*Catch (t)	Value (billion IDR)	IDR/t (million)	Value (million AUD)	$AUD / t
Indonesia	NTT	66,126	117,190	**IDR 1**481.5	4.1	53.7	458.23
	Maluku	88,778	341,966	1,573.30	4.6	175.5	513.21
	Papua	57,631	228,165	4,125.10	18.1	460.2	2,016.96
	Total	**212,535**	**687,321**	**6,180**	**9.0**	**689.4**	**1003.02**
Timor-Leste		6,360	3,066			5.3 M	1,140
Nth Australia		625+	13,340			110.3 M	8,271.81

This includes data from three provinces of Indonesia (source: National Fisheries Statistics of Directorate General of Capture Fisheries – DGCF 2010), three states of northern Australia (Handley 2009; DEEDI 2010; Fletcher and Santoro 2010) and Timor-Leste (dos Santos Silva 2009a; Nugroho 2009, NDFA-MAF 2010).

*Data for the Indonesian provinces include the entire area of each province, not just the islands or coastlines within the ATS. Information for Australian states includes only the commercial fisheries that actively fish in the ATS and does not include recreational or subsistence fishing. *Catch includes all wild caught species, such as fin fish, crustaceans and molluscs, and does not include aquaculture or pearl harvesting.*

The ATS is also a hotspot for illegal, unreported and unregulated (IUU) fishing which is largely due to the region's comparative remoteness and exploitation history. Wagey *et al*. (2009) estimate that IUU catch in the Indonesian Arafura Sea waters was most likely to have been more than one million tonnes per year among the various fisheries and gear types during the period 1984 to 2005. Equivalent estimates have not been made for Australian or Timor-Leste waters but it is widely accepted that IUU fishing has been a significant source of mortality for some species and probably exceeded, and may still exceed, that from some legal fisheries in Australia and Timor-Leste. Since 2007, when Australia intensified surveillance and control activities, IUU fishing in Australian waters has been radically reduced. The consequences of reducing IUU fishing in Australian waters are poorly understood in terms of the flow on effects to other parts of the ATS.

Data regarding the impact of destructive fishing techniques such as blast fishing and the use of cyanide are not available so the impacts of these activities on fisheries species and habitats is not fully understood.

Another insidious trans-boundary issue affecting fisheries in the ATS is marine pollution. Marine debris, including ghost fishing nets, have been a focus of attention in Australia but less so in the

other ATS countries. Identifying prints or marks on plastic items suggest that much of the debris appearing in Australian waters is of SE Asian origin (White 2006). Likewise, many of the ghost nets found in Australian waters are not of a type used in Australian waters (Gunn 2011). Many of these ghost nets may be lost or cast off from IUU fishing vessels.

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

Overall as a region, the ATS can be characterised by stark gradients across international boundaries in terms of human population, resource health, economic opportunity and strength of the governance arrangements. These gradients are strong drivers of trans-boundary activities.

4.2 Indonesia Capture Fisheries and Coastal Livelihoods

Fish and fisheries are of great importance to Indonesia. Fish provide a significant percentage of the population's animal protein and nutritional needs and it is estimated that 2.1 million Indonesians are directly involved in capture fisheries, that is, as fishermen. 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.

The Government of Indonesia has set very ambitious growth targets for its fisheries[42] which reflect Indonesia's emphasis on development and poverty reduction. While it is expected that much of any increase would come from aquaculture, some increase could be expected to come from capture fisheries for small pelagic species, skipjack tuna and squid from some fishery management areas of Indonesia where their exploitation is moderate (Anon 2010).

GOVERNANCE OF FISHERIES

Multiple layers of government are responsible for fisheries governance in Indonesia. Indonesian fisheries legislation (Peraturan Pemerintah Republik Indonesia No. 54/2002 Tentang Usaha Perikanan) states that district (Kabupaten) governments are responsible for licensing fishing vessels which are non-motorised, have outboard motors or have inboard motors but are less than 10 gross tonnes (GT). Provincial governors issue licenses for fishing vessels over 10GT and up to 30GT range. Licenses for vessels over 30GT and foreign-owned vessels are issued by the national government.

To support fisheries management in Indonesia, the territorial and EEZ waters were divided into 11 regions (Marine and Fisheries Ministerial Decree no. 01/2009). Four of these fisheries management areas are partially or entirely bounded by the ATSEA region, i.e. Arafura and Timor Sea (FMA –718); South and South-eastern Banda Sea (FMA-714); Southeast Maluku and Seram Seas (FMA-715) and the eastern part of Indian Ocean South of Java – Nusa Tenggara (FMA 573). With a total area of 481,511 km^2 in Indonesia the Arafura and Timor Seas constitute around 7% of the Fishery Management Areas or 11 % of eastern Indonesian waters. Indonesia's territorial and maritime borders within the ATS are shown below in Figure 12.

A list of Indonesian legislation dealing with fisheries is given in APPENDIX 3.

[42] www.antaranews.com/berita/244719/produksi-rumput-laut-lampaui-target - accessed 29/07/2011

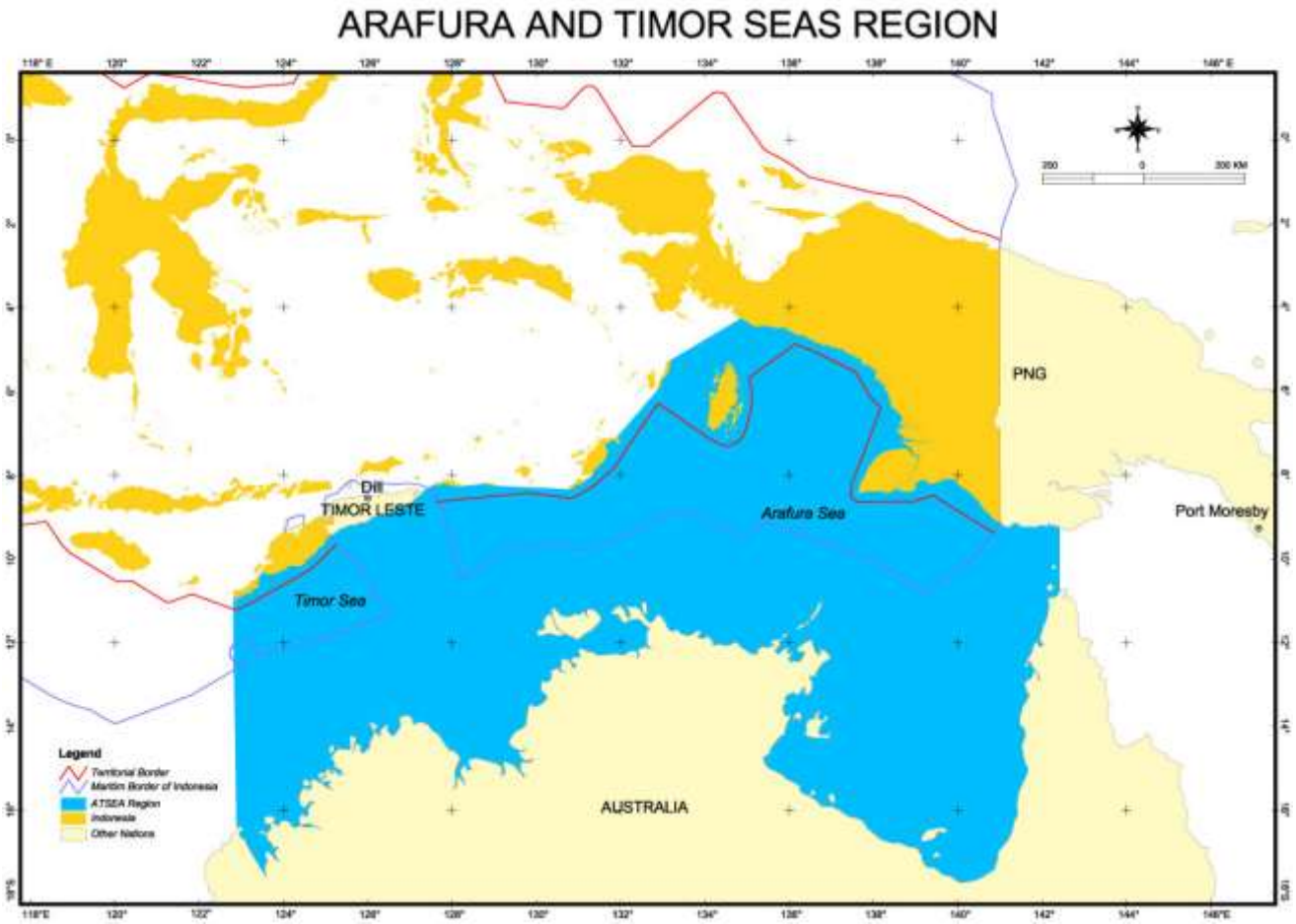

Figure 12: Approximate Arafura and Timor Seas region, showing State boundaries (from Ministry of Marine Affairs and Fisheries, Indonesia).

FISHERIES

Indonesia's industrial-scale fisheries are among the largest in the Southeast Asian and Australasian regions and the net fishing and shrimp trawl fisheries in the ATS, are two of the country's largest fisheries. The Arafura Sea has been heavily exploited for shrimp and demersal fishes for decades but a critical lack of fisheries biological and socio-economic information continues to hinder the development of a quantitative basis for fisheries management.

The shrimp fishery consists entirely of industrial scale commercial fishing, involving hundreds of trawlers and has been economically significant for generations. Purwanto (2010) estimates that in the year 2000 the shrimp fishery experienced fishing effort I that was as much as 25 percent higher than that needed to produce Maximum Sustainable Yield (E_{MSY}) and was at a level almost 50 percent higher than that needed to achieve Maximum Economic Yield (E_{MEY}). This suggests overfishing and substantial loss of economic rents from the fishery. Over the past decade fishing effort has been wound back to more sustainable levels (Purwanto 2011).

Equivalent estimates for the industrial fish net (demersal trawl) fishery are not available. However, the demersal fishery is classified as over-exploited, and particular species may be threatened. Nuraini and Ernawati (2009) note reduced CPUE for the saddle tail snapper (*Lutjanus malabaricus*) in the bottom longline fishery in the Arafura sea as well as diminishing size at first capture ($LC_{50\%}$) for this and other snapper species. The authors suggest that diminished CPUE and size could both be due to overfishing but didn't specify how the various sectors may contribute to the overfishing. It is

thought that between 700 and 800 vessels operated in the fish net fishery between 2000 and 2005 (Purwanto 2011, Blaber *et al*. 2005).

There is much species overlap between the shrimp trawl and fish net fisheries due to a high degree of spatial overlap and the use of similar gears – including small mesh size cod ends in the fishnet fishery (Nuraini & Ernawati 2009) and dispersed distribution of many species, including the red snappers which may appear as juveniles in the shrimp trawl fishery (Blaber *et al.* 2005).

Although the red snapper species make up less than one percent of the total catch of the fishnet fishery their selection at a small size and a very large total catch means that the effect on the red snapper fishery is likely to be significant. Assessments indicate that substantial reductions of snapper catch are needed to prevent a stock collapse in the Indonesian fishery (Blaber *et al*. 2005). Since the stocks are shared to some degree, by implication the Australian fishery may also be at risk.

Red snappers are of common interest to Indonesia and Australia because of their high value and the fact that their catch supports several Australian fisheries and the bottom longline fishery in Indonesia. There are however, many other species in the demersal trawl catches that are also vulnerable to over-fishing. In Indonesia many of these other species also have commercial value, unlike in Australia where their catch is minimised by gear design and operation (Handley 2009). Further, there is clear evidence of the impacts on the sessile benthic community from demersal trawling (e.g. Sainsbury *et al.* 1993). It is not yet entirely clear what impacts the loss of structure can have on community structure and fisheries productivity since many valuable species are often associated with structure at various times in their life history on an otherwise mostly featureless bottom.

In 2008, the coastal commercial fishery of the Arafura region contributed almost 80 thousand tonnes of fish landed (DGCF 2009).

Fisheries in the Timor Sea mainly target pelagic fish resources and the level of exploitation of demersal fish is low compared to that in the Arafura Sea. This is due to a relatively small area of trawlable grounds in the Timor Sea. Despite less fishing effort, the targeting of long lived species such as snappers, groupers, sharks and rays using selective gear such as bottom long lines on sloped areas means these fish species are probably experiencing high levels of exploitation.

Industrial scale fishing activities in the Indonesian ATS are often based out of ports beyond the ATS and sometimes as Indonesian-foreign joint ventures (Blaber *et al*. 2005). This suggests that benefits from the ATS region flow on to other parts of Indonesia and beyond. Demersal long-line and trap fisheries target commercially valuable snappers and are active throughout the ATS region (and elsewhere in Indonesia), including along the edges of the international boundaries. While contributing to the overfishing of red snappers, Blaber *et al*. (2005) considered this fishery to be a secondary threat after demersal trawling in the Arafura Sea.

Overcapacity fishing is a severe problem in many of the world's fisheries (FAO 2009) and the ATS is no exception. Indonesian statistical reports recorded 112,000 marine fishing vessels in the provinces bordering the ATS during 2009 (DGCF 2010). Only around 8,500 (7.6%) of these were vessels with inboard motors, thus many of the 112,000 vessels would be small and not all would be used in the ATS. Nevertheless, the numbers suggest a very large cumulative fishing capacity. This probably has far reaching consequences for the region since overcapacity and excess effort lead to lower catches per unit of effort and, therefore, lower fuel efficiency. The relationship between excess capacity and IUU fishing has been highlighted by both the FAO Committee on Fisheries and the UN General Assembly (FAO 2007; FAO 2009).

It is commonly accepted that the combined effects of intense domestic artisanal and industrial Indonesian and IUU fishing, often involving foreign fleets, is putting pressure on small-scale Indonesian fishers to cross boundaries in search of fish and sedentary resources. While Indonesia is trying to diversify livelihoods opportunities and reduce poverty, it is unlikely to remove these pressures in the near term and there is a possibility of fish stocks in areas of Indonesia declining

further before they get better. Thus the gradient between Indonesian and Australian fishing zones is steep, and may become even steeper, which is likely to continue to drive trans-boundary activity. This also seems likely to apply to waters under Timor-Leste jurisdiction.

FISHING COMMUNITIES

Fish and fisheries have long been integral parts of the socio-cultural and economic systems among Arafura and Timor Sea coastal populations. The populations of provinces in the ATS region are heavily reliant on fish as a source of protein and income.

Each of the 3 Indonesian provinces contains diverse ethno-linguistic coastal populations engaged in multiple livelihood strategies. Broadly these are categorised as having populations and villages identified as a) full time fishermen and/or heavily reliant on marine-based resources for food and income b) part-time fishing communities (mixed-fishing /agriculture/other). Among these two groups are a) long established local coastal populations with 'clear claims to tenure' (see above) and b) migrant fishing populations, particularly in NTT and Papua and to a lesser extent in Maluku, who are either long-term (fishers and families) or seasonal migrants most commonly belonging to the 'Bugis-Buton-Makassar-Bajo maritime populations of eastern Indonesia but also the Madurese. While there is frequent sociological mislabelling of these groups, in reality these migrants, particularly those active in the ATS region, come from small islands who are 'primary exporters of people' in South and Southeast Sulawesi including Bonerate, Karompa, Kalatoa, Batuata, Binangko, Kaledupa, Wanci, Pomana Besar and Selayar islands and more recently groups active in southern NTT province come from Alor district and the islands of Terang, Pura, Buaya and Pantar (Fox 2009, Fox 2011 – ATSEA Presentation).

Since the 17th century, sailing, fishing and trading activities have permeated as far south as northern Australia (Fox 1977; Stacey 2007; Fox 2009), throughout eastern Indonesia (Fox 2009, Fox *et al.* 2009) northwards to Malaysia and Singapore and even as far east as the island of Palau in the northwest Pacific (Stacey 1999, 2007). Over the last three centuries these groups have adapted diverse sailing, fishing and trading livelihood strategies in response to island environment, political processes and alliances, commercial trading networks (Sather 1997).

These migrating fishers and families of Bajo, Bugis, Butonese, and Makassarese originating from other areas of eastern Indonesia travel seasonally 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 exempt from licensing), contributing to declining habitats and reef resources in some areas.

Mobility and adaptability underlie the social and economic lives of these maritime populations and are key features of these communities (Fox 2009, Stacey 2007). People move regularly and frequently between home villages and transient or semi-permanent settlements across the archipelago, staying for short or extended periods in settlements. Mobility is facilitated by kinship, economic ties (patron-client), and historical antecedents (Stacey 2007).

The most mobile and specialised of all seafaring groups are the Sama-Bajo – commonly referred to in the academic and popular literature as 'sea nomads' (Lowe 2006, Stacey 2007, Fox 2005). This group are 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). The use of the term 'nomadic' is misleading and has been misused in the conservation literature, evoking representations of populations continually moving from place to place with no fixed address (Lowe 2006). This also ignores the customary practice of *merantau* among maritime populations in Indonesia.

Local and immigrant fishers in Indonesia have differences in capital assets; locals have access to land but immigrant have no land but both have local impacts on resources (Adhuri *pers comm*. 2010)

Various groups also engage in transboundary fishing in the Arafura and Timor Seas. Artisanal scale fishers from various settlements in NTT, including the districts of Rote Ndao, Kupang and Alor are engaged in trans-boundary fishing in the Timor Sea. This consists of both legal and illegal activities. Indonesians can legally fish in certain areas 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 MOU Box is approximately 55,000 square kilometres and includes Ashmore, Seringapatam and Scott Reefs as well as Cartier and Browse Islands and numerous banks. In 2008, over 550 fishers from Rote and Alor fished at Scott Reef, primarily for sedentary species. An unknown number fished for sharks more widely across the MOU Box. The total number of different Indonesian fishers who participate in the MOU Box fishery is much larger than the number active at any one time and probably numbers between 1,000 and 2,000 (2010) but may have been higher in previous years prior to border control.

Scientific evidence suggests that sedentary resources are being severely overfished. 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*). The MOU Box fisheries are 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).

Maluku

Given that 85% of Maluku is sea, it is hardly surprising that the people are highly dependent on marine products for their livelihoods, particularly for those living on small islands where access to agricultural land is limited. In 2009, there were an estimated 40,049 fisherman which accounts for only 9% of the total residents in the region (Table 17).

Table 17: Number of households involved in fishing activities and total fishers by district, 2009

District/Municipality	Fishery Households	Fishers
Maluku Tenggara	3,374	6,325
Maluku Tenggara Barat	4,411	12,663
Kepulauan Aru	n/a	13,403
Maluku Barat Daya	1,579	5,749
Tual city	953	1,909
Total		**40,049**

Source: BPS Maluku 2010

In practice, people living in coastal areas generally have double occupations, as farmers and fishermen. This represents a coping strategy for island communities in response to seasonal changes in resource availability and as a means of managing the environment. In some coastal and small island communities, women collect marine products in tidal areas, and children under the official working age also conduct fishing activities.

Fishing activities produce various marine products for the market (particularly for outside world markets), such as various kinds of coral and shallow-water fishes, sea cucumbers, abalones, pearls, trochus shells, *batulaga* shells [*Turbo marmorata*], crabs, shark fin, seaweed, green turtles, and lobsters. Some of these resources are endangered species. Most zones in this region are rich in marine resources (especially inshore waters/*wilayah meti*). However, production and marketing are mostly controlled by merchants based in the capital cities or elsewhere, and by large-scale foreign companies. Illegal and destructive fishing activities also threaten local marine resources.

Most of the population of Maluku are based in rural villages where people are engaged in swidden cultivation, hunting, forest extraction, animal husbandry, and fishing. Timing of economic activities is determined by the two seasons: the easterly season (dry season) and west monsoon (wet season). In addition to these activities, many people earn money from other occupations, such as waged labour for commercial fishing, private industry, civil service and work as *ojek* drivers (motorbike taxis).

Some prime commodities/products from agriculture are produced for subsistence and for market, such as yam and taro (Tanimbar), cassava (Kei), lemon (Kisar), onion (Lakor), sago (Aru), corn, peanuts, traditional coconut liquor (*sopi kelapa*), *koli* (palm liquor), and copra. Animal husbandry species are predominantly buffalo (Moa, Letti, Yamdena) and goats (Kisar, Letti, Lakor, Yamdena). Forests provide timber (Tanimbar), wild meats (deer, pigs, buffalo), birds (Aru, e.g. the famous birds of paradise, swallow bird nests, cassowary), and honey (Romang).

External economic factors influence local resource management systems, particularly fishing activities. However, fishers in the region are still characterized as artisanal 'subsistence' fishers using traditional technology and management systems. Fishing technologies and methods used by local fishers include fishing lines, nets, spears, harpoons, with fishers going out in traditional canoes, wading, and diving. However, outside technologies such as motorized and fibreglass bodied canoes have also long been used in some areas.

Although some local marine products fetch high prices on the world market, the income level of local villagers remains relatively low. This is largely due to limited technology, weather conditions, post-harvest techniques and technology, the presence of large-scale commercial fishing in the area, market problems, transportation and communication issues, daily expenditure and intertwined socio-cultural expenditure. Coastal fishing communities, especially those far from the economic centres, are considered economically poor.

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).

Papua

In Papua, the port towns of Sorong, Kaimana and Merauke are focal points for ATS fisheries from where both industrial and artisanal-scale fisheries operate. Local communities engage in small scale coastal fishing working as labourers and trading. Bugis, Butonese and Mimika fishermen are also active in the region.

Very few indigenous people of Papuan descent live on this coast. In Papua, the port town of Merauke provides a focus point for ATS fisheries, both industrial and artisanal scale. A number of settlements – e.g. Pintu Air on the periphery of Merauke, the fishing village of Lampu Satu (2 km to the east) and the boat building village of Kumbe (60 km to the Northwest) – host indigenous people and fishers belonging to migrant Bajo, Bugis and Butonese groups who access shark and trepang in the Arafura and Timor Seas. Illegal fishing voyages to the Gulf of Carpentaria usually commence in or around Merauke (Fox 2009).

Pintu Air is a fishing village located on the outskirts of Merauke[43] some 68km to the east of the Papua New Guinea border. Pintu Air sits on the shores of the Merauke River approximately two kilometres from the open waters of the Arafura Sea. According to local accounts it was established in the 1970s as a base for small boat shark fisherman operating in the Arafura Sea. The population of

[43]A large port town on the south coast of Papua province, in the regency of Merauke, subdistrict of Kurik.

Pintu Air is ethnically diverse comprising Bajo from Wuring village in eastern Flores, Bugis from Bulukumba and Pantai Beru in South Sulawesi; Makassarese and Bugis from Makassar city and Papuans from both the local Marind[44] group and the Asmat region on the south-western coast of Papua. The Bajo, Bugis and Makassarese are also intermarried and mingled with Javanese transmigrants. These ethnic groups have established distinct kampung (villages) in Pintu Air (Every 2009).

Prior to the introduction of new Australian government policies in 2006-2007 around the management of illegal fishing in the AFZ, shark fishing had been a key livelihood for maritime groups in coastal villages such as Pintu Air. Many shark fishermen however suffered great financial losses due to the destruction of their *bodi* shark boat fleets. In late 2008, many Bajo had returned to Wuring. The few remaining worked as crew on local fishing boats or had borrowed money from financers linked to the local seafood company to purchase new boats to engage in local fishing near Merauke harbour. Unemployment however was very high and according to the Bajo-Bugis heavy competition from industrial trawlers along with arbitrary 'fishing fees' and *sasi* restrictions on close-shore fishing imposed by the Marind and Asmat made it difficult to extract a profit from local fishing. Cargo boats carrying goods such as rice, fuel and building materials plying the large rivers from Merauke to the interior of Papua province also provide some local employment. These locally built boats owned by Chinese, Javanese or Makassarese bosses, make high profits because the prices of basic goods are much higher in the interior than in Merauke but competition for scarce positions is very fierce (Every 2009).

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.

Number of Fishers in ATS region of Indonesia

The fishing sector employs more than 247,000 fishers[45] in the provinces within the ATS region (Table 18) – from around the same number of households. It should be noted that the figures given below refer to the number of fishers across the entire province, some of which may not be within the ATS region. Fishers throughout the region utilise a range of types and sizes of boats and fishing gear.

Much Indonesian fisheries data is recorded based on coastal fishing zones of which there are eleven. Each coastal zone may incorporate several administrative districts.

[44] Marind is the name that applies to a large number of territorial groups that occupy the south-eastern coastal areas of Papua.

[45] Within this section we refer to fishers which fall into three categories based on the amount of time spent fishing, as follows: (i) Full time fishers –spend all of their working time fishing. (ii) Part time (major) fishers – spend the majority of their working time fishing but may have other work activities. (iii) Part time (minor) fishers – spend a minor part of their working time fishing.

Table 18: Number of fishers in ATS provinces of Indonesia, 2009

	Full time	Part time (major)	Part time (minor)	Total
Maluku	35,851	16,317	36,610	88,778
NTT	21,698	32,863	11,565	66,126
Papua	19,334	27,258	11,039	57,631
Papua Barat	11,655	16,432	6,655	34,742
TOTAL	**88,538**	**92,870**	**65,869**	**247,277**

(DGCF 2010)

Data based on national capture fisheries statistics from 2009 regarding the number of fishers (Full time, part time major and part time minor) in each coastal zone across Indonesia, are shown in APPENDIX 2: Table 24. The highest number of full time fishers (278,000) can be found in the waters north of Java which also had the highest number of fishers from all classifications followed by East Sumatera (Figure 13).

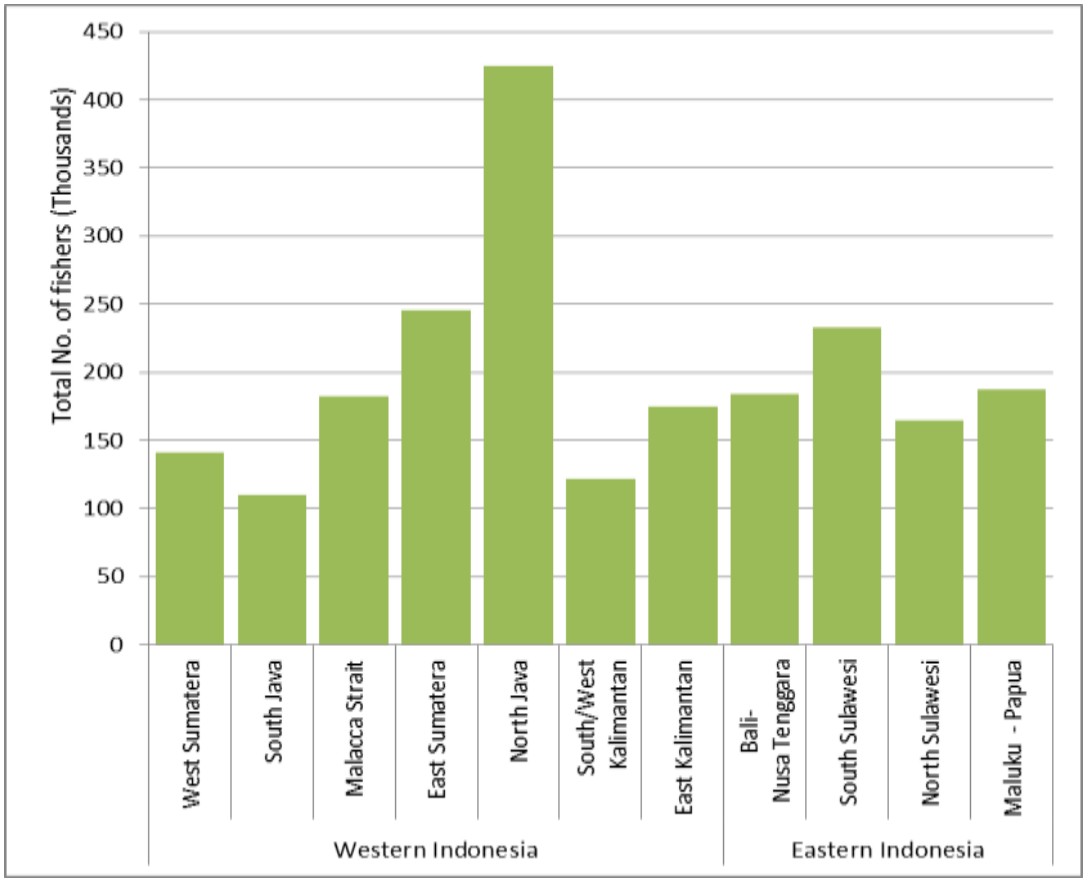

Figure 13: Total number of full and part time (major and minor) fishers in fishing zones of Indonesia, 2009 (DGCF 2010)

The majority of fishers within the ATS region are small-scale, artisanal and target coastal fishery resources. Migration of fishers from areas of high fisher populations and high exploitation levels to areas with low population with low exploitation levels has become a serious management issue for Indonesia.

There has been a general tendency for increasing fisher numbers in East Nusa Tenggara, Maluku and Papua over the period 1977-2008 (trends for numbers of full time fishers are given in Figure 14. The number of fishers in East Nusa Tenggara for example, was 300% higher in 2008 than in 1977. This peak in the number of fishermen in the mid-late 2000s also corresponds to high levels of illegal incursions in the AFZ.

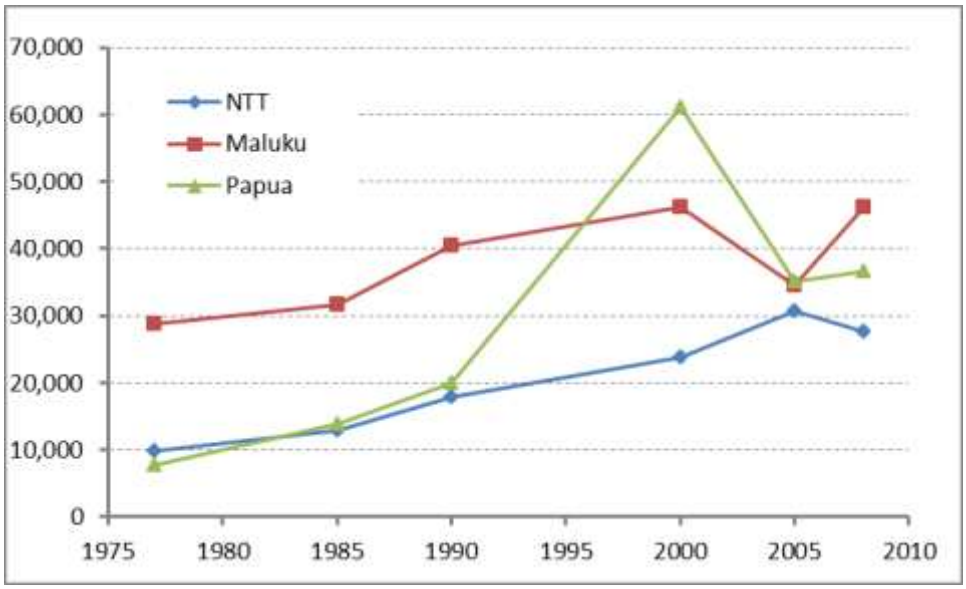

Figure 14: Number of fulltime fishers recorded in NTT, Papua and Maluku (1977- 2008) [Source DGCF 2010]

Figures for all groups of fishers (fulltime, major part time, minor part time) over the period 1977 to 2008 shows that numbers increased until 2004-2005 then declined in subsequent years in NTT and Papua provinces (APPENDIX 2: Table 25). However, the opposite was recorded in Maluku Province where the numbers of full time and minor part time fishermen increased following a decrease in 2005. There is no clear explanation for these changes but civil unrest in Ambon and Kei in Maluku may have contributed to the decrease. In general, the numbers of fishermen in Maluku and Papua are higher than in East Nusa Tenggara. These figures may not represent the number of migratory and seasonal fishers from outside of ATS provinces who are active in the ATS region.

FISHING VESSELS

The number of fishing vessels has increased continuously in NTT, Maluku and Papua since 1975 (Figure 15). Numerically the fishing fleet is dominated by vessels of less than 5 gross tonnes (GT) (APPENDIX 2: Table 27). Many of this class of vessel are non-motorized or have small outboard engines. The highest number of non-motorized fishing vessels was approximately 50,000 units in Maluku province and the lowest occurred in East Nusa Tenggara where there was about half of that number.

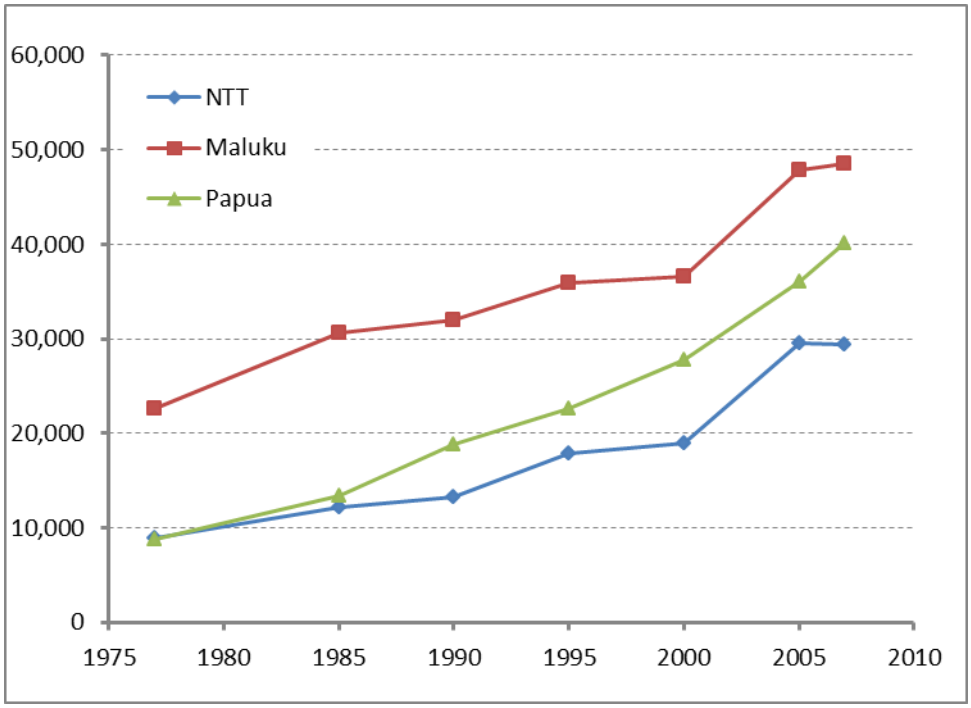

Figure 15: Total number of recorded fishing vessels in ATS provinces of Indonesia 1977-2007

Growth in the number of small vessels reflects the growth in the number of fishers. This phenomenon could simply indicate: (1) a general increasing fishing effort which is proportionately increasing pressure on fish resources, (2) increasing market demand for the available resources, or (3) a progressive increase in participation in fisheries by small scale fishers who exploit fish resources through using diverse fishing gear types; or all of the above.

There is a great deal of uncertainty about the availability and status of fish resources which are targeted by fishing activities, especially among the small (<5 GT) vessels in the fishing fleet.

Across the three provinces, the numbers of vessels in the 5 to 10 gross tonne size range have increased even more than the vessels under five gross tonnes. In Maluku and East Nusa Tenggara there has been an order of magnitude change during the past 20 years, while in Papua there has been a slightly smaller rate of change (APPENDIX 2: Table 27). The increase has also been rapid in the 10 to 30 gross tonnes size range. Statistics for large vessels in the 30 to 100 and greater than 100 tonne size classes are unclear.

Estimated Catches and Value

According to national fisheries data, the volume of capture fisheries in 2009 from provinces within the ATS was approximately 117,000 tonnes from East Nusa Tenggara; 342,000 tonnes from Maluku; 228,000 tonnes from Papua and 106,089 from Papua. These totals account for around 16.5% of the total recorded national marine capture fisheries production for 2009 (DGCF 2010). The estimated value of production for these four coastal provinces was 7.2 billion IDR 2009, which contributed around 14.5 percent of the total value of the national capture fisheries. Estimated total landings by coastal area are shown in Figure 16.

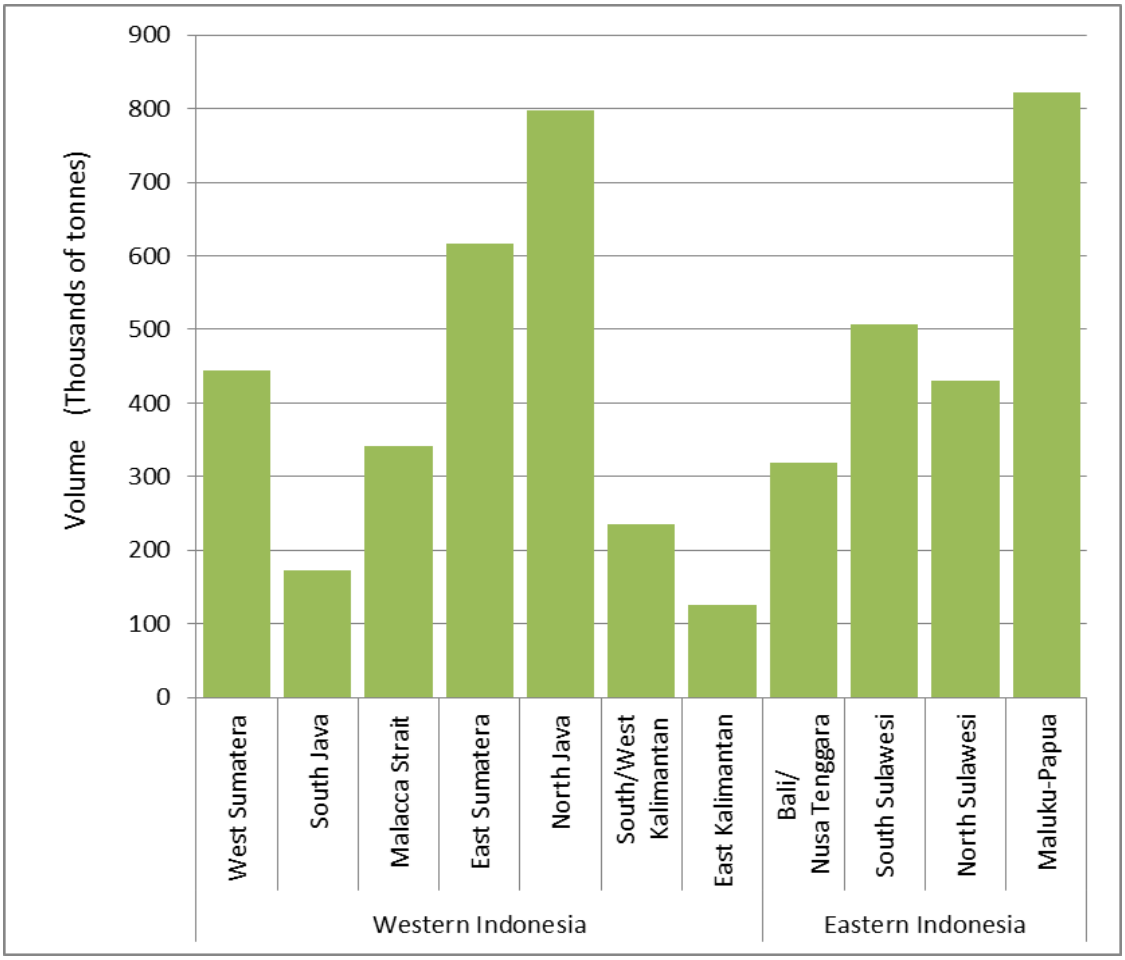

Figure 16: The estimated landings by coastal area in Indonesia in 2009 (Source DGCF 2010)

The Arafura Sea fishery is unlike other fisheries in Indonesia due to the large size of trawlers and the complex management problems associated with them, particularly for catches of demersal fish and shrimp and the destruction of benthic habitat (Dudley & Ghofar 2006). As problematic as these fisheries are, they provide important sources of national income and foreign exchange. It is also interesting to note in 2009, the total number of fishers in the four ATS provinces accounted for 11.4% of the national total, yet the recorded volume of fisheries product landed accounted for 16.5% of the national total (based on data from DGCF 2010) indicating a larger volume catch per fisher.

General indicators of shrimp catches in the eastern part of Indonesia[46] suggest catches reached a peak in the late 1990s (endeavour prawns) or early 2000s (banana prawns). In the time since these peaks, catches have declined by approximately 28 and 22 percent, respectively (APPENDIX 2 – Table 26). These trends suggest that after the year 2000, exploitation reached the maximum level. There is no evidence in the statistical data suggesting a similar decline in the catch of sharks or rays in recent years even though this vulnerable taxa is widely believed to be overexploited (Dulvy *et al.* 2008; Camhi *et al*. 2009). Catches of other small and medium demersal species have also continued a general rise.

Fishers Household and Production Profiles by District

Indonesia is a large archipelago and the area included in the ATS consists of many small islands. Sixteen districts administered by four different provincial governments and policies are located in the

[46] www.seaaroundus.org – accessed 21/05/2011

ATS region of Indonesia (Table 19). Districts belonging to the provinces of Papua and West Papua are closely connected to the shallow waters of the Arafura Sea and a number of estuaries and rivers along the coast. Fish resources of the Papuan provinces consist mainly of shallow water demersal fish species. The districts of East Nusa Tenggara and Maluku are mainly linked to oceanic waters and make use of small and large pelagic fish resources including the migratory species associated with the Timor Sea and South-eastern part of Banda Sea.

Data for district profiles are based on several available data sources obtained through local government websites. Due to gaps in historical data, all information shown may be based on data for 2008, 2009 or 2010.

The total population based on 2010 national census in this ATS districts is around 2.8 million people with almost 34,000 households working as either full or part time fishers. The largest number of fisher households can be found in Maluku Tenggara, with the smallest number found in the city of Kupang. Communities of these districts of Indonesia are arguably the most dependent on marine resources from the ATS among those of the four nations involved.

Table 19: Population density by district and number of fisher households in 2002 and 2009.

YEAR – POPULATION	2002*		2009**	
	Population	Fishers	Population	Fishers
PAPUA				
Mimika	131,715	1,739	183,633	2,107
Asmat	59,037	nd	77,053	2,226
Mappi	nd	nd	81,781	2,642
Merauke	336,376	4,381	195,577	4,155
MALUKU				
Aru			84,178	970
Maluku Tenggara	204,994	3,817	96,442	9,755
Maluku Tenggara Barat	155,645	15,474	105,341	
Maluku Barat Daya			70,372	1,822
Tual city	nd	nd	nd	nd
EAST NUSA TENGGARA* **				
Kupang district.	332,149	3,108	304,548	2,445
Kupang	251,170	941	336,239	495
Timor Tengah Selatan	404,516	577	441,155	590
Timor Tengah Utara	177,918	807	229,803	507
Belu	331,412	526	352,297	565
Rote Ndao	102,651	4,914	119,908	4,377
Total			**2,791,723**	**33,966**

Source : * Lubis *et al*., (2006b); ** www.bps.go.id; *** NTT 2009

Comparison of 2002 and 2009 data, show large increases in fisheries production levels reflecting continued effort by local governments to increase fisheries production. The estimated total production in 2009 (excluding data from Maluku) was more than 200,000 tonnes with a valued of 3.2 billion IDR. The highest level of production occurred in Merauke district with almost 133,000 tonnes valued at over 2.2 billion IDR. Timor Tengah Selatan, Timor Tengah Utara and Belu districts had the lowest production levels of less than 1000 kg year^{-1} (Table 20).

Table 20: Estimated Production (tonnes) and values (x 1000 IDR) by district

YEAR – POPULATION	2002*		2009**	
	Production	Values	Production	Values
PAPUA				

Mimika	2,969	27,681	7,197	144,817
Asmat	75,429	255,914	5,439	125,441
Mappi			25,125	353,373
Merauke			132,685	2,207,972
MALUKU				
Aru	nd	nd	22,304	62,629
Maluku Tenggara	nd	nd	292,733	104,593
Maluku Tenggara Barat	nd	nd	90,369	729,144
Maluku Barat Daya			15,253	170,853
Tual City	nd			
EAST NUSA TENGGARA* **				
Kupang district	6,451	19,324	11,884	47,786
Kupang	17,137	46,429	17,217	75,265
Timor Tengah Selatan	369	1,293	795	3,353
Timor Tengah Utara	377	1,377	940	3,200
Belu	222,4	7,611	918	7,897
Rote Ndao	1,580	3,830	2,536	7,117

Source : * Lubis et al., (2006b); ** www.bps-maluku.go.id; www.bps-papua.go.id ;
*** BPS NTT; nd : no data available

Fishing Patterns and Gear

The vast majority of fishing trips in the region are made by small-scale fishers going out and returning on a daily basis. The numbers of fishing trips made by large scale/industrial fishing operations are far fewer, but they account for a larger portion of total fisheries production. Larger vessels most frequently land their catch in the major fishing ports of Makassar, Kendari, Sorong, and Probolinggo which are located outside the ATS area. However, some land in Merauke, Tual and Ambon which are within the region. Fisheries data from 2008 show that gill-nets, long-line and hand-line are the numerically dominant fishing gear types used in the area (APPENDIX 2: Table 24). These gear types are used by all fishing groups from small scale fisheries (day trips) – which account for most of the gear units – up to commercial fishing vessels of more than 100 GT which stay at sea for long periods of time and use much larger versions of the same gear. Over the past couple of decades, the fishing gear used by many large-scale and mechanized fishing operations in the area has been shrimp and fish trawl gear and these operations account for most of the catch.

Whilst the number of trawls, fish nets and purse seiners is small compared to the number of many other forms of fishing gear, they produced the highest catches during 2008, while the more ubiquitous gear produced far less (APPENDIX 2: Table 24, Table 25). The small scale classes of fishing gear generally operate with low (or no) fuel consumption but do not produce large catches.

There has been considerable interest in alternatives to trawl fisheries because of the non-selective nature of this type of fishing which results in large volumes of by-catch and subsequent high discard rates. Additionally, trawlers can damage habitat because of contact between the net and the bottom. No substantial progress has been made towards finding an alternative at this stage and trawling is banned throughout Indonesia except for in the Arafura Sea (Evans & Wahju 1996).

Number of Fishing Boats and Gear

The number of fishing boats, particularly those fishing close to shore, has increased continuously in recent years. A large number of boats with inboard motors [for which there is no specific information regarding the length overall (LOA) or GT] occurred in the districts along the west coast of Papua (APPENDIX 2: Table 27). Of the total 2,100 outboard motors and 8,700 inboard motors recorded in the region in 2007, around 48% of all outboard motors and 86% of inboard motor boats were recorded in Mimika, Asmat, Mappi and Merauke.

Trawl fishing boats which target demersal fish species were found along the West Papua coast, particularly in Merauke, a fishing port close to the Arafura Sea, where there were around 1,100 trawl fishing boats. The west coast of Papua accounted for around 64% of all recorded trawlers. This combined with approximately 775 trawler units recorded at Kupang mean that trawl fishing equipment made up around 36% of the total gear recorded in the region (APPENDIX 2:Table 28).

Bottom long line fishing gear, which targets large demersal fish in areas unsuitable for trawling, was found in East Nusa Tenggara with the majority in Kupang with an estimated 370 units, around 170 units were recorded in Rote Ndao and 70 units in Timor Tengah Selatan. This suggests that the most significant exploitation of large demersal fish such as Snapper, Groupers and probably sharks and rays is by fishers based in those districts.

Only limited data are available regarding the number of boats and fishing gear from Maluku, though fisheries production in this province appears to contribute significantly more than East Nusa Tenggara.

ESTIMATED PRODUCTION

Data regarding exploitation of fish resources by district shows that the highest catches were landed in Merauke. Demersal species including shrimps, sharks and small pelagic fish made up the largest group of fish landed, followed by small pelagic fish (APPENDIX 2: Figure 25). Fisheries production in all districts along the coast was dominated by capture of demersal species, suggesting that coastal communities of those districts are strongly connected to the coastal shallow waters of the Arafura Sea. Demersal fish species are clearly a central part of local livelihoods, and sustainable use of these fish resources and protection of fish habitat is of vital importance.

Marine fish production in East Nusa Tenggara is mainly dependent on the small pelagic (scads, sardines, mackerel) and large pelagic fish resources (Spanish mackerel, skipjack and yellowfin tuna). However, demersal fish species also play a dominant role in total production in Kupang (city and district). Considering areas suitable for trawling are limited in the Timor Sea, this high production of demersal fish suggests that large numbers of fishing vessels equipped with bottom longline equipment must be operating in the area or some vessels equipped with fish nets that are based in Kupang operate in the Arafura Sea (APPENDIX 2: Figure 26).

According to 2007-2010 data, marine fish production in the districts of Maluku consists mainly of small and large pelagic fish species (APPENDIX 2: Figure 29), while shrimps contribute around 3 to 4%. Catch were dominated by skipjack and scads with average of 30 and 25% while the average production of tuna species approximately 10% of total landings (BPS Maluku 2010). A few demersal species were caught and listed as part of other species.

Fisheries catch data separated by district show that Maluku Tenggara makes the major contribution to marine fish production with small pelagic species. The majority of large pelagic species were also landed in Maluku Tenggara. The majority of shrimps caught were landed at Aru.

4.3 Timor-Leste Fisheries and Livelihoods

Coastal and fishing communities Timor-Leste broadly reflect the characteristics of general Timorese rural communities. They are socially and linguistically diverse, geographically dispersed around East Timor's coastline, and poorly connected to larger administrative and market centres.

NUMBER OF FISHERS

Contrary to the people of the surrounding islands of Indonesia, the East Timorese have not had a long maritime history (McWilliam 2003) and the number of Timorese families involved in full time fishing and marine-based activities is relatively small. Prior to 1999, many non-Timorese fishing populations (e.g. Bugis, Butonese, and Bajo) living in Timor-Leste supplied much of the local and export markets. After Timor-Leste's independence these populations left and have not returned to the newly independent state. However, informal arrangements between fishers in West Timor and other parts of NTT, and Timor-Leste still persist. Trade in tuna, fresh reef fish and sundried fish to Timor-Leste from West Timor and further afield in NTT has developed to supply seafood to restaurants in Dili (Ria Fritriana, *pers comm*). Small scale, informal joint ventures between Timor-Leste fishers and Indonesian fishers also exist, such as tuna fishing around Fish Aggregating Devices (FADs) locally referred to as *rumpon* (dos Santos Silva, *pers comm*).

The current low levels of fishing are also a result of the almost total destruction of fishery infrastructure during 1999 (dos Santos Silva 2009a). Many villages and towns with fishing communities were severely affected and this resulted in a significant drop in available operational boats and gear. Recent technical assistance, particularly from China which reportedly contributed some 300 (15 hp) outboard motors and 1500 gill nets, has helped address some of these constraints. However, the immediate prospects for a revitalised and prosperous local community-based fishing sector remain poor. This conclusion also takes into account the natural ecological conditions of Timor-Leste, where the steep coastal topography limits the area of shallow waters and the growth of coral reefs (Sanyu Consultants 2001). Current evaluations indicate that offshore reef and deep-water fishing, particularly on the marine resource rich Sahul Shelf some 140 km to the south of East Timor are more suitable for development. However, the economic resources required to exploit such areas are beyond the means of most coastal Timorese fishing households and their prospects for future participation in such activities is probably very limited.

During a recent study by the Food and Agriculture Organisation fishermen stated that a lack of fishing gear was the most significant factor constraining their ability to fish, followed by lack of skills, education and capital (FAO 2011). Constraints such as lack of storage, gear limitations and the cost of fuel mean that current fishing activity is generally restricted to small-scale inshore fishing.

Many rural coastal villages are not well connected to urban areas and as a consequence are heavily reliant on subsistence farming and fishing. However, few East Timorese rely on fisheries as their primary livelihood activity (dos Santos Silva 2009b). Whilst there has been some increase in the number of people engaged in fishing (Figure 17) in recent years, the number still remains low. Most fishing activities are conducted by the estimated 6,360 full time fishermen (0.60% of the population) (MoF-NSD 2010).

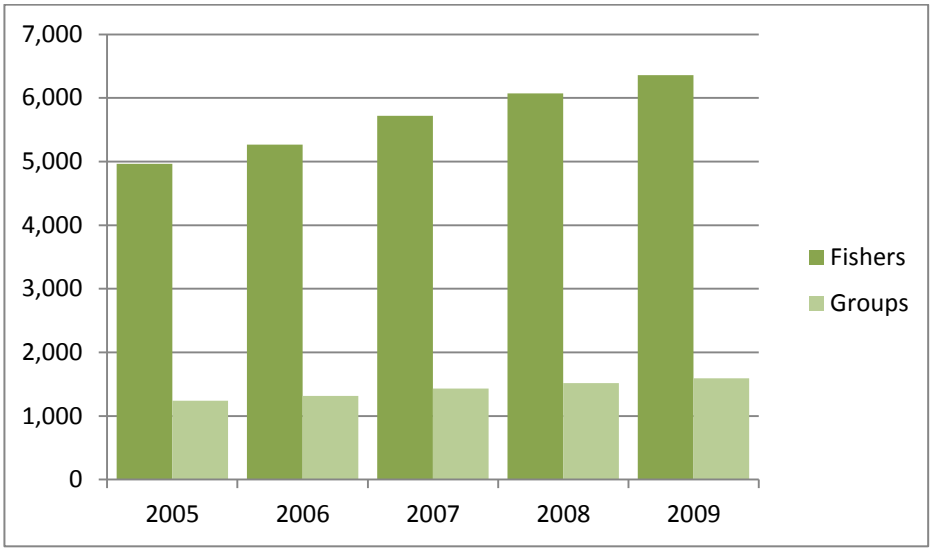

Figure 17: Number of fishers and fishing groups in Timor-Leste (2005-2009)

[Source: NDFA-MAF 2010]

Women glean inshore areas for various marine products collecting shellfish at low tide and also participating in the "sea worm festival". (Lloyd *et al*. 2009) but appear to have no significant role in commercial fisheries. The greatest numbers of fishers are located in the district of Dili (Table 21), which also includes the island of Atauro.

Table 21: Number of fishers (fulltime) in Timor-Leste and fishing centres (2009)

Districts	Area (km^2)	Total				Fishing Centres
		Population (2010)	Pop. Density	Fishers	Groups	
Aileu*	737	45,512	61.8	0	0	0
Ainaro	804	59,382	73.9	42	11	2
Baucau	1,506	111,484	74.0	664	166	10
Bobonaro	1,376	89,787	65.3	412	103	11
Covalima	1,203	60,063	49.9	357	89	10
Dili	367	234,331	638.5	2439	610	31
Ermera*	768	114,635	149.3	0	0	0
Lautem	1,813	60,218	33.2	511	128	12
Liquica	549	63,329	115.4	607	152	31
Manatuto	1,782	43,246	24.3	427	107	18
Manufahi	1,323	48,894	37.0	193	48	5
Oecussi	814	65,524	80.5	440	110	13
Viqueque	1,877	70,177	37.4	268	67	8
TOTAL	**14,919**	**1,066,582**	**71.5**	**6,360**	**1,591**	**143**

*[Source: NDFA-MAF 2010, MoF-NSD 2010] * Non-coastal districts*

Fisheries data for Timor Leste demonstrate the relatively small scale of Timorese fishing activity and the modest contribution it makes to rural livelihoods across the nation. High levels of poverty and minimal resources amongst small-scale artisanal fishers means that fishing activity is largely limited

to inshore fishing using low-technology gear and subsistence reef gleaning on exposed tidal platforms (McWilliam 2003).

Fishing Vessels

Apart from the Atauro Islanders, who operate larger boats in offshore areas, most fishing activities occur within 300m of the shoreline (dos Santos Silva 2009b). This tendency for near coastal fishing is also a result of the fact that the majority of fishing boats used in most districts of Timor Leste are not motorised (Figure 18).

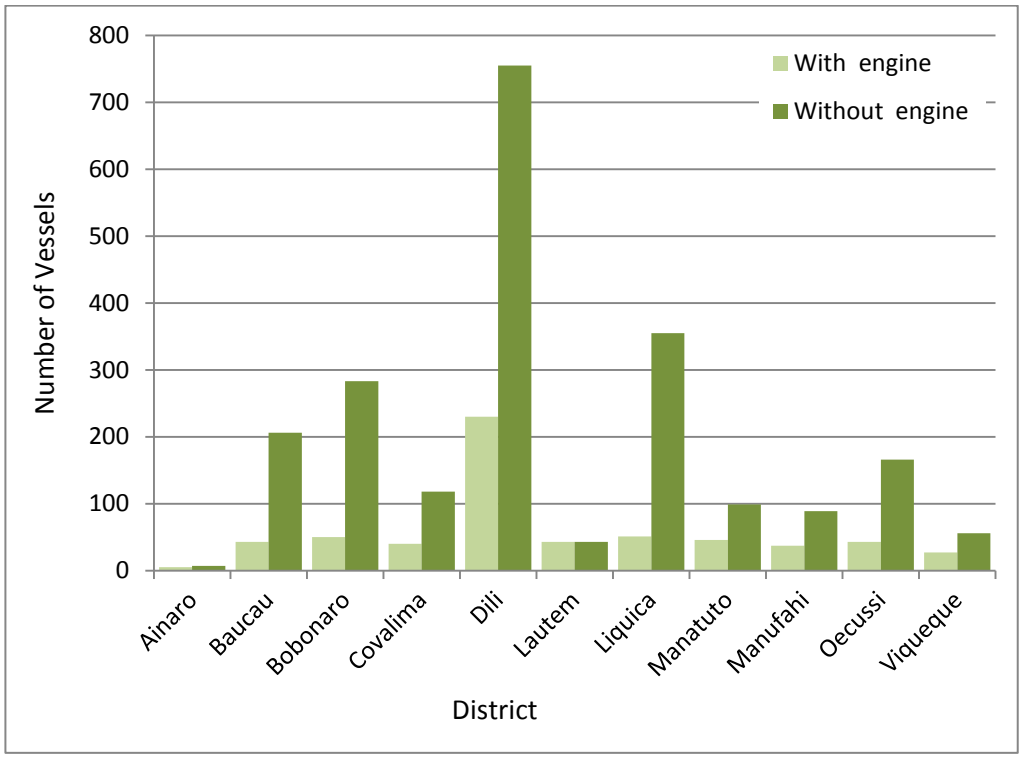

Figure 18: Number of motorised and non-motorised fishing boats in Timor Leste per district (2009) [Source: (NDFA-MAF) 2010]

Fishing Gear

Gill nets and hand lines are the most popular type of fishing gear in the coastal fisheries because they are easy to use and the equipment is relatively cheap to buy and maintain. The National Directorate of Fisheries & Aquaculture (NDFA) provides nets and hand nets to local fishers as part of a fishermen's assistance program. Trammel nets are commonly used by small-scale fishers in southern coastal areas to catch shrimp and traditional of spear guns are popular among Atauro fishers. Bottom longline and Fish Aggregation Devices continue to be popular in the coastal fisheries. Figure 17 shows the kinds of fishing gear and number of units used for fishing in Timor-Leste in 2009.

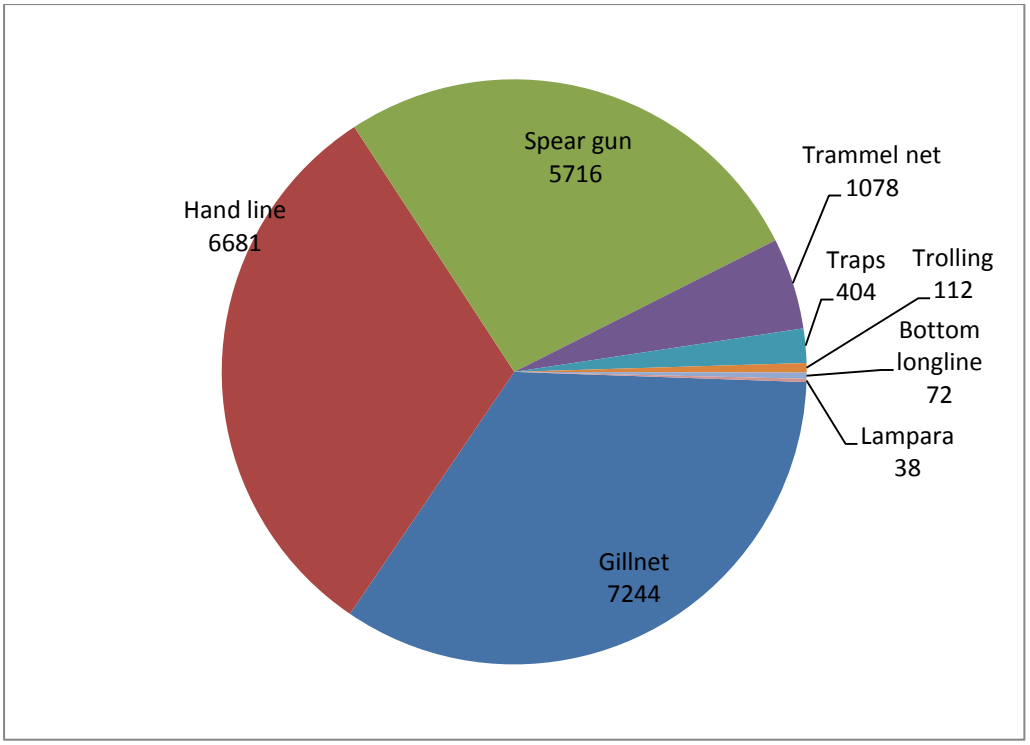

Figure 19: Total number of units of fishing gear used in Timor-Leste (2009)

[Source: NDFA-MAF 2010]

A lack of marketing infrastructure, particularly ice-making and transport facilities continues to restrict the sale of fresh fish to supplying the limited local demand. Such observations reinforce the anecdotal evidence of a limited and small-scale Timorese cultural and economic engagement with their coastal waters and marine resources. They also highlight the likelihood that the extent and elaboration of customary marine tenures will be culturally variable and probably weakly articulated in terms of defined property rights and obligations, given the dispersed geography of coastal settlements and the low pressure on fishing resources in the contemporary environment.

A Spanish funded and Regional Fisheries Livelihoods Programme (RFLP) currently being implemented by the FAO in Timor-Leste (and NTT in Indonesia) is analysing results from two surveys on fish consumption and animal protein consumption as well as the potential demand for both processed and fresh fishery products.[47] Most Timorese settlements are along the coast where residents use coastal waters for subsistence and local scale fishing using low technology for inshore fishing and gleaning.

It is suggested that intensive fishing at some population centres has resulted in damage to coral reefs and localised depletion of fisheries resources (Chin *et al*. 2008). It is not unreasonable to conclude that this situation is more widespread than the few centres where it has been observed. It is possible that the more "bountiful fishery resources" (Nugroho 2009) in deep slope and pelagic waters could sustain greater harvests, since limited equipment and local know-how for commercial-scale deep sea

[47] A Tetun language glossary of terms used in fisheries legislation in Timor-Leste is being developed to help local officials better understand and implement legislation which is written in Portuguese, while RFLP has also undertaken a preliminary analysis on a Human Resources Development Plan for the National Directorate for Fisheries and Aquaculture (NDFA) carried out by Spanish agency TRAGSA.

fishing have thus far limited fishing in these environments. There is evidence that prior to 1999, fishing levels were much higher and that now the fish populations are most likely recovering from years of intense harvesting. Among fishers, there does not seem to be a perception that harvests are too intense as only 40 percent interviewed perceived a decline in catch during past year (2010/11) and only 26 percent of those considered that it was due to competition between fishers (FAO 2011)

Fisheries management and governance have been identified as significant challenges in the development of Timor-Leste fisheries capacity (Nugroho 2009). Since gaining independence in 1999, foreign aid and NGO projects have been directed at assisting Timor-Leste in its development of sustainable fisheries. Several recently completed collaborative projects have the potential to provide a strong basis for improving fisheries management. These include a project to develop a fisheries licensing and data management system which would enable better regulation of Timor-Leste fisheries and also collection of relevant data to assess the status of the fishery stocks (Slack-Smith and Encisco Silva 2005). The potential for a fishing tourism market was also assessed in an ATSEF funded project. Results suggested that the potential for recreational fishing was very good in the Jaco Island area (Lloyd *et al*. 2009). In 2009, Timor-Leste's first recreational fishing competition attracted 265 participants, of which 125 were international[48]. There are potentially significant opportunities to expand this activity in Timor-Leste.

Timorese fishers [Photo: N. Stacey]

FISH PRODUCTION

According to fish production data from the National Directorate of Fisheries and Aquaculture, an estimated 2,889 tonne of fish (with equivalent value of US$ 5,778,000.00) was landed in Timor-Leste in 2005. There was a modest increase over the following few years with 3,066 tonne (valued at US$ 6,132,000) landed in 2009. Dili is the most active fishing district, dominating the country's fish production (Figure 20) and seaweed exports.

[48] http://www.islandofadventure.tl/fishingcomp.html - accessed 3/08/2011

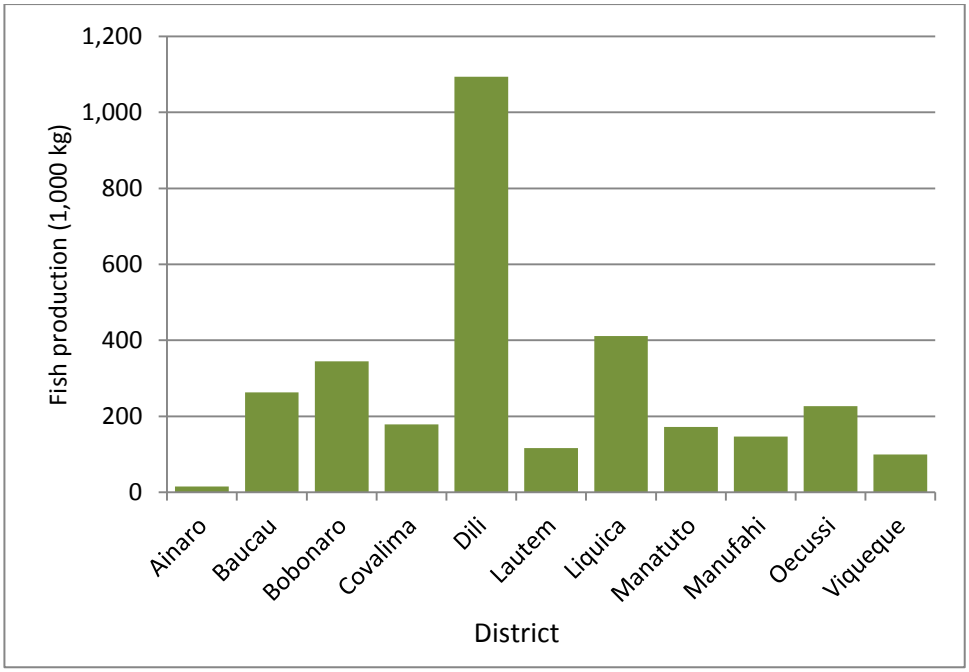

Figure 20: Total fish production in Timor-Leste according to district (2009)
[Source: National Directorate of Fisheries & Aquaculture (NDFA-MAF) 2010]

TARGET SPECIES

Timorese fishers use various types of fishing gear, and the fish species caught varies depending on the gear used.

Handlines and gill nets are commonly used to catch demersal species such as snapper, croaker and bream, and pelagic species like tuna, mackerel, scad and sardines (FMES 2000). Other species frequently caught include prawns, crabs, lobsters, bivalves and cephalopods. Women's fisheries activities tend to focus on the collection of molluscs, crabs, small fish, varieties of seaweed and other edible plants within the inter-tidal zone (Sandlund *et al.* 2001). Plaited fish traps and stone enclosures utilising tidal action are also used extensively. These tend to be semi-subsistence activities with some local-scale sale of products (McWilliam 2003).

The international data base of fish species, FishBase (www.fishbase.org)[49] lists 196 marine fish species in 50 families for Timor-Leste waters, with four species listed as Threatened, the Bigeye Tuna (*Thunnus obesus*), Whale shark (*Rhincodon typus*), honeycomb stingray (*Himantura uarnak*) and the Celebes medaka (*Oryzias celebensis*). Nine of fish species are listed as deep water species. Many of the species listed for Timor-Leste are found throughout the tropics and are important commercial species such as the tuna, mackerels and snappers.

It is estimated that over 80% by weight of local marine fish consumed in Timor-Leste belong to 15 main Families and 128 species (Cook 2005). Results from 58 sampling stations show that 95 species of marine resources were caught using 5 gear types in the Exclusive Economic Zone of Timor-Leste, consist of 47 families and 70 genera (RDTL & SEAFDEC 2005).

[49] http://www.fishbase.org/Country/CountryChecklist.php?c_code=626&vhabitat=all2&csub_code - accessed 7/07/2011

Fish Distribution

The fish market in the capital city Dili consists of five key elements. These are fishermen, *papaleles* or *vendedor* (traders or middlemen), street vendors, beach side restaurants, and consumers. The market structure of fish distribution in Dili is shown in Figure 21 (Furudate 2008). Much of the fish market in Dili is dominated by the aggressively developing *papaleles*, with an estimated 60 *papaleles* operating in the city.

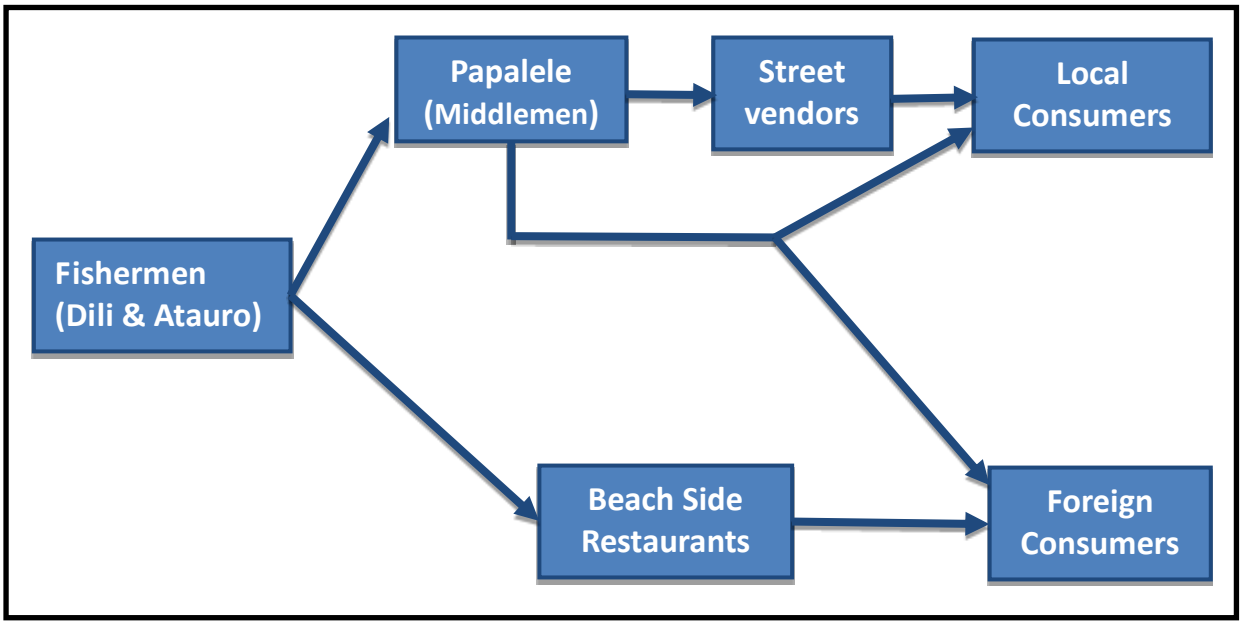

Figure 21: Fish market structure in Dili

[Source: Furudate 2008]

Recent research into the economics of fisheries production (Furudate 2008) was not really able to provide a clear picture of the incomes associated with trade of fish products. Papaleles were found to make a relatively high profit margin of approximately US$0.50 to US$1.00 from fish priced from US$2.00/kg to US$5.00/kg. The volume handled daily varied from 20 kg to 110 kg according to information given during the research workshop, but results of a questionnaire survey showed the volume may vary from 2 kg to 500 kg. These two different results would suggest a monthly income of US$ 150.00 to US$ 300.00 based on information given during the workshop or US$ 40.00 to US$1,500.00 per month according to survey results. All papaleles use ice purchased from small freezer businesses at a price of US$ 0.20 per kg.

4.4 Australian Fisheries

The population in the coastal area of Australia bordering the ATS is less than 200,000. Indigenous Australians comprise a high percentage of this population and, consequently, customary and subsistence fishing for a wide range of coastal vertebrate and invertebrate species is important in the region. Few of the species traditionally harvested by indigenous Australians have distributions overlapping with Indonesian and Timor-Leste waters. However, notable exceptions are some populations of marine turtles that are known to migrate between feeding and nesting areas across the ATS international boundaries (Limpus 2008, Dethmers *et al*. 2010).

Fishing is one of the most important recreational pastimes in northern Australia. While the population of recreational fishers in northern Australia is comparatively small, they exert a disproportionate amount of effort in places where other recreational activities are limited. Like indigenous Australians, their activities are concentrated inshore near population centres, but unlike indigenous Australians, recreational fishers target large "trophy" species including barramundi, black jewfish and Spanish mackerel as well as high value food fish including coastal snapper species. In the offshore snapper fisheries, there is no significant overlap between commercial and recreational fishing. A small proportion (~6%, Handley 2009) of recreational fishing is conducted offshore on features such as the Sahul Banks adjacent to the Australian-Indonesian boundary. Target species include *Pristipomoides* and *Lutjanus* species some of which are shared stocks (Ovenden *et al*. 2002, Salini *et al*. 2006). Migratory pelagic species are also highly sought after but catches are small. Recreational fishing is a very significant sector in the Northern Territory economy as well as in several small population centres in North Queensland and the Kimberly in Western Australia.

Currently, there are 16 managed commercial fisheries in Australian waters that are permitted to fish in AFZ where it overlaps the ATS. However, many of these fisheries are not active in the ATS despite being permitted access to the area. The numbers of licences, units of fishing gear and other fishery inputs are highly regulated. Some output, or quota, arrangements have also been introduced. Generally, these fisheries represent a highly evolved and effective governance system.

The largest fishery in the Australian area of the ATS is the Northern Prawn Fishery which targets banana and tiger prawns. However, nearly all of the fishing activity is within few kilometres of the coast, aside from a very small deep water fishery for scampi near the boundary with Indonesia (Wilson *et al*. 2010). From a trans-boundary perspective Australia's five snapper fisheries, in which some of the fishing takes place near the boundaries, are the most important. Australian fisheries selectively target snappers through gear configuration and spatial and temporal application of fishing effort unlike the Indonesian fisheries that target a much broader range of species for which they have markets. The Australian snapper fisheries effort is considerably less than that in Indonesian fisheries. Compared to the fleet of hundreds of vessels in the Indonesian fish net fishery (Blaber *et al*. 2005), two trawl vessels operate in the Arafura Sea (Handley 2009, DEEDI 2010). In addition, the "semi-demersal" trawl net used in the NT fishery has been shown to reduce the amount of non-target species, including sessile benthic invertebrates, in the catch (Brewer *et al*. 1996). Australian trawl fisheries are also required to use "bycatch reduction devices" which allow larger non-target and protected species (such as turtles) to escape the net before hauling.

Table 22: Fisheries in Australia that overlap the ATS

Fishery	Management	Active in ATS	Area of fishery
Northern Demersal Scalefish Fishery*	WA	Yes	See map Appendix 4
Mackerel Fishery	WA	Yes	121°E to NT border (coastal)
WA North Coast Shark Fishery	WA	?	See map APPENDIX 5
Bêche-de-Mer Fishery	WA	?	Throughout WA waters with specific closures.
Kimberley Prawn fishery	WA	Yes	See map APPENDIX 5
Demersal fishery*	NT	Yes	See map APPENDIX 5
Finfish trawl fishery*	NT	Yes	See map APPENDIX 5
Timor Reef fishery*	NT	Yes	See map APPENDIX 5
Offshore Net and Line Fishery	NT	Yes	NT high water mark to AFZ
Spanish Mackerel	NT	Yes	Seaward of NT coast to AFZ
GoC Developmental Finfish Trawl*	Qld	Yes	See map APPENDIX 5
Joint Authority Northern Shark Fishery	JA	No	See map APPENDIX 5
Northwest Slope Trawl Fishery	Aust	Yes	See map APPENDIX 5
Northern Prawn Fishery	Aust	Yes	See map APPENDIX 5
Western Skipjack	Aust	No	
Western Tuna and Billfish	Aust	No	
Southern Bluefin Tuna Fishery	Aust	No	

WA – Western Australia, NT- Northern Territory, Qld – Queensland, JA – Joint Authority (WA and Commonwealth Government), GoC – Gulf of Carpentaria.

**Fisheries which are most important with respect to trans-boundary issues..*

4.5 Papua New Guinea Fisheries

A small region of PNGs exclusive economic zone includes the Arafura Sea. This includes 3 small islands/cays. This region is typically a shallow marine environment with seagrass meadows and some coral reefs and is an important habitat globally for turtles and dugongs, which are harvested as part of customary fishing activities of Indigenous Torres Strait Islands and Papuans under a Torres Strait Treaty (1985) between Australia and PNG. Administratively, the Western Province of PNG and the coastal South Fly District are the key areas bounded by the Arafura Sea.

PNG waters abut Australian waters at the Torres Strait where the Torres Strait Protected Zone (TSPZ) Joint Authority is responsible for management of commercial and traditional fishing in the Australian area of the TSPZ and designated adjacent Torres Strait waters. Commercial fishing is one of the most economically important activities in TSPZ and provides a significant opportunity for financial independence for community fishers. Individual fisheries include prawn, tropical rock lobster, Spanish mackerel, barramundi, pearl shell, dugong and turtle, finfish, crab, trochus and sea cucumber (beche-de-mer).

4.6 IUU Fishing

In the Arafura Timor Seas region, various fishing operations from Indonesia and countries to the north (e.g. Thailand, Taiwan, South Korea, China, the Philippines) illegally target various species of

high commercial value in Australian and Indonesian waters (e.g. snapper, trepang, shark fin) (Fox *et al.* 2009, Stacey 2007, Resosudarmo *et al.* 2009).

The very fact that IUU fishing is illegal, unreported and unregulated means that quantifying the activity is problematic. In Indonesian waters alone in the Arafura Sea hundreds of vessels may be operating illegally. 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.

Indonesian fishermen have visited northern Australian coastal areas since at least the 18th century for the purposes of fishing (Macknight 1976, Stacey 2007), most notably for trepang. These visits went beyond simple fishing expeditions to cultural associations and blood relations with Australian Aborigines. In the years since this historical fishing activity was brought to an end, Indonesian fishers have frequented the coast primarily, to harvest (illegally) trochus shells along the Kimberley Coast.

Illegal, unreported or unregulated (IUU) fishing has been an issue in northern Australian waters for decades. The species targeted by IUU fishing have been dynamic and driven by economic opportunity. Within Australia's area of jurisdiction in the ATS, illegal fishing, predominantly of Indonesian origins, reached levels that triggered a strong response by the Australian government in 2005. In Australian waters in 2005-2006 there were a total of 8,378 sightings of IUU vessels and 412 apprehensions. The government committed almost AUD $400 million to address illegal fishing inside the AFZ over the 4 year period from 2005-2009, which significantly reduced illegal activity in Australian waters.

However IUU fishing has continued. Maps of foreign vessels sighted or apprehended in Australian waters in 2006 and 2010 are provided in 0. In 2007-2008 there were 798 sightings with 165 apprehensions in the AFZ (AFMA 2008; Fox 2008). Comparison of numbers of illegal fishing vessels observed between 2006 and 2010 suggests there has been some success in reducing incursions into Australian parts of the ATS (0). It is unknown what role other social and economic forces in Indonesia, such as rising fuel prices, may have had in reducing illegal activity.

PHOTO: AUSTRALIAN CUSTOMS SERVICE

Rising affluence and demand, primarily in China, has fuelled a dramatic increase in shark fishing in countries such as Indonesia (Tull 2009). In the ATS region this resulted in the extirpation of some shark species and the implied overfishing of other species in the wider region (Blaber *et al*. 2009). Indonesian shark boats then expanded their operations into northern Australian waters. This activity triggered a proportionately strong response from Australia and at its peak, in 2006, 365 IUU vessels were apprehended of which 315 were targeting sharks (Handley 2009). The current Australian catch of sharks in the Northern Territory Offshore Net and Line Fishery is considered to be below sustainable yield at 457 tonnes (Handley 2009).

In Indonesia's Arafura Sea Fisheries management area – one of the most heavily exploited regions in Indonesian waters – inappropriate and destructive activity in the marine environment is undertaken by industrial scale fishing fleets (Wagey *et al.* 2009, Fox *et al.* 2009. Some of these are Indonesian and others are from countries to the north such as Taiwan and China who operate using fish trawls, shrimp trawls and bottom long lines. Priority concerns regarding fishing in Arafura Sea are

unrecorded catch – which covers catch that is thrown away (by-catch, discards), catch which is not reported, catch which is reported but not properly recorded (misreported), and illegal fishing activities. Furthermore, it is estimated that more than 80% of demersal fish, mostly Red Snapper (*Lutjanus* sp.) harvested between 1980 – 2005 from the Arafura Sea using Bottom Long Line, was defined as unreported (Wagey *et al.* 2009). With regard to illegal fishing activity, particularly in the fish net fishery, fish are trans-shipped from the fishing vessel to a foreign carrier vessel for transport to country of origin. Thus a major problem is the clear gap in official fisheries statistics for the Arafura Sea and actual real catch and effort.

Indonesia also claims that it has made inroads into reducing the numbers of illegal vessels in its area of jurisdiction since 2000 (Wagey *et al*. 2009, Purwanto 2010, Purwanto 2011). Nevertheless, recent radar observations from the Research Vessel *Baruna Jaya VIII* overlaid with Vessel Monitoring System (VMS) data suggest that there may still be a significant number of illegal fishing vessels in Indonesia's area of the ATS (ATSEA 2010).

In Timor-Leste there is less information about the level of IUU fishing however 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. However in October 2010 a joint operation between Police, Navy and Marine Patrol Unit apprehended and charged 30 crew on of Indonesian fishing boat (Bateman & Bergin 2011).

IUU fishing also occurs in PNG waters. For example, in the first half of 2006, 42 Indonesians were apprehended for fishing illegally in PNG. In 2007, 33 Indonesian crew operating out of Meurake, but who originated from Sulawesi, were apprehended for illegal shark fishing in PNG waters. Other incidents have been reported in coastal river areas around the PNG-Papua border inside the Tonda Wildlife Management Area (SPC 2006 Regional Marine Information Bulletin Issue 37).

Other types of illegal fishing, such as blast and cyanide fishing are usually missing from calculations of losses due to IUU fishing because these activities are generally discussed under the topic of 'destructive fishing.' Exactly what constitutes a destructive method is open to debate but in the context of this report it refers to methods prohibited by the relevant law making governments.

In Indonesia, most of these activities are conducted by small scale fishermen and the practice is widely conducted in the ATS and throughout other parts of the country. Cyanide fishing for live reef fish is also connected to international markets. The driver and impact of such fishing practice must be taken into account when discussing ATS fisheries governance.

While in Australia destructive fishing methods are not defined in Commonwealth fisheries laws they are prohibited under conservation legislation (EBPB Act 1999). Timor-Leste on the other hand has fisheries law that specifically prohibits fishing with the use of explosives or toxic substances (Law No. 12/2004), while Indonesia achieves the same end through its management of Coastal Zones and Small Islands legislation (Law No. 27 2007). Despite the legislation in all three countries, destructive fishing practices remain an ever present threat to fisheries resources and marine ecosystems. The use of explosives by Indonesian fishers who were otherwise in compliance with the 1974 MOU has been detected by hydrophones used to monitor cetaceans. Such trans-boundary transgressions are probably infrequent relative to the use of these methods in countries of origin, however they pose acute socio-political threats because of how these activities are viewed by the broader public in each country.

While much of the focus is on the Illegal part of IUU fishing because of its infringement of each country's sovereign rights, its capture of resource rents and its generally higher visibility, the unregulated and unreported aspects are potentially of even greater concern in the ATS. Unreported fishing makes it very difficult to accurately estimate fisheries production and fishing effort, both of which are basic inputs for stock assessment. The absence of accurate information begins a chain of

negative feedbacks. Where assessments are not robust, management advice will potentially be poor or inadequate leading to management inaction. This is likely to lead to declines in resource status and subsequent loss of value and therefore loss of incentive to regulate or manage the resource. Where a resource is no longer considered valuable, governments are less likely to invest in ensuring the sustainability of the resource. Strong arguments can be made that it is not possible to regulate effectively what cannot accurately be described and assessed.

4.7 Aquaculture

Although not significant as a direct trans-boundary issue, aquaculture is a major industry at some places in the ATS region and it has been suggested that aquaculture represents the world's fastest growing food production sector (Andrew *et al*. 2010). It is seen as a viable means of increasing supply to meet the demand for fish and other aquatic resources, 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, depending on the different social, cultural and economic conditions within each country.

The effects aquaculture will have on the ATS remains to be seen. Many people are hopeful that it will provide alternative livelihoods for those who are highly dependent on capture fisheries and who are in most cases already severely impacted. On the other hand, 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 for trash fish feed for example, are generally poor, many tonnes of fish will be 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 and Sheriff 2008) but may lose access to the low cost feed species.

Governance, policy and management present major challenges for aquaculture and to a significant extent, explain the condition of the capture fisheries in the ATS region. Unless, there are successful outcomes in each of these areas it is likely that aquaculture will experience some serious problems in the future. 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. The seaweed disease known as "*ais-ais*" is already a threat to regional production and may partly be the result of unmanaged high density culture (J. Fox *pers. comm*.)

In areas where regional aquaculture enterprises provide important livelihood activities for poor rural/coastal communities, disruptions are unlikely to force people back to capture fisheries to maintain their supplies of food and income.

INDONESIA

In 2008, Indonesia was the world's fourth largest producer of cultured fish, crustaceans and molluscs, with a total production of approximately 1.7 M tonnes ($US2.8 M) and the second largest producer of aquatic plants with a total production of 2.1M tonnes ($US300,000). In contrast, Timor-Leste produced just 151 tonnes of aquatic animals and 100 tonnes of aquatic plants in 2008 (FAO 2010b).

Alternative livelihoods have been proposed as a solution to overfishing for more than two decades (Crawford 2002), with aquaculture development a particular priority for the Indonesian government since the 1980s (Nurdjana 2006). Programs promoting alternative livelihoods have often been introduced to coastal communities and small-scale fishers, particularly through the introduction of various forms of mariculture. Generally, the two main objectives for promoting alternative livelihoods are to raise the economic standard of living of fishers and coastal communities and to reduce fishing effort.

In 2010, the Ministry of Marine Affairs and Fisheries established an aquaculture development program. It is a popular policy with aquaculture seen as an alternative livelihood activity to improve the socio-economic status of small-scale fishers and reduce fishing pressure on overexploited fisheries in coastal areas of Indonesia.

Indonesia has an estimated area of 15.59 million hectares with potential for marine, fresh, brackish water deemed suitable for aquaculture. Of this only a small portion of the area is used for this purpose (Nurdjana 2006).

In 2008, Indonesia was the second largest producer of seaweed in the world behind only China The Ministry of Marine Affairs and Fisheries[50] has singled out seaweed as one commodity to become the focus for increased production. The program aims to accelerate economic development of poor coastal areas in seven provinces, i.e. South Sulawesi, Southeast Sulawesi, Central Sulawesi, Maluku, North Maluku, NTB and NTT (Nurdjana *undated*). This program has several objectives: (1) to develop livelihoods in rural areas for improved community welfare; (2) poverty alleviation; (3) to fulfil domestic consumption and export demand; (4) to fulfil raw material demand for industry; (5) to provide raw material for biofuel/bio energy; (6) to encourage economic growth at district/municipality, provincial, and national levels.

There are several benefits of developing seaweed production i.e.: (1) potential huge market share; (2) low technology inputs; (3) low investment and operating costs; (4) quick yielding (short culture period); (5) availability of culture areas; (6) various species with potential for further development; (7) carbon dioxide absorbent; (8) potential for a diverse range of business scales (small to large/industrial).

Statistical records of seaweed production in several provinces indicate that these programs have been widely accepted among coastal communities. Amongst the provinces of the ATS region, East Nusa Tenggara (NTT) has had the highest total seaweed production (Table 23).

Table 23: Seaweed production (tonnes/year) by province in east Indonesian Waters

PROVINCE	2004	2005	2006	2007	2008
Maluku	2,279	121	2,845	1,683	36,281
NTT	66,384	271,846	478,114	504,699	696,273
Papua	4	3,431	8	19	197
West Papua	0	0	0	626	49

Source: Nurdjana (undated), MMAF, Indonesia

TIMOR-LESTE

Aquaculture of tilapia and carp in inland ponds played a significant role in the rural economy of Timor-Leste prior to independence from Indonesia (Xavier do Amaral 2010).

Aquaculture development in Timor-Leste is focusing on rehabilitating existing pond culture and establishing some new small, low technology, seaweed culture projects. Aquaculture productivity in Timor-Leste has increased annually by around ten percent over the past ten years, a rate which is faster than other agricultural activities. However, to date this higher production rate does not appear to have had any impact on levels of rural poverty (Xavier do Amaral 2010).

According to Andrew *et al*. (2010) Timor-Leste produced 120 tonnes of dried seaweed in 2008 and 2009 combined.

[50] www.kkp.go.id accessed 24/02/2011

AUSTRALIA

Aquaculture in northern Australia is dominated by the production of pearls and in the Northern Territory this represents a total value of $24.7M (Handley 2009). The value of the pearling industry makes up around $19M. Non-pearl aquaculture in northern Australia includes barramundi and prawn production for domestic sale. The value of NT barramundi farming is around $5 million. Other small scale experimental aquaculture ventures include sea cucumber (trepang) ranching (for export), giant clam rearing for the aquarium trade and farming of black lipped oysters for local food supply. These ventures are being undertaken to identify successful models for Indigenous livelihoods in partnership with the NT seafood industry.

4.8 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 province and Maluku in particular there are significant levels of mining and oil and gas exploration across the region and a number of these prospects are likely to be developed in the near future. In NTT there are gold and copper mines on Wetar and Sumbawa islands.

Recent developments in the region include Manganese mining which 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 as well as safety and health problems for the miners (to the extent that lives have been lost) 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 has noted that similar to the expansion of the seaweed industry in the mid-2000s, the industry has drawn in fishers as mine labourers[51]. Artisanal mining can have big impacts because of the practice of strip mining to access the top layers. Also, 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. There is a large Freeport Mining operation near Timika (copper/gold/silver) but sediments and tailings ponds are fairly well contained. 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.

[51] Kupang Post, 31/3/10 Editorial

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 (almost midway along the Indonesia-PNG border). The mine is owned by BHP Billiton and has been the subject of litigation by traditional landowners both in respect of environmental degradation and disputes over royalties[52].

4.9 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. Most current production is located in the western part of the archipelago. According to the Indonesian Energy and Mineral Resources Ministry, investments in the oil and gas sector may exceed US$16 billion in 2011.[53]

There has been a decline in oil production since the 1990s which means that production cannot keep up with increasing domestic demands[54].

Natural gas production has increased as has 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. Indonesia had 97.8 trillion cubic feet (Tcf) of proven natural gas reserves as of January 2007. One of the largest reserves is in Bintuni Bay, West Papua (north of ATS region). In 2009, the Tangguh LNG Terminal in West Papua began operations which contains over 500 billion m³ (17 Tcf) of proven natural gas reserves, with estimates of potential reserves reaching over 800 billion m³ (28 Tcf). Several new projects are under development, including Masela LNG Terminal, Donggi Sulawesi LNG Terminal and Abadi LNG Terminal (in the Timor Sea southwest of Tanimbar Islands) which will be important energy sources for the country.[55]

The growth in the GDP since 2004 in Timor-Leste is attributed to the petroleum sector, with real petroleum GDP growth of 991% 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 – Greater sunrise will yield an estimated US$24 billion over the next 30 years (50% shared with Australia). An onshore processing plant will be located in either northern Australia or Timor-Leste. Ability to respond to threats to the marine environment such as from oil spills is limited especially along the south coast of Timor-Leste.

The oil and gas industry is a major contributor to the Australian economy. In 2006-07 the industry accounted for about 3.8 per cent of the total GDP and generated estimated revenue of A$39.1 billion and A$33.6 billion, respectively. Australia's biggest export in the industry is LNG. Australia is now the 18th largest producer of natural gas, the seventh largest exporter of LNG in the world and the third-largest LNG 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[56].

In northern Australia and particularly in northwest Australia there is major expansion underway in the gas sector in the Browse, Bonaparte and Amadeus Basins off the northwest coast in Commonwealth waters. There is significant potential for the development of petroleum resources in

[52] http://en.wikipedia.org/wiki/Western_Province_(Papua_New_Guinea) – accessed 29/7/2011

[53] http://www.globserver.com/en/press/indonesia-told-hunt-oil-eastern-regions - accessed 2/8/2011

[54] http://en.wikipedia.org/wiki/Economy_of_Indonesia#Hydrocarbons – accessed 2/8/2011

[55] http://oil-and-gaspost.blogspot.com/2011/05/indonesian-govt-to-hunt-for-more-oil-in.html; http://abarrelfull.wikidot.com/indonesia-oil-gas-profile - accessed 2/8/2011

[56] http://www.austrade.gov.au/Oil-Gas-overview/default.aspx - accessed 29/7/2011

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 Pty Ltd and Worley Parsons 2005, Clifton *et al.* 2007a).

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.

The threat posed by accidents involving the oil and gas industry in the ATS has the potential to cause wide-reaching impacts throughout the region. In August 2009, a gas and crude oil leak, believed to be one of the worst in Australian history, began on board an Australian owned mobile offshore drilling unit oil rig located approximately 690 kilometres west of Darwin. Oil from the Montara Wellhead also entered Indonesian and Timor-Leste waters, and media reported impacts on local livelihoods, both fishing and other marine-oriented industries, such as seaweed mariculture within the region, though the actual extent of these impacts are unclear.[57]

Within days following the leak, local people reported oil flakes found on beaches in West Timor followed by the arrival of the carcasses of various marine animals including dolphins, fish and sea turtles along with thousands of hectares of seaweed. Estimates to the loss of revenue for the province of NTT seaweed and fishing industries vary, but are potentially significant.[58] Reports from fishermen situated in NTT indicate decreases in their catch, and reports that drastically declining fish stocks are forcing thousands of fishermen to migrate in search of alternative livelihoods.[59]However there was a lack of verifiable scientific evidence to support claims by local communities and governments for compensation from the company.

4.10 Shipping and Ports

Sea transport is important in the ATS region 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 Indonesian's. In some islands of the Arafura Sea the only means of transportation available is by sea. Most goods are shipped through major (e.g. Makassar, Ambon, Bintuni Bay, Kupang, Merauke) and smaller feeder ports in the region. The national shipping line – Pelni – provides passenger services to ports throughout the country on a two to four week schedule, stopping at major ports of Kupang, Saumlaki, Dobo, Tual, Merauke, Timika, Kaimana and Ambon and smaller ports in Lesser Sunder islands (Kalabahi, Sabu, Maumere, Ende). Hundreds of small inter-island ferries (motorised boats) also operate and contributed significantly to local economies. It is highly important and the main form of transportation in Indonesia. In addition to cargo ships, traditional fleets of wooden (motorised vessels – *Pinisi, Lambo*) also play an important role in transporting goods around the archipelago.

Shipping in and out of East Timor port of Dili continues to grow with an estimated 242 vessels moving general cargo imports of 57,885.27 ton/m^3 in 2005 to 342 vessels 2009 with general cargo imports of 155,487,70 ton/m^3. This trend is expected to continue. However administration of shipping is underdeveloped and Timor-Leste ports do not comply with international standards (Bateman & Bergin 2011).

[57] http://www.abc.net.au/news/stories/2010/02/25/2830421.htm; - accessed 9/08/2011

[58] http://new.asiaviews.org/?content=634ft600014545e&features=20100325113652.

[59] http://www.thejakartaglobe.com/home/timor-sea-oil-spill-forcing-ntt-fishermen-to-migrate/382331 - accessed 9/08/2011

In northern Australia, the major ports (Darwin, Dampier, Broome, Weipa, Karumba, Nhulunbuy,) 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 & 2008b).

There are also a number of non-government port authority ports associated with private resources sector (e.g. in areas adjacent to Gove, Groote Eylandt, McArthur River in the NT) with major expansions in ports underway for gas developments in Northwest region. In Broome there were reported 393 ship visits in 2006-2007 but majority of shipping activity is further south in Dampier region. There are also increases in Offshore Support Vessels in the Northwest region associated with oil and gas industry and exploration. An increase in shipping and port expansion associated with the growth of the resources sector in the region has potential implications for the marine environment (DEWHA 2008b).

4.11 Marine Tourism

Indonesia has one of the most biologically diverse marine environments in the world and marine-based tourism is popular in many of the regions throughout the archipelago. The region is popular for a range of activities including diving, boating and surfing. However, the areas of eastern Indonesia which fall 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 marine based activities. In Indonesian region of ATS the marine tourism is generally on a 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 north and east coast and could deliver social and economic benefits through employment. Some ecotourism, including cultural tourism in coastal areas, interaction with marine wildlife (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 northern Australia commercial marine tourism is an important industry although small component of the overall tourism sector. Activities include charter fishing, diving, snorkelling, whale mammal 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 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 and Greiner 2010).

In the cruise shipping sector in northern Australia for example Darwin Port authority reported over 20,000 passengers and crew of 13 cruise ships docking in 2010 which was a 33.5% increase compared to 2008-09 (Fernandes and Greiner 2010).

In northern Australia recent reports have noted that the prospects for change or growth in the tourism industry overall in the near future are small (Carson *et al*. 2009, Stoeckl 2011). Another trend is the likelihood of increased urbanisation of tourism, with smaller numbers venturing beyond regional centres each year but there are potential growth areas such as scenic and experiential tours.

Tourism expansion in the Kimberly is expected to be higher than in the Pilbara, increasing from 2.3 million visitor nights in 2006 to 2.61 million in 2015 (Tourism Western Australia 2006). Much of the expected growth will be concentrated in Broome, with some expansion likely in Kununurra (Clifton *et al.* 2007b).

4.12 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 but subsistence farming with exports 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[60]).

The dry season across eastern Indonesia is long at around 8 months per year and the period between the end of the dry season and onset of the west monsoon is locally referred to as the 'hungry season' (*musim lapar* or *musim paceklik*). In La Nina drought years the period lasts longer and is more severe and known locally as '*musim lapar luar biasa*') or 'exceptional hungry season' which can occur every 3-5 years (Fox 2011). 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).

Across much of eastern Indonesia farmers are reliant on a single crop, produced on arid land, though in Maluku families often produce multiple crops. The economy is largely subsistence based with many not able to achieve self-sufficiency through their farming activities due to lack of resources, water shortages and degraded environments (Rural Poverty Portal[61]).

In NTT, around 70% of the population depend on dry land farming for livelihoods (maize, legumes) although in general the soils of islands in the ATS region are poor, made up of coral and rock, and are unsuitable for many crops except cassava and maize (Fox 2011). Land is most commonly used for low-yielding subsistence agriculture based on multiple activities including free-grazing stock and upland maize supplemented by crops mixed-tree gardens, home gardens, irrigated and rain fed rice-fields (Mudita 2000). For coastal communities on Timor, Sabu and Rote populations the lontar palm has also long been recognised as extremely important (Fox 1977).

Diversified crops are a strategy for coping with the harsh ecosystem with frequently unreliable rainfall. Annual burning is commonly used by farmers throughout NTT to clear land of weeds, promote grass growth for livestock and provide easier access for shifting maize cultivation (Mudita 2000). The province is known to be drought-prone and in the last few years it has been affected by delayed monsoon and protracted dryness (UNICEF/WFP/FAO 2010).

Whilst agriculture accounts for around 59% of employment across the province of Maluku, the rate is closer to 75% in rural areas. During the period from 2002 to 2009, the overall contribution of agricultural to the province's GDP increased whereas 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, historically staple foods in Maluku have largely consisted of non-rice foods such as root crops (cassava and taro), sago and maize. Due largely to government policy, wetland rice farming in Maluku increased dramatically from 2000 to 2009 with the total land used for production increasing from around 5,000 hectares to 16,000 hectares (Girsang 2010), though all of this is outside of the ATS districts of Maluku. Production per hectare is far lower than that in Java due to lack of suitable irrigation technology/infrastructure and lower levels of skills and knowledge amongst farmers.

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).

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[60] http://go.worldbank.org/RHGAAY6GY0, accessed 28/7/2011

[61] http://www.ruralpovertyportal.org/web/guest/country/home/tags/indonesia accessed 29/7/2011

The 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 a very mountainous topography leaving only a very small area of land suitable for cultivated crops. However, agriculture is the main form of livelihoods in the country with approximately 80% of the population involved in agriculture. Approximately one third of households rely on subsistence agriculture exclusively (World Bank Report62), 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). 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).

Agricultural productivity is very low in Timor-Leste partly due to a reliance on traditional practices based on very low resource inputs and from a culture of dependence on government subsidies and artificial markets which characterized the Indonesian period. High agriculture losses due to spoilage, pests and quality problems continue to hinder exports (World Bank Report). Higher yielding varieties of existing staple crops such as maize, cassava, sweet potato, rice and peanut have been introduced over the past decade through programs such as Seeds of Life (Williams et *al.* 2008).

Coffee is Timor-Leste's leading export commodity, and in 2002 there were an estimated 16,000 ha of productive coffee gardens with an additional 16,000 ha of unproductive coffee plantations. In that year approximately 20,000 farm families received a substantial amount of their income from small coffee holdings, while another 15,000 get a minor portion of their income from this source (Amaral 2003).

The agricultural potential of northern Australia's natural resource base is highly contested, with some markedly more pessimistic assessments than in earlier times (Lawn 2011). Rainfall is concentrated in a period of 3-5months wet season but is inconsistent, thereby restricting non-irrigated crops. Agriculture in northern Australia is dominated by pastoralism and intensive irrigated agriculture, the latter concentrated in the Kununurra Kimberley region (Clifton et al. 2007b) and the former dating back to the 19th century. Agriculture and forestry employed approximately 11.5% of northern Australia's workforce (Larson & Alexandridis 2009).

Only around 5% of land within the TRaCK region of northern Australia is used for intensive agriculture (Stoeckl *et al.* 2010) but a much larger area is used for livestock grazing based on unchanged land (Larson & Alexandridis 2009).

Much of the soil throughout PNG is low in quality with the majority of agriculture consisting of subsistence farming. Only small Incomes are earned from the sale of food, fish and rubber in the South Fly district of PNG. 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).

The agricultural industry's main interaction with coastal areas is as service centres and for export of products and commodities such as livestock through ports (DEWHA 2008b, Clifton *et al.* 2007a). In 2005-6, for example, the Port of Broome exported 22,306 tonnes of livestock to destinations in South-east Asia, one of the largest livestock exporting ports in Australia (Clifton *et al.* 2007a).

[62] http://go.worldbank.org/GN0Z5BCHB0 accessed 28/7/2011

PART B:

ECONOMIC AND SOCIAL DRIVERS

(OF MARINE AND COASTAL ACTIVITY AND IMPACTS FROM ENVIRONMENTAL DEGRADATION)

5 Economic and Social Drivers

A "driver" is defined as any factor that changes an aspect of an ecosystem (Millennium Ecosystem Assessment 2005). It is crucial to understand the direct and indirect drivers[63] of changes in ecosystems and ecosystem services to design interventions that capture positive impacts and minimize negative ones.

Marine and coastal activity and associated environmental degradation in the ATS region are affected by a range of interconnected drivers and processes operating at the global, national, regional and local scales which are often difficult to separate.

Global drivers include:

- World population demand for seafood and fisheries development and increasing trend towards settlement in urban coastal areas;
- International macro-economic trends (world economic growth, trade patterns, commodity prices, energy prices, exchange rates, interest rates and demand);
- International politics and policies (such as industry protection, development policy, and geopolitical instability).

National drivers include:

- National macro-economic conditions (including economic growth, consumption patterns, and labour markets);
- Domestic politics and policies, and regulation (including taxation, industry protection, environmental policy, industry assistance and development);
- Regional specific trends, including land supply, land rights claims, views on the environment, regional development policy, demographic and labour market change (Clifton *et al.* 2007b).

Key drivers of priority environmental concerns in the ATS region (i.e. depletion and loss of fisheries and coastal resources and biodiversity, habitat modification, degradation and loss, pollution and impacts of climate change) include:

- High consumer demand (local, export) for fish especially 'prestige' products and other marine and coastal resources due to population growth and per capita demand for goods from growing economies and high prices[64];
- Workforce availability – both for fisheries and the minerals sector;

[63] A direct driver unequivocally influences ecosystem processes and can therefore be identified and measured to differing degrees of accuracy. An indirect driver operates more diffusely, often by altering one or more direct drivers, and its influence is established by understanding its effect on a direct driver. Both indirect and direct drivers often operate synergistically.
The *indirect drivers* of change are primarily: demographic (such as population size, age and gender structure, and spatial distribution); economic (such as national and per capita income, macroeconomic policies, international trade, and capital flows); socio-political (such as democratization, the roles of women, of civil society, and of the private sector, and international dispute mechanisms); scientific and technological (such as rates of investments in research and development and the rates of adoption of new technologies, including biotechnologies and information technologies); and cultural and religious (such as choices individuals make about what and how much to consume and what they value).
The *direct drivers* are primarily physical, chemical, and biological such as land cover change, climate change, air and water pollution, irrigation, use of fertilizers, harvesting, and the introduction of alien invasive species (from Millenium Ecosystem Assessment 2005).

[64] According to Garcia and Rosenberg (2010) the demand for seafood has been rising at more than 2.5% per year in both the developed and developing worlds. In highly populated countries such as China and India this is likely to be rise more strongly.

- Poverty of resource users resulting in difficulties for livelihood diversification and alternatives to fisheries and other marine industries;
- Increasingly efficient fishing effort and technological changes (e.g. GPS, sounders, fish finders);[65]
- Weak fisheries and environmental governance.

Direct users of coastal and marine resources include the owners and crews of fishing enterprises and transport vessels, hunters and collectors, coral and sand miners, salt makers and mangrove cutters.

Indirect users of resources include those dependant on raw production – fish processors, transporters, traders, including women who perform these roles, and other associated industries and consumers. Then there are also those who benefit from the goods and services provided by the ATS region.

[Photo AFMA]

5.1 Economic Drivers

Generally, global capture fisheries production has plateaued and consumption is stable (FAO 2010), though in most parts of Southeast Asia the human population continues to grow and, to maintain levels of fish consumption, increased supply would need to come from aquaculture.

However, many of the products of economic importance in the ATS region are not likely to see substantial or any greater supply from aquaculture, such as shark fin, sea cucumbers and valuable fish species like red snappers. It is reasonable to conclude that the supply side for these products is likely to lead to higher prices at some or all points in the value chain. Growing affluence, particularly in China, is likely to put upward pressure on demand for marine products with perceived or real health benefits or prestige.

Higher prices paid for species with diminishing supply allows fishers to maintain the profitability of their operations even though their catches are diminished. Fishers will continue to exploit a resource (virtually to extinction) provided that scarcity raises prices as supply dwindles (Fox 2009). Of course the ATS region is not the sole source of supply for these species but the trends in the ATS are often reflected much more broadly in the region and beyond thus making this process of increasing values for diminishing stocks a serious issue. A very real example of this is continuing visits to the MOU box

[65] Technological developments also have negative impacts from automation with subsequent reductions in labour (Garcia & Rosenberg 2010).

by Indonesian fishers who have commented that their catches have declined but they are paid more for their catch (of sea cucumbers and shark fin) (Fox 2009).

As local communities become more connected to distant markets – especially through market intermediaries (middle men and traders and producers) – this can result in increases in levels of exploitation of marine resources, thus creating stronger links between market demand and patterns of exploitation in the ATS region.

Patron-client relationships are deeply ingrained in ATS coastal communities and produce entangled social relationships and fishing practices which can be difficult to change. On the other hand, poor market access by fishers to sell many pelagic and demersal species results in low prices, limiting income earning opportunities.

Economic impacts of IUU fishing include extremely high losses of revenue for Timor-Leste, Indonesia and Australia.

Confiscation or destruction of vessels due to IUU fishing – or suspected of IUU[66] – and incarceration of suspects for extended periods can contribute further to debt levels of fishers. This has far reaching impacts on fishers and their families reliant on the income; the boat owner who was outlaid cash for supplies that are lost; any patrons who financed the trip; and the community reliant on the food source to be delivered. In addition, confiscation and destruction of vessels can result in increased the indebtedness of the fishers to the boat owner/patrons and thereby increasing the vulnerability of the fisher as they may have to accept a lower return than if they could access the open market. This can drive increases in fishing effort and the taking of greater risks to repay debt.

5.2 Market Access and Value Chains

There is a diverse range of markets for the ATS fisheries products. Subsistence and artisanal fishers are generally highly constrained in how they process and market their products. Salting and drying fish remains the principle method of preservation for this sector. For sea cucumbers and shark fins these methods are still able to produce a product of high quality and value, though this is not uniformly achieved. Artisanal fishers are also able to produce high quality and nutritious fish products using this simple technology however this limits their markets and results in much lower value than is possible with refrigerated (iced, chilled or frozen) product. Proximity to markets may also have highly localised impacts as was found in PNG where the availability of valuable fisheries species was noticeably lower in regions in close proximity to local markets suggesting communities had overfished higher value and high trophic level species (Cinner & McClanahan 2006).

In contrast, industrial scale fisheries refrigerate their catches of fish and have many marketing options including export to other parts of Southeast Asia and beyond. Because of the relative remoteness of the ATS, being able to chill or freeze the catch is a strong advantage that overcomes a lack of local infrastructure and a constrained market for high value species. Catch is often reprocessed into value added products outside of the ATS region, notably in Java. Even some Australian trawl catch is exported to Indonesia for processing (J. Martin *pers. comm.*). It is known that some demersal fisheries trans-ship at sea and that product often leaves the ATS region without being landed. Trans-shipping at sea is generally illegal but this has not prevented the activity occurring, at least occasionally.

Few fishers anywhere are able to market their catches directly to the end markets/consumers and – even though that is where highest prices are paid –this is not always the most efficient or profitable strategy anyway. However, many fishers, including those in Australia, are able to access open markets where competition between multiple buyers maintains competitive prices. Among many

[66] Sometimes legislation cannot prosecute, but boats have been destroyed by the time this is established.

artisanal fishers in the ATS this is generally not the case. Most artisanal fishers in the ATS region are enmeshed in a patron-client relationship which forces them to sell to the person(s) providing the financial backing for the fishing operation. Under this effective monopolistic arrangement, prices achieved by the fishers are a much lower proportion of final prices than is generally achieved where market access is not so constrained. An example of how this might vary between an industrial/commercial and artisanal fishery is shown in Figure 22.

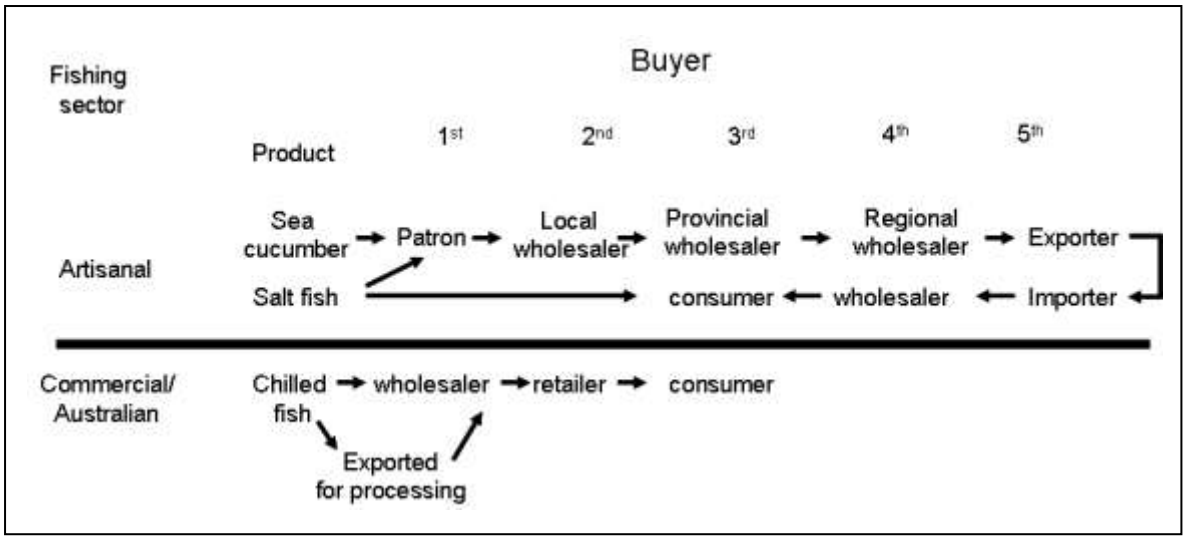

Figure 22: Value chain example for a typical ATS artisanal fisher and an industrial scale or Australian fisher in the same region.

(Note that two products are shown in the artisanal chain including dried sea cucumber which is predominantly an export product and salted fish which is more often for domestic consumption. Many women play a role in marketing salted fish directly from their husbands catch to consumers but large quantities may go through a patron.)

5.3 Subsidies

In the context of fisheries, subsidies "*are government actions or inactions that are specific to the fisheries industry and that modifies – by increasing or decreasing – the potential profits by the industry in the short-, medium- or long-term*" (FAO 2003). There are essentially two general forms subsidies can take i) the direct transfer of monies or ii) the provision of services. There is international interest in relation to fisheries subsidies because of the way that they can distort trade and importantly, because of the way subsidies may influence fishing capacity and the patterns and intensity of fisheries exploitation.

This section is not intended to be a full analysis of fisheries subsidies and their effects in the ATS region. However, for the sake of completeness in describing the fisheries of the region it must be earmarked as one of the factors contributing to the current state of the fisheries. Some of the fisheries subsidies that have been known to be found in the region include subsidies for fuel and fishing equipment. Less obvious and potentially less well accepted are subsidies for the full costs of management, including research, management planning and implementation and monitoring, control and surveillance (MCS) activities. Also, rarely considered are the infrastructure inputs like fishing port facilities which are often not fully recovered from the fisheries utilising them.

While not all subsidies are bad, subsidies can for example lead to improved management where costs of management might otherwise not be met, they more often have a negative impact on the fishery through support that leads to issues such as over-capacity and over-exploitation.

Subsidies for fisheries are in fact a feature, to a lesser or greater extent, of the fisheries of all three ATS countries. One of the better known fisheries subsidies in the ATS is the fuel subsidy available to

motorised fishing vessels in Indonesia. Although there have been two price increases to cost of fuel, the subsidy has remained. The subsidy is thought to have attracted some foreign fishing to the ATS from foreign nations as fuel could be purchased in Indonesia cheaper than in flag states. This has been curtailed but there remains a subsidy which can be accessed by 'joint venture' foreign boats.

Australia does not have a direct fuel subsidy, however it does rebate the excise tax on diesel fuel when it is used for commercial fisheries. This in effect increases the profits from fishing and would, in the absence of sustainable management systems, promote overfishing.

Subsidies also exist in Timor-Leste where the focus has been on helping fishermen's groups acquire motors for their boats and other fishing gear. This assistance which constitutes a subsidy comes from numerous sources including from the Fisheries Office 20%, local NGOs 15%, international NGOs 12% and District Government 9% (FAO 2011). In the case of Timor-Leste where the coastal fisheries are rebuilding after independence, these subsidies are probably favourable however their effects will need to monitored, like all fisheries subsidies, to ensure that they do not become negative in terms of sustainability.

5.4 Weak fisheries and environmental governance

In the context of fisheries, weak governance is considered to be one of the main factors driving overfishing and stock decline (Garcia & Rosenberg 2010).

Fisheries systems are complex and governance of these systems must take into account the natural resource and the ecological systems that support them, trading system that engage people at local to global scales, and the human systems, comprising the institutions and capabilities of individuals, households, communities and states. Governing fishery systems must therefore involve subsets of governing the environment, trade and economy, and society (Allison & Kelling 2009).

Governance is a complex area and Garcia and Rosenberg (2010) suggest seven aspects of governance include: i) connections between fisheries policy and national policy frameworks; ii) capability of fishery administrations; iii) entitlements (e.g. individual or communal) to resource access such as through co-management; iv) level of participation of stakeholders; v) level of availability and enforcement of deterrence measures; vi) the level and extent of inter-ministerial coordination and; vii) the quality of international collaboration.

In the ATS region there are specific governance issues affecting coral reefs and associated fish populations and habitats related to the availability and lack of control around use of chemical products (potassium cyanide) and explosives (e.g. fertilisers) for illegal fishing (as opposed to the former, traditional use of fish poisons).

Compared to the western part of the country, eastern Indonesia suffers from a shortage of skilled fisheries scientists with who are able to inform decision-makers when developing policies to address increasingly complex development issues (Dutton *et al.* 2009).

5.5 Social Drivers

Social drivers resulting in depletion of fish stocks, marine biodiversity and habitat degradation in the ATS region, particularly among coastal communities and fishing populations, include:

- Demand for prestige marine products (e.g. shark fin, snapper, sea cucumbers) by consumers for their social value;
- Low levels or lack of particular assets – such as lack of financial, physical and political capital – a common feature of fishing communities;

- Vulnerabilities including poverty, poor education, seasonality of activities, marginalisation and limited diversification options;
- Competition amongst artisanal and industrial fishing groups and sectors (limited resource availability and depletion of localised resources);
- Lack of rights and tenure and existence of common property regimes, and
- Poor governance.

One of the main drivers of the decline and loss of these 'prestige' marine products such as shark fin, sea cucumbers and red snappers is the desire by consumers for their perceived value rather than for daily nutritional dietary protein (see section 4 on fisheries). The value of these products is driven by special *social demands*. As such the value of these products cannot be substituted for in the same way as other regular fish and marine products.

Shifting fishing activities of mobile maritime populations who are active in the ATS region such as the Sama-Bajo, Butonese and Madurese are in response to a wide range of historical, economic, environmental and political factors which include IUU fishing and competition amongst populations (Fox 2005), impacts from conservation initiatives and MPAs, tourism (e.g. in Wakatobi), infrastructure and mining developments and associated pollution and environmental impacts in the coastal zone (Clifton 2010, Lowe 2006, Majors 2008), seasonal climatic and food security issues when men spend large periods of time away on boats (Fox *et al.* 2009, Stacey 2007) and cultural traditions – such as the practice of *merantau* (Stacey 2007).

Another important key social driver of fishing among many of these artisanal fishing groups are patron-client relations defined broadly as mutually obligatory arrangements between an individual who has authority, social status, wealth, (the patron) and another person who benefits from his or her support or influence (the client). These relationships are often long-standing across generations and very complex. For fishers such relationships operate as a survival strategy, where patrons provide financial support to fishers and their families in times of need. However, these ties of dependence can result in high short or long term debt to patrons. These can act as a fishing driver where fishers are, in many cases, left with little option but to undertake coastal or distant shore fishing ventures for highly sought after and highly valuable products to be 'sold' to their patron or 'boss' to clear their debts.

Depletion of fisheries resources is a result of many social drivers including increase in fishing effort due to increasing populations. Indonesia is expected to be the fourth most populous country in the world by 2030 at 289 million after India, China and the USA (Fernandes and Greiner 2010) and the population in Timor-Leste is also fast growing. In China for example, income growth and increased urbanisation has resulted in increased fish consumption. However, increasing populations are not always key drivers of overfishing, especially when the price of fish has increased (rather than decreased compared to others sources of protein such as red meat) and become too expensive and thus unaffordable for some groups such as rural poor (Hassan et al 2005). Other interconnected drivers relate to promotion of fishery resources as important sources of protein, vitamins and micronutrients as part of a healthy, nutritious diet and thus changing food preferences among some populations who can afford it (Hassan et al 2005).

High demand for products, habitat degradation and over-investment in the fisheries sector are also important drivers. Addressing this issue usually involves costs for those involved in exploitation – such as reduced incomes from catches as well as those involved in handling and marketing, from producers to consumers. Unless alternatives are provided for producers in the face of high market demand there is little incentive to accept costs (Townsley 2004). Indeed research from West Africa small scale fisheries has shown that poor fishermen are unable to mobilise assets needed to exit fisheries from poor returns (Cinner *et al.* 2009).

Social drivers of degradation of critical habitats range from patterns of direct use by resource users to more indirect causes from external factors resulting from pollution from industry, shipping, human settlements and activity in upstream catchments.

Short term concerns for survival among poor communities – living on a day-by-day basis – take precedence over longer term resource sustainability which is a key goal of conservation and management programs and the most difficult to 'sell' to local communities where changed access and production will result in decreased incomes from fishing closures.

Another social driver in some areas may relate to changes in resource use patterns and diminishing - or lost – skills and local environmental resource knowledge (traditional ecological knowledge, indigenous knowledge or local knowledge) and consequent disruption to 'traditional' livelihood patterns. This is particularly prevalent among communities with non-transferable skills used by many artisanal fishers.

Marginalised socially, weak and landless coastal fishing populations, such as the Sama-Bajo, immigrant Buginese, Butonese and Makassarese plus those living further from centres of power such as in remote regions of Maluku and Papuan provinces, have a higher dependence on exploitation of coastal and marine resources and consequently have limited power and influence over access and management of resources through political channels and decision-making.

Changes in use of technology from fisheries based on specialised knowledge and skill, to more mechanised modes of production, has allowed less or non-specialised groups who have less knowledge and concern for longer term resource sustainability to enter fishery domains. This has resulted in increased competition and can be seen amongst groups engaging in transboundary fishing activity in the ATS region and in particular, the north Australian region (Fox 2009, Stacey 2007).

The number of fishing boats and the total engine capacity has been growing annually. Destructive fishing gear and methods such as cyanide – most notably for the live fish and aquarium trades – are generally more expensive but simpler to use than more sustainable practices which may require more skill (Townsley 2004).

Research in Southeast Asia indicates that small-scale fishermen like their occupations and are bound to it by indebtedness and hence only a minority would change (Pollnac *et al.* 2001) or leave fishing for an alternative (Crawford 2002). Alternative livelihoods activities may inherently involve major changes to lifestyle (e.g. terrestrial-based, static lifestyle) which may or may not be preferable to communities and individuals. Fishers generally have a personal preference for their occupation and their identities are intimately connected to such occupations.

The key environmental concerns across the ATS region all have potentially severe social impacts for coastal communities. However these remain largely unquantified at the local level. The two main social impacts of overfishing and habitat degradation relate to i) reduced capacity to meet basic human needs and food security and ii) loss of income.

Some local populations in the ATS region (especially those marginal groups who do not have access to or ownership of land and are migratory in nature) are heavily dependent on fish for food and it is likely this pattern is undergoing change in some areas of the ATS (Darwin ATSEA Workshop Proceedings 2008). Overfishing, including that by migratory and foreign fishers, is placing additional pressure on existing food sources and local livelihood sustainability, leading towards a major problem. This can also result in conflicts between user groups for shared resources (e.g. between locals and foreign fishers).

Overall there are limited baseline data on the socio-economic dependence of communities in the ATS region and the more 'stressed' communities in the ATS region. It is therefore important for us to ask 'which communities are close to 'tipping point'?' (Darwin ATSEA Workshop 2008).

Social impacts of pollution (from sewerage, industry, debris, agriculture), particularly in urban areas, relate to increased risks to human health and increased health costs. Other impacts of polluted marine environments include losses in tourism, recreational or aesthetic values and negative effects on artisanal and subsistence fishing communities and aquaculture production from sedimentation.

Social impacts of climate change leading to losses in marine productivity (e.g. through disruption of the food chain, or increased acidification of oceans, and ecological changes to marine habitats) will be particularly severe in demographically vulnerable coastal communities, including low lying areas and 'floating' coastal villages. These will impact on well-being, food availability and reduced income. The vulnerability of coastal communities to climate change impacts can be determined by three factors: i) exposure to a specific change; ii) their sensitivity to that change; iii) their ability to respond to impacts or take advantage of opportunities (Garcia & Rosenberg 2010)

5.6 Conservation Drivers

Indonesia, Timor-Leste and northern Australia are centres of high marine biodiversity. Indonesia is particularly known for coral reefs with the highest biodiversity on earth (Glaser *et al*. 2010). In order to protect these valuable assets from the effects of fishing and other destructive practices there is a growing effort to create and manage marine protected areas (MPAs). In addition to protecting the marine biodiversity MPAs may also provide local employment and "eco-tourism" enterprise opportunities. There are claims that MPAs may bolster fisheries by increasing reproductive capacity, in particular by allowing fish to grow to large and highly fecund adult sizes. Further, MPAs may also export recruits directly to the fisheries that border them.

While such positive impacts are all helpful in producing positive human wellbeing outcomes, they may sometimes come at a cost. Since few areas of the ATS region are not already heavily impacted by human activities, particularly fishing, the delivery of important ecosystem services first requires restoring the ecosystem in the MPA, e.g. the export of more fisheries recruits is not instantaneous when the MPA is declared, as fish stocks are often in no better condition than those in surrounding waters.

There is also a risk that the positive impacts from the MPA will be offset by negative impacts caused by displaced fishers who are forced to concentrate their fishing in an area made smaller by the creation of the MPA. Among the nations in the ATS region, Australia is the only one that has broadly dealt with the issue of displacement and there is a diversity of opinion about the success of Australia's approach (MPA News 2011[67]). Australia's environment department is now working on a policy to deal with displaced fishing effort as Australia moves to manage its marine environment in Commonwealth waters, including those in the ATS region. Opportunities to manage displaced fishing effort are directly related to the livelihood alternatives that are available and potentially the willingness of the fishers to adopt new livelihoods. Many people are fishers by choice and want to remain fishers (Fauzi & Anna 2010) thus adding to the difficulty of making these shifts. According to a recent paper by Peterson and Stead (2011), some researchers have highlighted that MPA managers should "examine livelihood preferences at different scales (individual, within and between communities) prior to users being affected by MPA-created displacement to more effectively address marine conservation and food security goals".

Thus, while MPAs are important measures for conserving the region's rich biodiversity and potentially providing greater security for fisheries and the dependent livelihoods they may also push fishers from a regulated area to another unregulated area unless there are accompanying programs to prevent this. To date this has not been the case outside of Australia.

[67] http://depts.washington.edu/mpanews/MPA119.htm - accessed 7/08/2011

Countries within the ATS region are signatories to a host of international conservation agreements which may impact on fisheries in the region. One such agreement is the Convention on International Trade for Endangered Species of Wild Flora and Fauna (CITES) to which Indonesia, Australia and Papua New Guinea are all signatories but Timor-Leste is not.

Enforcement of such agreements varies between the nations. Indonesia has a vast range of laws and regulations protecting wildlife species and protected areas and is signatory to many international conventions including CITES. However, for a range of reasons enforcement is weak and trade in wildlife is rampant across the country (Lee *et al.* 2005) including in marine species such as the Humphead Wrasse (*Cheilinus undulates*) which is a species of high value on Asian live trade markets.

6 Key Threatening Trans-boundary Issues

The fisheries resources of the ATS are vitally important to many of the people who border these seas. Many of the human populations are highly vulnerable to any declines or collapses that could come about as a result of a failure of governance. In the short term even the application of good governance, that may require politically, culturally and practically difficult decisions about making large reductions fishing capacity or in catch, may have severe human wellbeing impacts.

Participation in fishing also goes beyond meeting nutritional and income needs. While it is often considered that fishing as an occupation is a last resort due to lack of alternatives, the situation in the ATS is infinitely more complex in relation to socio-economic and cultural issues such as tenure, access, rights, identity, and so on. Many fishers identify themselves with the occupation and, given a choice, even with lower returns, would continue to fish. Thus changes in fisheries in the region can have serious impacts on the society, health and culture of the human populations.

The natural systems are at risk of severe degradation because of fishing and pollution. These risks to the natural systems are exacerbated by many social and economic factors concerning activities, resources and ecological systems.

Growing human populations will add more pressure to the system unless it is possible to re-direct more people to other sustainable or non-extractive activities.

Marine debris and pollution is likely to worsen unless measures are successfully introduced to cut the rate at which pollutants/debris are discharged or lost into the marine environment. In the ATS region there are a number of regions proposed to undergo major development. Expansion of urban centres and certain sectors (e.g. tourism, mining, petroleum sector) can adversely impact on the environment and marine

Marine debris (Photo by AFMA)

species through sewage treatment and dispersal, urban run-off and litter. Ghost fishing gear presents a great risk in transboundary waters as it often continues to 'fish' for extended periods and more ghost fishing gear means less fish for humans.

Severe impacts from industrial accidents or oil spills, and increases in shipping activity, oil gas and mining are also likely to have major impacts in the region particularly in north and north western regions of Arafura-Timor Seas

Island communities in the Arafura Sea have also been affected by illegal fishing (including foreign fishing) and over exploitation of Arafura Sea stocks.

6.1 Knowledge Gaps

Improvements in the ATS region and addressing environmental concerns resulting from sectoral activity will depend on a range of governance arrangements internationally, nationally and locally. Improved welfare of the people in the area should be the main objective of governments and it is this common goal that provides the foundation for all governments in the Arafura Timor Seas to cooperate to improve the management of those seas. Nevertheless, management challenges are immense partly due to the huge differences in the social, economic, cultural and political conditions of each country in the region.

Overall there is limited detailed baseline information available through the literature on the socio-economic dependence of communities and more stressed communities, who are affected or impacted by transboundary environmental concerns in the ATS. In particular less is known concerning communities in the region of Merauke in Papua, Indonesia and the PNG region of Arafura Sea than coastal communities in the Provinces of NTT and Maluku, Timor-Leste and northern Australia.

Fisheries data are generally poor (incomplete or inaccurate) or perhaps absent all together (especially in relation to gender disaggregated data) which makes the assessment of stock status unreliable or impossible. In turn, the lack of robust assessments and scientific advice may compromise timely decision making, resulting in a negative feedback loop.

There are also few studies available on issues concerning nutritional dependence and personal choices among dependent communities in the ATS region (although results forthcoming through FAO RPLP in Timor-Leste and NTT in Indonesia); the status of resources versus livelihood strategies; poverty, income and wealth distribution in more remote regions of ATS; climate change impacts on local livelihoods and food security for marine dependent communities; patron-client relations and markets and value chains for various fisheries in ATS region; policies supporting and working against livelihood improvements and development policies relating to drivers of resource depletion; local institutions and institutional analysis in particular at regional versus district levels.

There are gaps related to the drivers, trends and characteristics of IUU fishing and data on catch levels. However, there is an urgent need to commence management actions particularly in relation to industrial IUU fishery. The impact of new decentralisation and governance on fisheries and marine management in Indonesia also creates a new operating environment which delivers uncertainty in relation to how this will affect marine and coastal resource management in the short, medium and long term. There is a clear need to identify the drivers and impacts of IUU fishing on local livelihoods in key coastal areas in NTT, Papua and Maluku.

Uncertainties also relate to the nature of scientific information. For example, some resource estimates state that stocks are badly depleted and the threat is through overfishing but scientifically this has not actually been proven. Thus there is a need for caution. There appears to be reasonable information on shared genetic species but more work needs to be done at the biological level. There are shared genes that may only evidence infrequent exchange and functional sharing where fish more routinely cross the boundary at some point in their life. It is the latter that matters most and is

least understood. Various collaborative research projects have been undertaken on potentially shared stocks (e.g. snapper, tuna and sharks), but there is a need to review these projects and activities as part of the ATSEA TDA. Baseline information on the MOU Box fisheries is currently being reviewed and expanded to improve management of traditional fisheries in the area.

6.2 Enhancement and diversification of livelihoods

The links between livelihood enhancement, food security, conservation and biodiversity management are complex and challenging particularly within the complex social, economic and political arena of the ATS region.

The peer reviewed global literature argues that leaving aside the 'luxury' items, it is near impossible to address food security with the projected increases in human population and food requirements for protein - an increase required of approximately 50% by 2050 to be sought from fish or agricultural staples. Like fisheries agricultural production is likely to continue to decrease making the challenge even greater to source protein (Rice and Garcia 2011). How will poor rural and remote ATS communities survive globalisation and higher local/regional demands on basic fish products?

There are major social, economic and cultural challenges, not only in sustaining current fisheries or marine based livelihoods but also in developing new activities outside of traditional or established activities for local coastal populations.

Some work has been piloted such as the aquaculture projects led by the ANU with local communities in Rote and Kupang in NTT, Indonesia. Such projects offer some promise for replication in some – but not all – areas of the ATS region. Livelihoods diversification to seaweed cultivation for example, has both advantages and disadvantages. It can supply a regular, recurrent (seasonally dependant) income, but there is high risk of disease due to overcrowding, resulting in subsequent (long) breaks in production. It can also supplement other livelihood strategies but may cause other problems such as lower stockpiles of agricultural-based food sources in some mixed fishing/farming communities during the 'hungry seasons' (e.g. Sabu). Essential elements for any alternative livelihood scheme in these communities include i) the need for land-based projects for women, ii) provision of micro-credit and iii) funds for children's education (Fox 2010 ATSEA meeting presentation).

Other trials are underway through the FAO Regional Fisheries Livelihoods Programme in Indonesia (NTT) and Timor Leste (e.g. PT Widaya Buana Prasetya 2010). Similarly there are other lessons to be learned which are relevant to the northern Australian indigenous situation regarding enterprise development success factors and opportunities and constraints, especially with regard to livelihood development based on coastal bush products or aquaculture.

However, no single scheme will fit all communities in the ATS region. In order to improve food security and incomes it is necessary to consider a suite of livelihood enhancement and diversification activities such as improving existing, or developing new, maritime related opportunities. Prerequisites include providing secure tenure, improving local market access and infrastructure, providing access to micro-credit schemes, opportunities for women, tailored education for particular social groups and a sound understanding of the social, economic, cultural and political contexts.

6.3 Recommendations

Due to the serious poverty issue in the ATS, any plan to better manage the ATS should include programs to combat poverty and address food security. Considering poverty has been relatively persistent in the area, it is a huge challenge to combat poverty at the same time as managing the environmental quality in the area. Improving human capital quality in the ATS areas is certainly needs attention.

In general the following areas provide opportunities for addressing priority transboundary environment concerns in the ATS region at all levels. These include:

- Improved information and knowledge
- Reduction in fishing pressure - in areas where there are clear links to depletion and overfishing (e.g. illegal activities in Arafura Sea)
- Improved policy and management (e.g. access, monitoring, surveillance, compliance, policy)
- Improved access to services, infrastructure and market access
- People-centred approaches and pathways to maintain food security and incomes and strengthening coastal community livelihoods for coastal communities reliant on ATS resources using a Sustainable Livelihoods Approach framework

Approaches which put people at the centre – such as Sustainable Livelihoods (SLA) Approach which not just natural assets that people draw on for their livelihoods - but other assets and their relationships, to consider the way livelihoods are determined and how they may be improved. There appears to be a need for new and innovative approaches that focus on building on existing capital assets of local communities, reducing vulnerabilities and facilitating market access rather than a top down technology approach driven by external agents that deliver little or no benefit to local people. As Allison and Ellis (2001) have identified:

> "The key to sustainable fisheries management and development is to facilitate small-scale fisherfolk to find their own routes out of poverty by building on their existing capital and capabilities".

We recommend a Livelihoods, Poverty and Vulnerability Analysis of fishing communities in the ATS. This would identify the communities most at risk, most poor and most dependent on coastal or marine livelihoods and those in need under the ATSEA goal of improved, sustainable socio-economic conditions and opportunities for coastal peoples in the Arafura and Timor Seas region.

[Photo: N. Stacey]

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APPENDIX 1. Provinces of Indonesia

Province	Capital	Population[68]	Area (km²)	Density (pop/km²)	Geographical unit	Cities	Regencies	Subdistricts	Villages
Aceh	Banda Aceh	4 486 570	57,956	77	Sumatra	4	19	275	6,420
Bali	Denpasar	3 891 428	5,780	673	Nusa Tenggara	1	8	57	698
Bangka-Belitung	Pangkal Pinang	1 223 048	16,424	74	Sumatra	1	6	43	361
Banten	Serang	10 644 030	9,662	1,102	Java	4	4	154	1,530
Bengkulu	Bengkulu	1 713 393	19,919	86	Sumatra	1	9	116	1,442
Central Java	Semarang	32 380 687	32,800	987	Java	6	29	573	8,577
Central Kalimantan	Palangkaraya	2 202 599	153,564	14	Kalimantan	1	13	120	1,439
Central Sulawesi	Palu	2 633 420	61,841	43	Sulawesi	1	10	147	1,712
East Java	Surabaya	37 476 011	47,799	784	Java	9	29	662	8,502
East Kalimantan	Samarinda	3 550 586	204,534	17	Kalimantan	4	10	136	1,404
East Nusa Tenggara	Kupang	4 679 316	48,718	96	Nusa Tenggara	1	20	286	2,775
Gorontalo	Gorontalo	1 038 585	11,257	92	Sulawesi	1	5	65	595
Jakarta Special Capital Region	Jakarta	9 588 198	664	14,440	Java	5	1	44	267
Jambi	Jambi	3 088 618	50,058	62	Sumatra	2	9	128	1,319
Lampung	Bandar Lampung	7 596 115	34,623	219	Sumatra	2	12	206	2,358
Maluku (Moluccas)	Ambon	1 531 402	46,914	33	Maluku Islands	2	9	76	898

[68] Population data from BPS Census 2010

Province	Capital	Population[68]	Area (km²)	Density (pop/km²)	Geographical unit	Cities	Regencies	Subdistricts	Villages
North Maluku (N. Moluccas)	Sofifi	1 035 478	31,982	32	Maluku Islands	2	7	109	1,041
North Sulawesi	Manado	2 265 937	13,851	164	Sulawesi	4	11	150	1,510
North Sumatra	Medan	12 985 075	72,981	178	Sumatra	8	25	408	5,649
Papua	Jayapura	2 851 999	319,036	9	Western New Guinea	1	28	330	3,583
Riau	Pekanbaru	5 543 031	87,023	64	Sumatra	2	10	153	1,500
Riau Islands	Tanjung Pinang	1 685 698	8,201	206	Sumatra	2	5	59	331
South East Sulawesi	Kendari	2 230 569	38,067	59	Sulawesi	2	10	199	1,843
South Kalimantan	Banjarmasin	3 626 119	38,744	94	Kalimantan	2	11	151	1,973
South Sulawesi	Makassar	8 032 551	46,717	172	Sulawesi	3	26	301	2,874
South Sumatra	Palembang	7 446 401	91,592	81	Sumatra	4	11	217	2,869
West Java	Bandung	43 021 826	35,377	1,216	Java	9	17	625	5,827
West Kalimantan	Pontianak	4 393 239	147,307	30	Kalimantan	2	12	175	1,777
West Nusa Tenggara	Mataram	4 496 855	18,572	242	Nusa Tenggara	2	8	116	913
West Papua	Manokwari	760 855	97,024	8	Western New Guinea	1	10	149	1,291
West Sulawesi	Mamuju	1 158 336	16,787	69	Sulawesi	0	5	66	564
West Sumatra	Padang	4 845 998	42,012	115	Sumatra	7	12	169	964
Special Region of Yogyakarta	Yogyakarta	3 452 390	3,133	1,102	Java	1	4	78	438

Source: Wikipedia, *Provinces of Indonesia* (http://en.wikipedia.org/wiki/Provinces_of_Indonesia [accessed 14/06/2011], with population data from BPS Report '*Hasil Sensus Penduduk 2010: Data Agregat per Propinsi*'

APPENDIX 2. Indonesian Fisheries Data

Table 24: Distribution of Fishers by type by coastal areas, 2009

Coastal Zone	Full time	Part time (major)	Part time (minor)	Total
West Sumatera	107,404	26,691	6,859	140,954
South Java	56,221	36,016	17,440	109,677
Malacca Strait	143,486	32,867	5,736	182,089
East Sumatera	131,144	80,261	34,488	245,893
North Java	277,964	109,629	37,068	424,661
South/West Kalimantan	55,121	47,487	19,326	121,934
East Kalimantan	69,831	72,556	32,089	174,476
Bali-Nusa Tenggara	78,667	73,117	32,134	183,918
South Sulawesi	48,832	156,248	27,851	232,931
North Sulawesi	58,155	66,924	40,018	165,097
Maluku - Papua	69,464	61,201	56,984	187,649
NATIONAL TOTAL	1,096,289	762,997	309,993	**2,169,279**

Source: DGCF 2010

Table 25: Five years intervals (1977-2008) on Number of Fishers in NTT, Papua and Maluku Provinces

	NTT			IRJA/PAPUA			MALUKU		
	FULL	MjPART	MiPART	FULL	MjPART	MiPART	FULL	MjPART	MiPART
	REFERENCE VALUES (1977)								
1977	9899	9233	3582	7645	5099	4799	28828	26890	10431
INDEX TO REF. VALUES									
1977	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
1980	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1985	1.3	2.0	1.9	1.8	3.3	1.7	1.1	1.2	1.3
1990	1.8	2.9	2.7	2.6	5.4	3.2	1.4	1.5	1.6
2000	2.4	5.2	3.6	8.0	18.5	7.3	1.6	1.0	4.6
2005	3.1	5.1	4.6	4.6	9.2	3.4	1.2	1.7	1.6
2008	2.8	4.5	4.1	4.8	10.2	4.4	1.6	0.8	4.6

Table 26: Increases (1950-2006) in number of gear and catch by group of species and their values in Indonesia.

Year	No of bottom trawls	No of shrimp trawl	Catch of Metap shrimps (tons)	Catch of Banana prawn (tons)	Catch Sharks & rays (tons)	Value Sharks & rays (US $)	Value of catch by bottom trawls (US $)	Value of Shrimps catch (US $)	Value Small demersals (<30 cm) (US $)	Value of Medium demersals (30 - 89 cm) (US $)	Value of Crustaceans (US $)
REFERENCE VALUES											
1950	3257	1883	746	830	594	345,933	1,472,895	3703212	7167622	345632	3,816,579
INDEKS TO REF. VALUE											
1950	1	1	1	1	1	1	1	1	1	1	1
1955	7	5	4	6	6	5	7	5	6	8	5
1960	7	5	4	6	5	4	7	5	5	7	5
1965	11	8	6	10	12	10	11	8	7	12	8
1970	12	9	7	11	13	11	11	9	12	16	9
1975	18	12	9	14	26	16	14	5	8	7	5
1980	32	33	31	28	31	18	48	47	25	32	53
1985	39	30	31	23	40	21	53	70	28	30	75
1990	49	39	39	34	55	34	67	65	31	45	73
1995	70	47	46	39	72	52	87	80	34	81	90
2000	60	42	54	31	70	27	38	49	11	56	49
2005	72	37	45	35	76	67	55	44	29	67	47
2006	72	37	44	35	74	64	56	44	30	68	46

.

Table 27: Number of fishing boats recorded by type and size in NTT, Maluku and Papua Provinces between 1977 and 2007

	Year	Total	Non-motorised				Outboard motor	Sub total	Inboard Motorised Vessels (size in GT)											Sub total
			Dug-out boat	Small*	Medium	Large			< 5	5-10	10-20	20-30	30-50	50-100	100-200	200-300	300-500	500-1000	≥ 1000	
NTT	**1977**	8,958	4,306	3,468	846	223	98	8,843	15	1		1								17
	1980																			
	1985	12,174	6,652	3,623	601	48	896	10,924	310	37	6									354
	1990	13,271	8,272	5,694	642	137	849	14,745	509	92	76									677
	1995	17,917	8,876	6,350	969	132	742	16,327	643	144	55	6								848
	2000	18,906	10,948	4,897	225		843	16,070	1,344	444	178	27								1,993
	2005	29,494	14,559	4,483	1,640	170	3,629	20,852	3,771	859	170	210	3							5,013
	2007	29,442	14,517	4,498	1,646	164	3,612	20,825	3,780	871	154	200								5,005
MALUKU	**1977**	22,622	18,150	2,564	988	407	411	22,109		2	14	16	10	8	15	37				102
	1980																			
	1985	30,683	24,600	2,873	1,843	318	778	29,634		8	92	60	43	11	25	32				271
	1990	32,002	22,251	4,914	2,150	225	1,542	29,540	338	128	225	41	38	7	56	87				920
	1995	35,978	24,591	5,621	2,152	201	2,271	32,565	396	186	226	106	58	19	107	44				1,142
	2000	36,629	24,896	5,643	2,210	211	2,396	32,960	423	206	238	133	42	45	132	54				1,273
	2005	47,862	31,489	6,755	2,066	706	4,873	41,016	922	783	174	89	2	1	2	0	0	0	0	1,973
	2006	48,102	30,826	7,031	2,278	809	5,118	40,944	930	803	181	93	8	0	11	6	8	0	0	2,040
	2007	48,495	30,411	7,033	2,283	814	5,403	40,541	1,037	960	353	142	10	1	26	17	5	0	0	2,551
PAPUA	**1977**	8,731	5,800	1,870	456	107	419	8,233					30	3	22	24				79
	1980																			
	1985	13,350	7,066	4,194	763	328	916	12,351		7	11	9	10		40	6				83
	1990	18,793	7,618	7,300	1,808	363	1,372	17,089		20	104	21	83		84	20				332
	1995	22,600	9,070	7,829	2,211	836	1,893	19,946	83	80	160	117	124	48	102	47				761
	2000	27,826	9,380	8,967	2,586	1,504	3,451	22,437	208	367	329	182	337	179	181	155				1,938
	2005	36,034	13,659	11,012	3,821	1,614	4,454	30,106	376	402	448	176	10	54	7	1	0	0	0	1,474
	2007	40,121	16,486	10,576	3,725	1,787	5,937	32,574	502	567	329	145	11	53	2	1	0	0	0	1,610

** Small (<7), Medium (7 to 10 m), Large (>10 m), Source: DGCF 2010*

Table 28: Number of fishing gears, volume and catch/gear/trip in Indonesian region of the ATS (2009)

	No of Fishing Gears				Volume (tonnes)				Average Catch/Gear/Trip			
Coastal Area	NTT	MAL	PAP	WPAP	NTT	MAL	PAP	WPAP	NTT	MAL	PAP	WPAP
Trawl	0	50	173	216	0	4,252	13,827	2,357	0.00	7.45	13.40	0.92
Fish net		176	240	38		62,258	133,204	239		55.49	67.07	0.02
Danish seine	2,029	570	1,984	358	10,524	14,443	507	3,289	0.39	0.75	0.03	0.06
Purse seine	659	385	76	17	5,265	45,975	8,604	112	0.41	6.53	3.26	0.66
Gill nets	17,704	12,602	23,671	6,426	23,683	57,157	41,747	30,307	0.20	0.13	0.05	0.03
Lift nets	178	1,752	200	389	4,842	23,625	3,137	4,830	0.63	0.33	0.06	0.09
Long/pole line	20,848	6,723	7,672	4,776	18,967	60,094	1,266	39,976	0.35	0.26	0.01	0.08
Lines	5,200	6,997	0	172	19,710	19,123	0	167	0.27	0.07		0.00
Squid jig	635	314			969	951			0.14	0.05		
Traps	2,388	2,273	154	63	1,906	7,452	258	576	0.09	0.07	0.04	0.04
Sea cucumber GR	60	251			63	488			0.08	0.07		
Cast net	550	334			421	437			0.03	0.05		
Harpoon etc	1,043	1,394	5,417	1,865	3,589	1,246	13,502	13,501	0.31	0.02	0.01	0.05

Source: DGCF, 2010

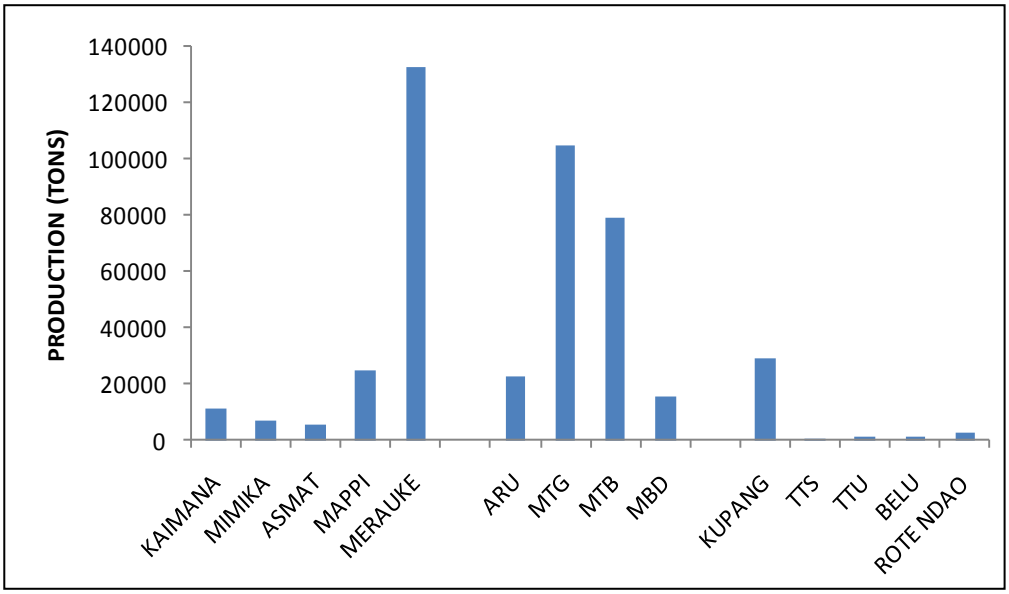

Figure 23: Marine Fish Production by districts

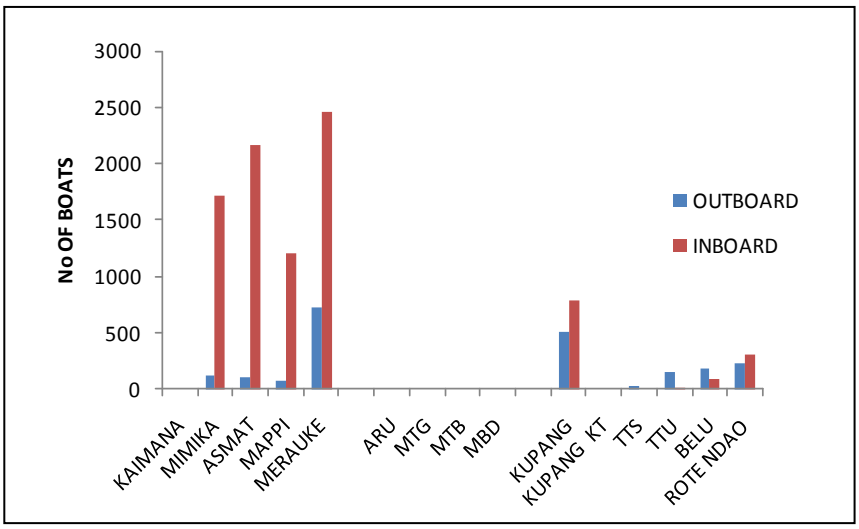

Figure 24: Distribution of fishing boats by districts (2008, 2009)

Source: BPS, Papua 2010; NTT; 2009

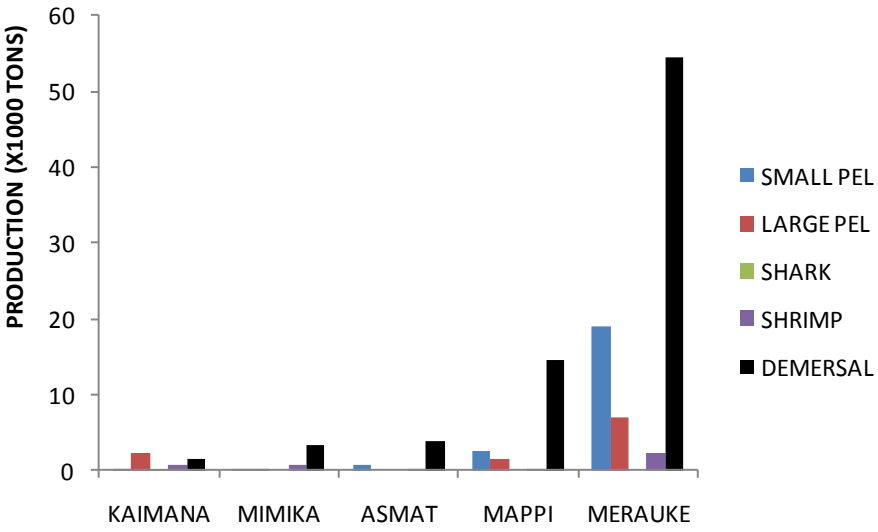

Figure 25: The landing of marine fish by group of species by district off the west coast of Papua (2009)

Source: BPS, Papua and Papua Barat in figure 2010

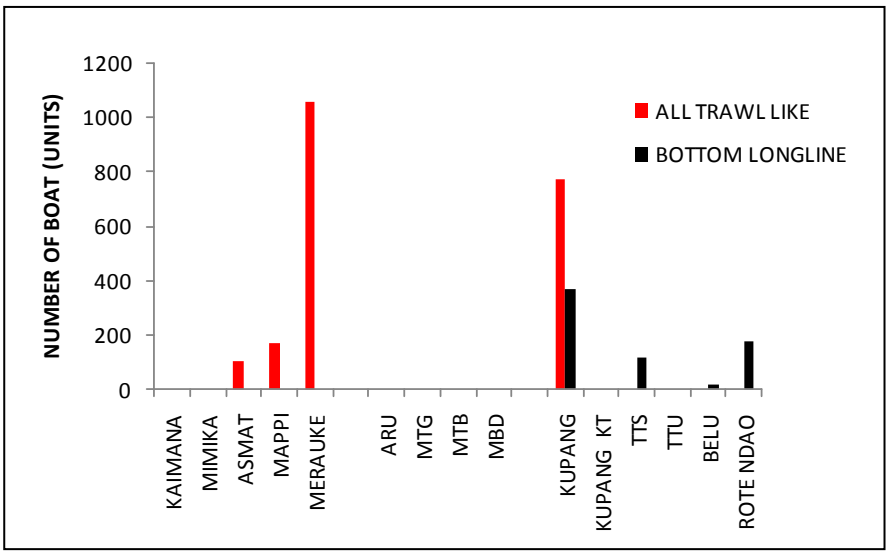

Figure 26: Number of boats related to shrimp, demersal and shark fisheries by district (2008, 2009)

Source: BPS Papua, Papua Barat in Figure 2010; NTT in figure 2009

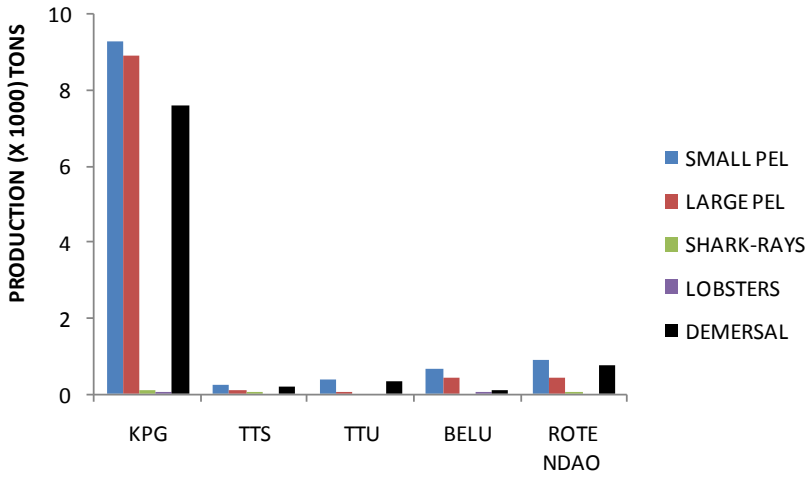

Figure 27: The estimate production of marine fish by group of species by district of East Nusa Tenggara (2008)

Source: BPS, NTT in figure 2009

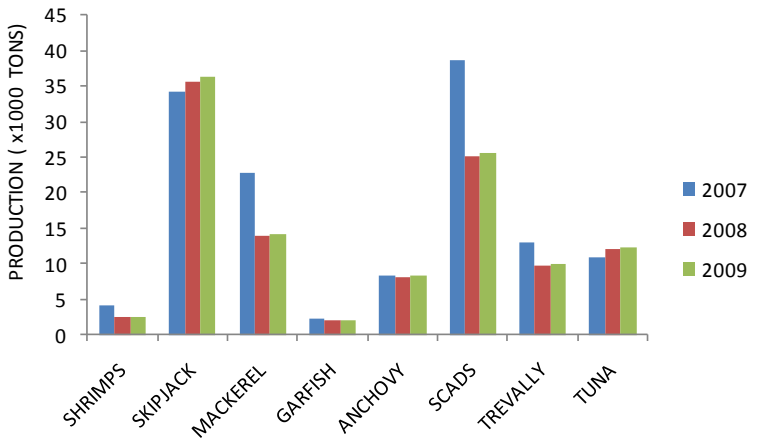

Figure 28: The landing composition by species in Maluku Province (2007-2009).
Source : BPS, Maluku in Figure 2010

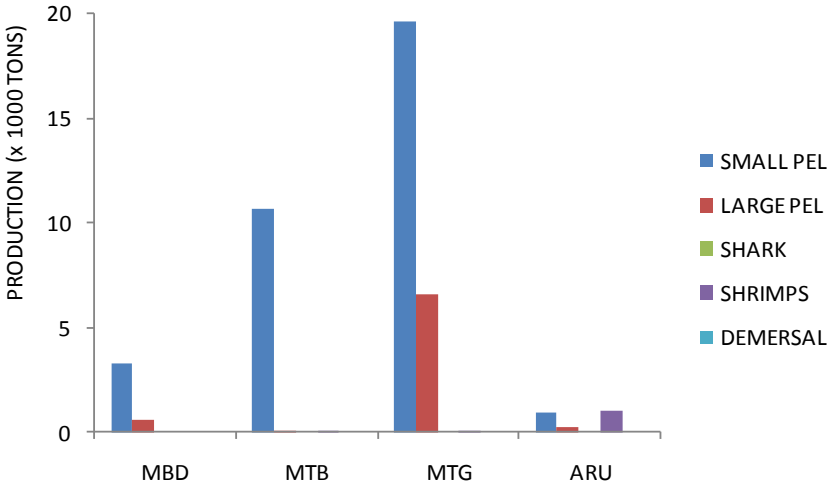

Figure 29: Estimated Production by group of species by district in Maluku (2009)

APPENDIX 3. Indonesian Policy and Legislative Frameworks Affecting Fisheries

		1950's	1960's	1970's	1980's	1990's	2000's
GR 64/57	Sharing Authority with Provinces	1957[1]					
L 4/60	Indonesian Waters		1960[2]				
L 1/67	Foreign Investment		1967[3]				
L 6/68	Domestic Investment		1968[3]				
MAD 561/3	Bycatch exclusion device			1973[4]			
MAD 40/74	Bycatch			1974[4]			
MAD 607/76	Fishing Zone Reserve			1976[5]			
PD 39/80	Trawling ban				1980[6]		
MAD 503/80	Trawl Model Banned				1980[6]		
MAD 694/80	Trawl boundaries				1980[6]		
MAD 542/81	Trawling Limits for Java, Bali and Sumatera				1981[6]		
PI 11/82	Limiting Trawling				1982[6]		
PD 85/82	Shrimp Trawl in Arafura Open>10m				1982[5]		
PD 85/83	Turtle Exclusion Device (TED)/Bycatch Exclusion Device (BED)				1983[4]		
L 9/85	Fish Management – Sustain Optimal				1985[7]		
L 17/85	UNCLOS Ratification				1985[2]		
L 22/99	Decentralisation					1999[1]	
MAD 392/99	Fishing Zone, Boat Size, Gear Type					1999[5]	
L 25/99	20% Revenue to Central Government					1999[1]	
GR 54/2002	Fisheries Business						2002[3]
L 32/2004	Delivering Responsibilities - Provinces						2004[1]
MMFD 16/06	Fishing Ports						2006[7]
MMFD 03/07	Letter of Seaworthiness						2007[7]
MMFD 38/07	Sharing Prov/districts						2007[1]
MMFD 05/07	Vessel Monitoring Systems						2007[7]
MMFD 05/08	Capture Fisheries						2008[7]
MMFD 01/09	Fisheries Management Areas of Indonesia						2009[7]
MMFD 27/09	Fishing Vessel Labeling						2009[7]
L 21/09	CMSFS & HM S UNIA						2009[4]
MMFD 06/10	Fishing Gear in Fisheries Management Areas						2010[7]
MMFD 16/10	Licensing 30-60 to Province						2010[1]

GR: Government Regulation
MAD: Ministry of Agriculture Decree
PD: Presidential Decree
PI: Presidential Initiative
L: Law
MMFD: Ministry of Marine and Fisheries Affairs Decree

1 Sharing authority with Central/Local governments
2 Right to exploit marine biota
3 Investment
4 Bycatch
5 Fishing Zone
6 Fishing Gear
7 Fisheries Management

APPENDIX 4. Fisheries in the ATS Region

Fishery	Licences or Vessels	Management Authority	Active in ATS	Area of the Fishery	Major Ports/centres	Catch (Mt)	Ref yr
Australia							
Northern Demersal Scalefish Fishery*	11	WA	Yes	See map Appendix ??	Broome Darwin	1010	2008
Mackerel Fishery	19	WA	Yes	121 E to NT border (coastal)	Broome Darwin	343	2008
WA North Coast Shark Fishery	9	WA	?	See map		591	2003-04
Bêche-de-Mer Fishery		WA	?	Throughout WA waters with specific closures.		196	2008
Kimberley Prawn fishery	137	WA	Yes	See map		168	2008
Demersal fishery*	60	NT	Yes	See map	Darwin	505	2009
Finfish trawl fishery*	1	NT	Yes	See map	Darwin	1114	2009
Timor Reef fishery*	12	NT	Yes	See map	Darwin	733	2009
Offshore Net and Line Fishery	17	NT	Yes	NT high water mark to AFZ	Darwin	1287	2009
Spanish Mackerel	16	NT	Yes	Seaward of NT coast to AFZ	Darwin	233	2009
GoC Developmental Finfish Trawl*		Qld	Yes	See map			
Joint Authority Northern Shark Fishery	5	JA	No	See map			
Northwest Slope Trawl Fishery	7	Aust	Yes	See map	Darwin	confidential	
Northern Prawn Fishery	52	Aust	Yes	See map	Darwin Cairns Karumba	6740	2008-09
Western Skipjack	13	Aust	No				
Western Tuna and Billfish	95	Aust	No				
Southern Bluefin Tuna Fishery	97	Aust	No				
Subsistence Indigenous fishing	N/A	Unmanaged	Yes	All coastal areas adjacent to the ATS	All communities	Unknown	
Recreational Fishing	N/A	WA,Qld, NT	Yes	Many coastal areas adjacent to the ATS	Weipa, Nullumboy, Darwin	Unknown	
Indonesia							

Fishery	Licences or Vessels	Management Authority	Active in ATS	Area of the Fishery	Major Ports/centres	Catch (Mt)	Ref yr
Bottom Longline	99		Yes	Arafura and Timor Sea continental slopes	Probolinggo, Sorong, Merauke and Benjina		2004
fish trap			Yes				
demersal gillnet	274		Yes		Fakfak, Sorong and Merauke		2004
squid jig			Yes				
Arisanal flyingfish		Unmanaged	Yes	See map			
fish net	815		Yes	See map	Merauke, Tual, Benjina, Kaimana and Sorong		2004
shrimp trawl	336		Yes	See map	Sorong, Kendari, Kupang, Timika, Benjina and Dobo		2004
Pole and Line	8		??				2004
Artisanal trepang	N/A	Unmanaged	Yes	Coastal areas and coral reefs of ATS	Kupang, Makassar and Surabaya (accumulation points)	Unknown	
Artisanal shark longline	N/A	Unmanaged	Yes	fish widely through the ATS	Papela, Kupang, Merauke, Dobo	Unknown	
Timor-Leste							
Tuna Longline	5	MAF	Yes	South of Timor-Leste	Dili	just beginning	2011
Artisanal gill net	>6000	Unmanaged	Yes	Coastal Timor-Leste	All coastal communities		
Artisanal spear fish							

APPENDIX 5. Maps of Australian Fisheries

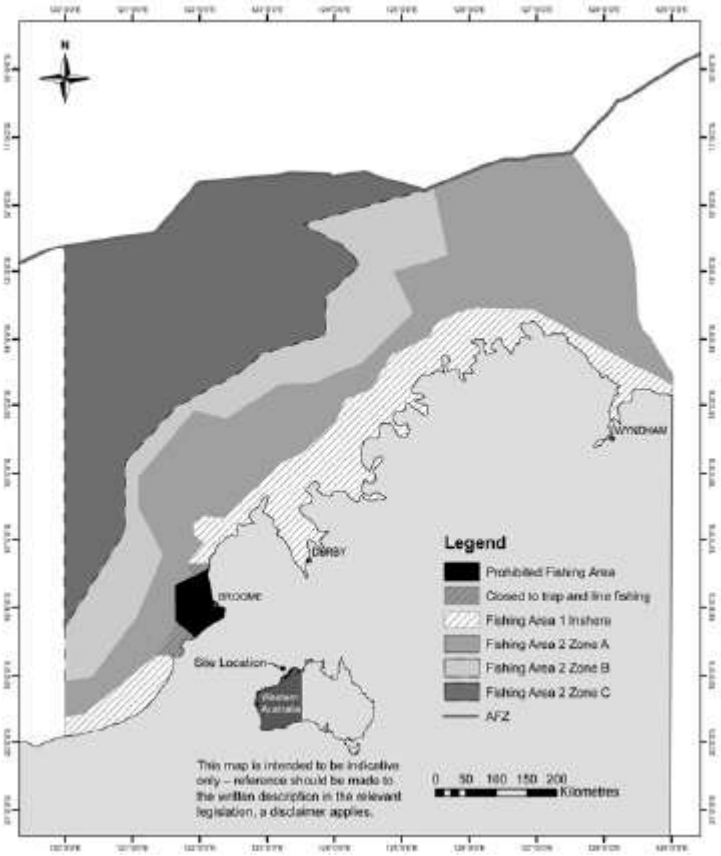

Figure 30: Western Australian Northern demersal scalefish fishery area

[Source: Fletcher & Santoro 2010]

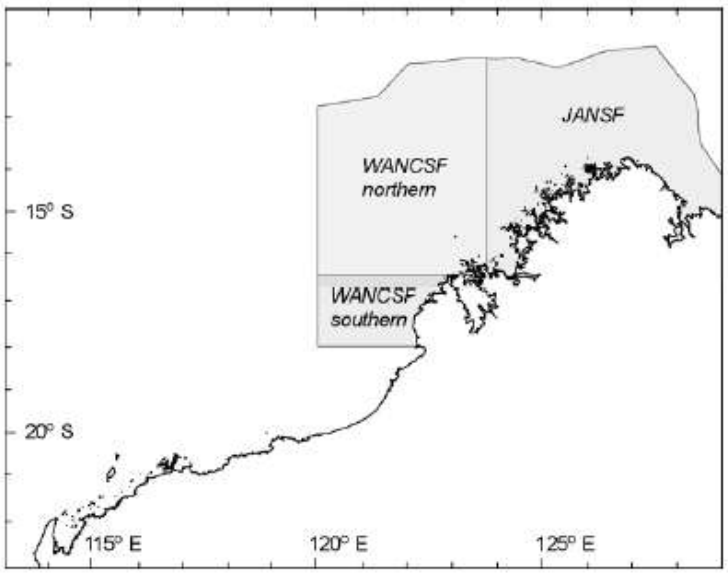

Figure 31: WA North Coast Shark Fishery and Joint Authority Northern Shark Fishery areas

[Source: Fletcher & Santoro 2010]

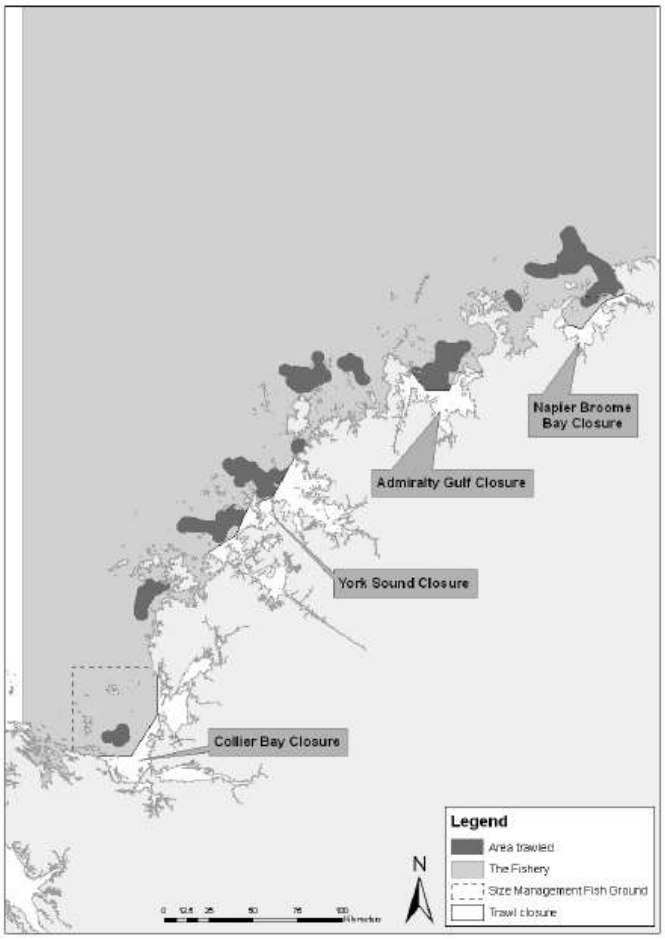

Figure 32: Kimberley Prawn fishery managed area

[Source: Fletcher & Santoro 2010]

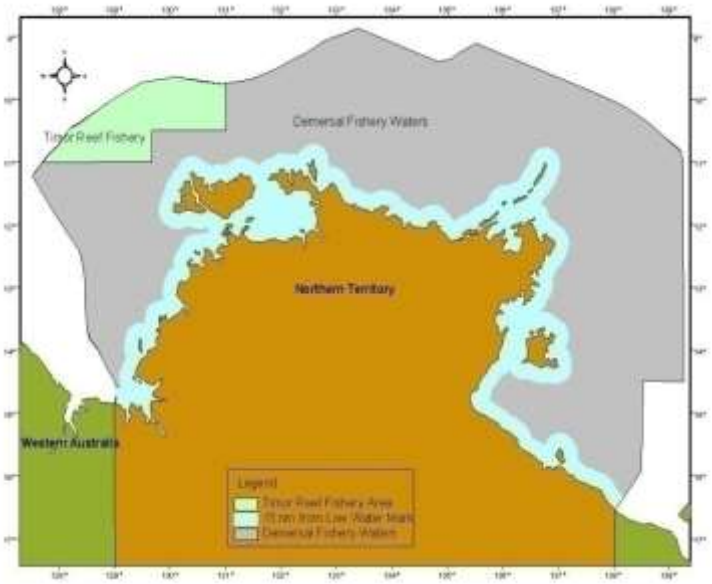

Figure 33: NT Timor Reef and Demersal Fishery areas

[Source: Handley 2009]

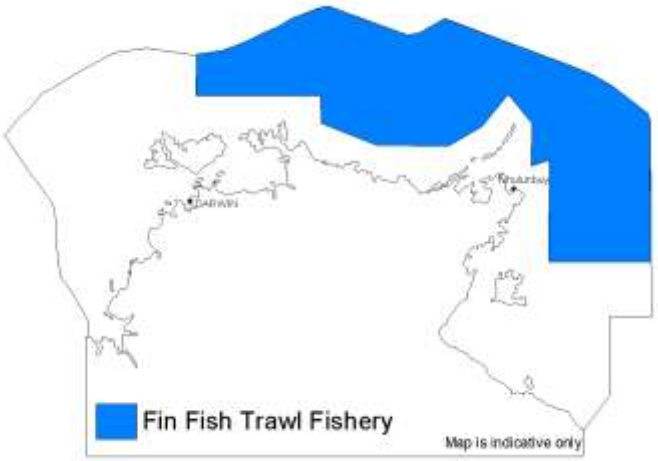

Figure 34: Finfish Trawl fishery area
[Source: Handley 2009]

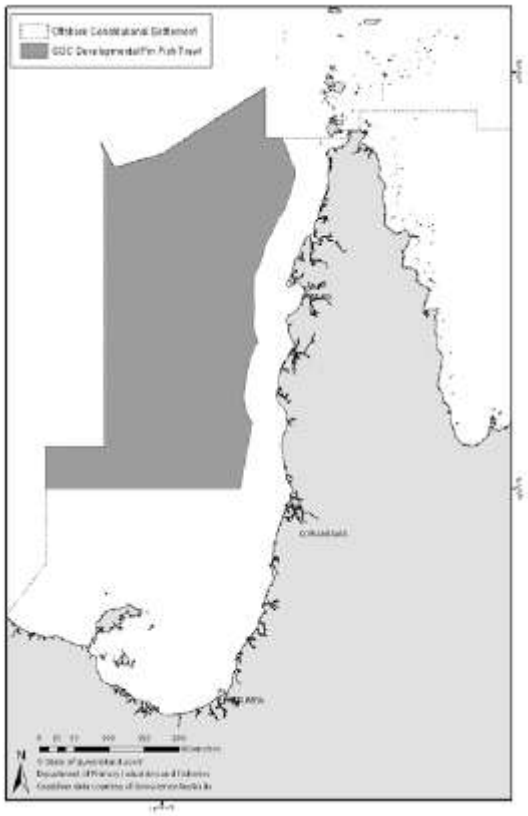

Figure 35: Queensland Gulf of Carpentaria Developmental Fin Fish Trawl Fishery area
[Source: DEEDI 2010]

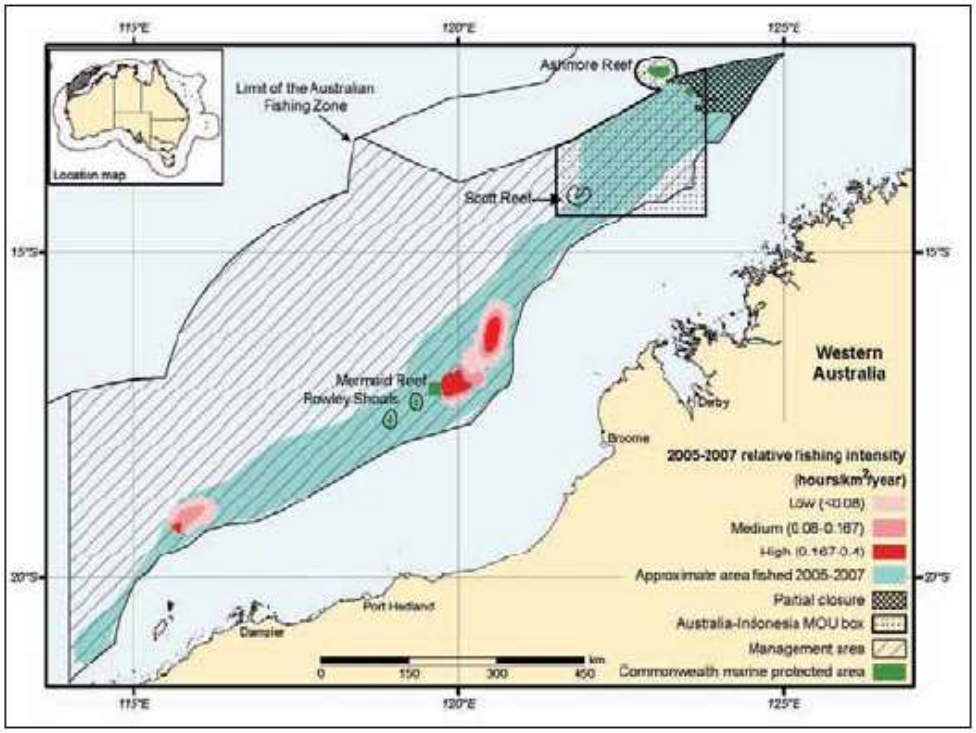

Figure 36: North West Slope Trawl Fishery area.

[Source: Wilson *et al.* 2009]

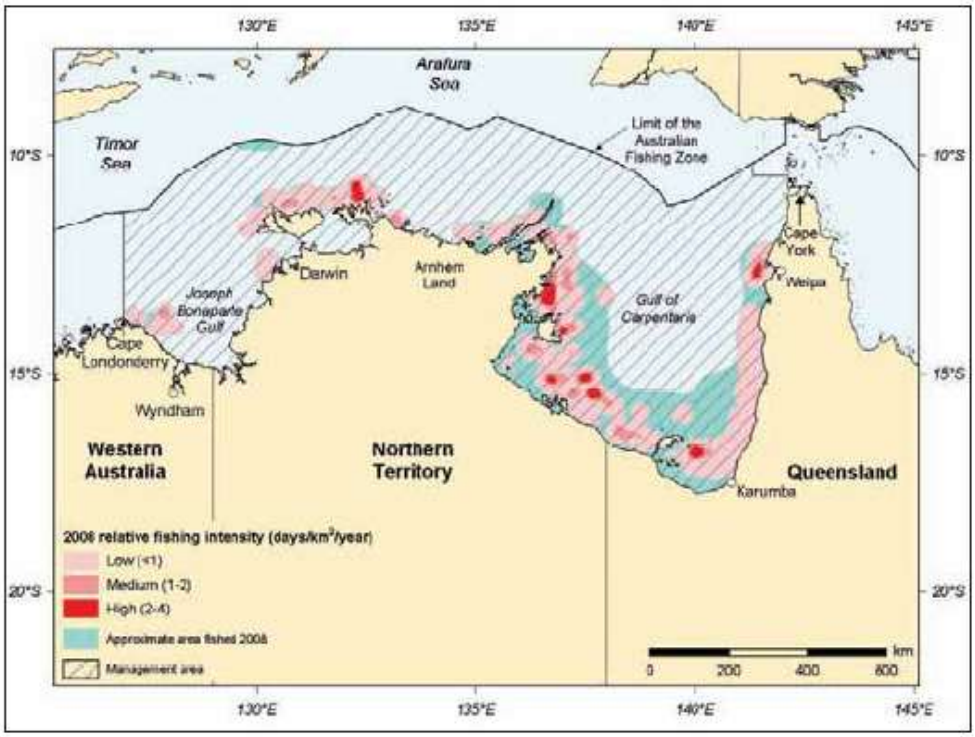

Figure 37: Northern Prawn Fishery area.

[Source: Wilson *et al.* 2009]

APPENDIX 6. Maps of Foreign Fishing Vessels Sighted or Apprehended in Australian Waters

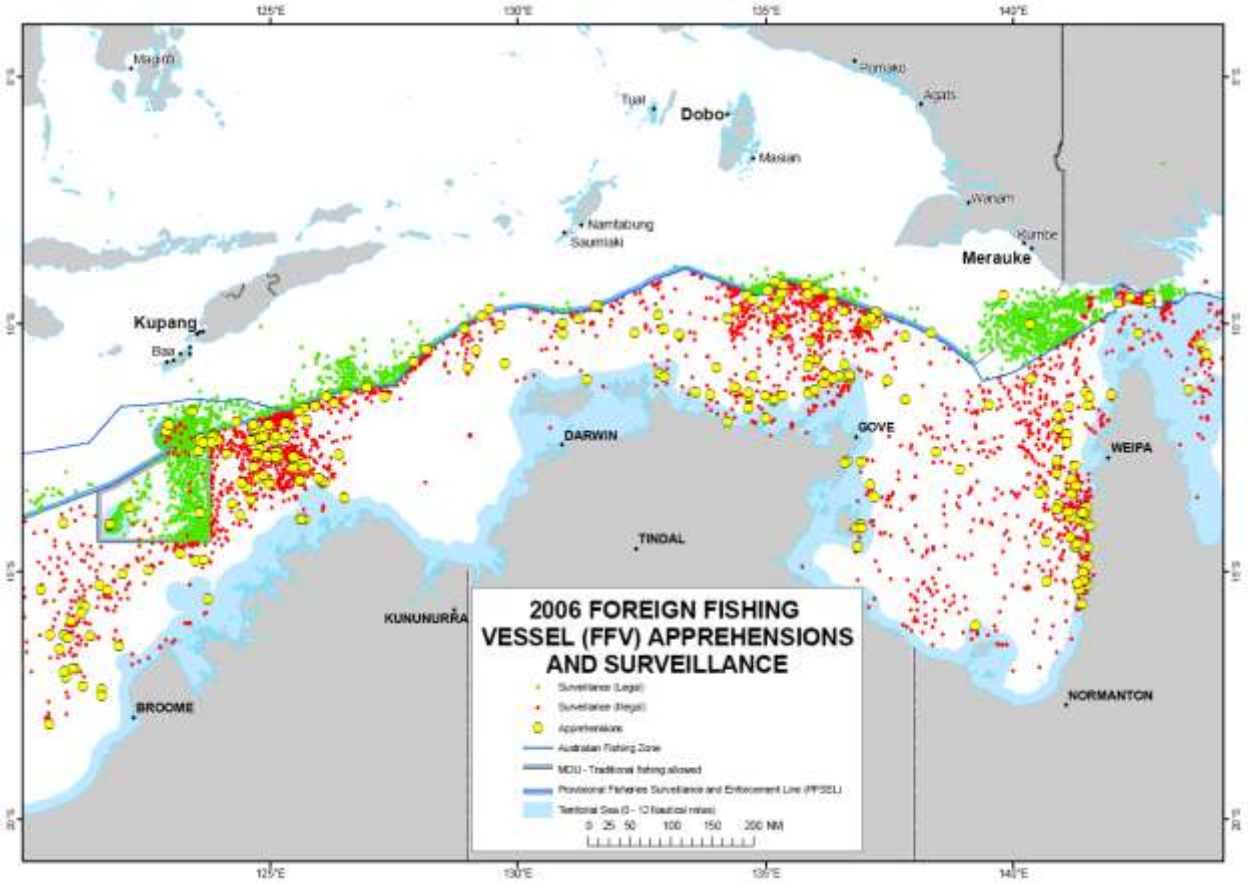

Figure 38: Sightings from surveillance aircraft of legal and illegal fishing vessels of non-Australian origin in Australian waters, and legal or illegal (status unknown) fishing vessels in the waters of Indonesia, Timor-Leste and Papua New Guinea during 2006.

Note that individual vessels may be sighted more than once, however some other vessels go unsighted. Vessels north of the Provisional Fisheries Surveillance and Enforcement Line (PFSEL) are considered legal only in so far as they are not operating south of the PFSEL. Note also that since Australian surveillance aircraft to not frequent airspace north of the PFSEL numbers of vessels in those waters are not equally represented, i.e. there are disproportionately fewer observations from those waters. (Source: Australian Border Protection Command)

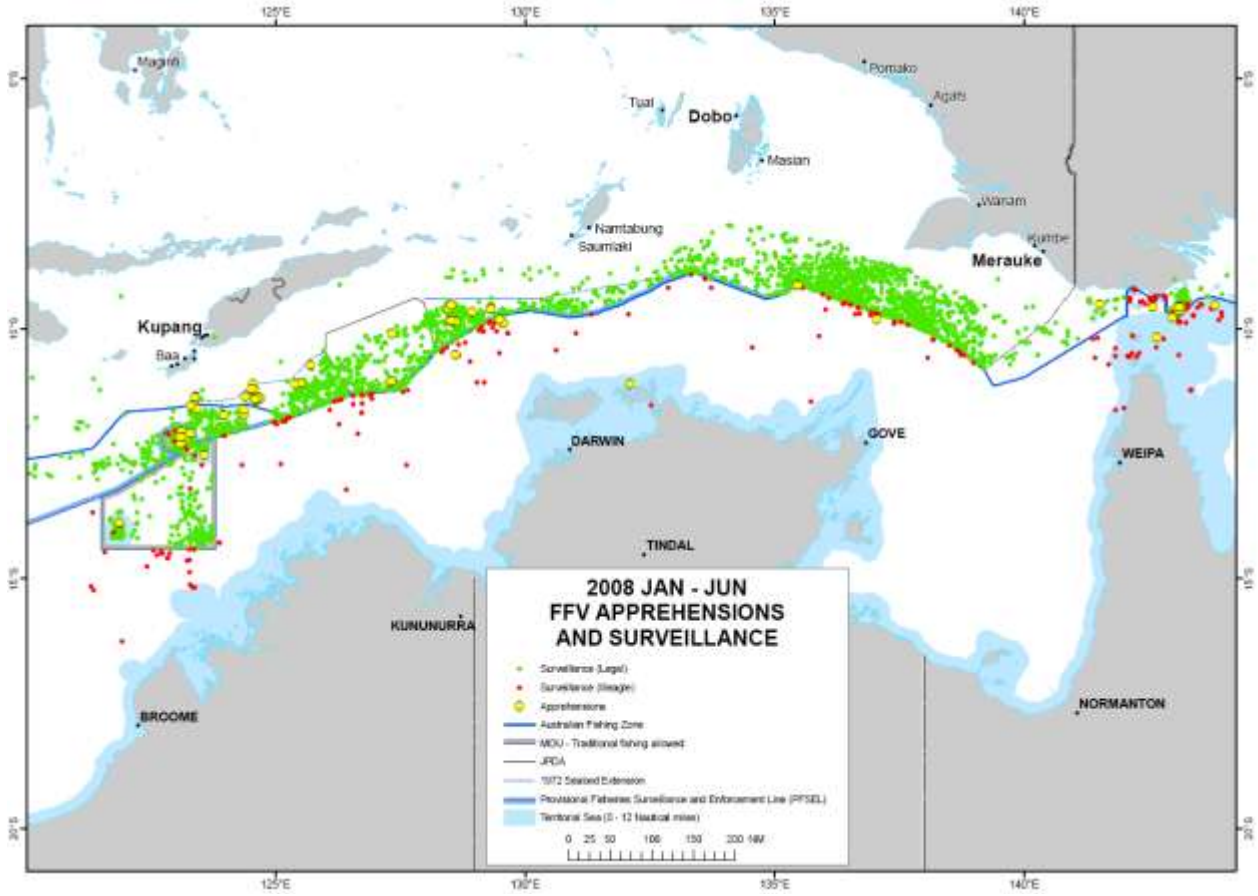

Figure 39: Sightings from surveillance aircraft of legal and illegal fishing vessels of non-Australian origin in Australian waters, in 2008

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