

TRANSBOUNDARY DIAGNOSTIC ANALYSIS (TDA) FOR THE ARAFURA AND TIMOR SEAS (ATS) REGION

2023

STATEMENT OF ENDORSEMENT

The Regional Steering Committee, serving as the Project Board, with the following signatories hereby endorse the 2023 ATSEA Transboundary Diagnostic Analysis (TDA) as submitted on 5 June 2023.

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TRANSBOUNDARY DIAGNOSTIC ANALYSIS (TDA) FOR THE ARAFURA AND TIMOR SEAS (ATS) REGION

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EXECUTIVE SUMMARY

ATSEA-2 is the second phase of the GEF-financed, UNDP-supported ATSEA program, and is designed to enhance regional collaboration and coordination in the Arafura and Timor Seas (ATS) region, which is composed of Australia, Indonesia, Papua New Guinea, and Timor-Leste. This Transboundary Diagnostic Analysis (TDA) has been prepared under the auspices of ATSEA-2, in order to review the status and trends of important coastal and marine resources, identify priority transboundary environmental issues in the ATS region, and understand the key drivers and impacts of these issues, in order to support the formulation of strategies that can best address them.

This revised TDA builds on the initial TDA developed for the ATS region in 2011, under the first ATSEA project. It also draws on a series of recent thematic technical assessments undertaken by the ATSEA-2 program between 2019-2022.

The marine and coastal ecosystems of the 167-million-hectare ATS region provide ecosystem services to the four littoral nations of the ATS with a combined annual value estimated at USD 7.3 billion. These values include the provision of fisheries, providing the spaces and environmental conditions needed to support valuable mariculture industries, storage and sequestration of carbon in 'blue carbon' coastal ecosystems, cultural and traditional goods and services, and providing the special places and attractions that support marine and coastal tourism industries. The Arafura and Timor Seas region is also a stronghold for globally significant biodiversity values. In many cases, these values exist within national jurisdictions (i.e., territorial waters), while in other cases may be distributed across boundaries, due to the high degree of connectivity of ecosystems, habitats and species in the region.

The TDA was developed using TDA and Causal Chain Analysis (CCA) methodologies established under the Global Environment Facility International Waters (GEF/IW) programme and supported by a Regional Working Group (RWG) comprised of regional and national experts from the four ATS littoral countries. Participatory regional processes were undertaken to identify and analyse the priority transboundary issues affecting the ATS.

The broad steps in creating the TDA included:

1. Review of thematic technical assessments developed under ATSEA-2 at the regional and national level
2. Generation of Country Synthesis Reports, as well as additional primary data gathering, by Indonesia, Papua New Guinea and Timor-Leste with the support of national working groups (NWGs) and national consultants
3. Establishing a regional working group (RWG) with representation from the NWGs and other experts
4. Conducting Causal Chain Analysis for identified issues in order to understand cause-and-effect relationships inherent in each issue
5. National consultation workshops held in Indonesia, Papua New Guinea and Timor-Leste between August and October 2022
6. Endorsement of priority identified issues by Indonesia, Papua New Guinea and Timor-Leste during the 4th Regional Steering Committee Meeting in November 2022 (subject to confirmation by Australia)

7. Completion of first draft TDA in November 2022
8. National validation workshops in November 2022 to review the first draft TDA
9. Completion of second draft TDA in December 2022
10. Regional validation workshop on February 2023 to review the second draft TDA
11. Completion of third draft TDA in March 2023

Based on the assessments and participatory processes outlined above, the RWG agreed on the following framework of three broad priority transboundary issues and eleven subordinate, specific ‘fundamental concerns’ affecting the ATS region:

ATS Priority Transboundary Issue	Fundamental concerns (‘sub-issues’)
Issue #1: Pollution of marine and coastal environment	1.1 Oil spills
	1.2 Harmful marine debris including plastic pollution
	1.3 Abandoned, lost and discarded fishing gear (ALDFG)
	1.4 Land-based pollution and sedimentation
Issue #2: Ecosystem, habitat and biodiversity decline	2.1 Climate impacts on ecosystems, ecological communities and critical habitats
	2.2 Declining populations of endangered, threatened, and protected (ETP) species
	2.3 Deterioration of critical ecosystems and habitats resulting from anthropogenic causes
Issue #3: Unsustainable capture fisheries	3.1 Unsustainable harvest levels (overfishing)
	3.2 Illegal, unreported and unregulated (IUU) fishing
	3.3 Fisheries bycatch
	3.4 Fisheries impacts on habitats

It was agreed by the RWG that this framework of issues and fundamental concerns be used as the basis for further investigation and prioritisation in the lead-up to renewal of the SAP. It is important to note that any final selection of issues and concerns to be addressed in the next iteration of the SAP will be undertaken in subsequent steps, as part of the SAP initiation process.

Inputs on these priority issues and concerns were generated through country-level consultations and synthesis reports, ATSEA-2 regional thematic reports, and external published sources such as peer-reviewed literature and government reports. Issues selected were considered to be transboundary in nature, in that they originate in the marine jurisdiction of one or more ATS countries and impact on the waters of one or more other ATS countries. Issues without a transboundary dimension were excluded and are not considered within the scope of this TDA; rather, they are to be managed under existing national or sub-national arrangements.

Further, two important cross-cutting concerns emerged from the TDA process. Primarily, the issue of anthropogenic climate change is already a significant driver (both direct and indirect) of transboundary issues, and its influence will continue to increase in coming decades. The ATS displays high vulnerability to climate change, which may be attributed to its low-profile coasts, shallow continental shelves and macro-tidal conditions (ATSEA 2012). Climate change has been shown to be a driver of all three transboundary issues identified above; it is proposed as

fundamental concern 2.1 but drives many of the other issues addressed within and should therefore be considered across all future planning.

Related to this, the social and economic impacts of climate change are already a major concern for ATS communities, threatening lives and livelihoods across all littoral countries. However, where social vulnerabilities currently exist, they are likely to be exacerbated by climate change; where gender discrimination, poverty or social exclusion are already being felt, they are likely to worsen under climate change scenario, both in terms of the way impacts are felt, and the burden for adapting to them. Such inequities inherent in the system should be systematically addressed in the development of responses to the priority transboundary issues.

Across the three issues (and eleven subordinate fundamental concerns), several common root causes were identified, including the aforementioned impacts of climate change, population growth in the ATS region, tourism growth in the ATS region, and global demand for seafood. Within the region, ineffective governance, insufficient resources for management and ineffective coordination were also frequently cited as indirect drivers of transboundary issues. Governance failures were frequently cited as indirect drivers or root causes of transboundary environmental issues in the ATS; conversely, in almost all cases, strong, effective and participatory governance approaches will be necessary to enable the mitigation strategies needed to address the priority issues.

Significant changes observed by participants since the first TDA was developed for the ATS in 2011 included: the emergence of a new transboundary fishery for 'fish maw' (swim bladder), the expansion of some land-based activities in eastern Indonesia including oil palm plantations, an increase in oil/gas exploration activities in Arafura and Timor Seas (including seismic testing), and an increase in issues related to sewage, sanitation and plastic waste in coastal settlements, partly driven by tourism, and the ongoing accumulation of Abandoned, Lost and Discarded Fishing Gears (ALDFG) in the marine environment.

However, strong progress has been made since 2011 across the region on many issues, including the adoption of Ecosystem Approach to Fisheries Management (EAFM) and Fisheries Improvement Projects (FIPs) across major fisheries, creation of new and more effective Marine Protected Areas (MPAs), implementation of numerous plans of action to protect threatened species, strong regional and bilateral cooperation to tackle IUU Fishing, greatly enhanced scientific understanding of the region, and greater involvement by communities in coastal and marine resource management. These successes, and the strong willingness of ATS littoral countries to cooperate for mutual benefit provide a strong basis from which the ATS community can address the priority issues outlined in this document.

Summary of ATSEA-2 Thematic Assessment Key Findings

A series of Thematic Regional Assessments was also undertaken by ATSEA-2, in preparation for this TDA. The following summary information from these assessments is relevant to the transboundary issues prioritised:

Sustainability of fisheries

At regional level, ATSEA-2 works to improve fisheries management for red snapper, especially the saddletail snapper, crimson snapper, red emperor and goldband snapper by employing the Ecosystem Approach to Fisheries Management (EAFM). Based on FAO statistics (2021), the ATS region contributed 2.76% or 13,604 tonnes of the estimated global Lutjanid catch for 2019. The baseline review conducted in 2020-2021 shows that snapper fisheries in the ATS are diverse and include small and industrial scales. The stock status of red snappers also varies with Australia's stock considered to be sustainable, Indonesia's overfished and undefined for both Timor-Leste and Papua New Guinea. Threats on the fisheries such as stock sustainability, ecological impacts of fishing operations, bycatch, transboundary conflict, conflict between sectors, lack of infrastructure and market access, policy to support rights-based management of small-scale fisheries, IUU fishing and lack of consistent/unified data across regions were identified and targeted to be addressed by implementing the recently developed EAFM plan for red snapper fisheries in the ATS region.

IUU fishing is a prevalent threat for the ATS region. To understand the threat better, ATSEA-2 facilitated a regional assessment to quantify law enforcement capabilities by calculating losses avoided through the apprehension of both domestic and foreign vessels. The assessment covered the period of 2015-2019 and shows the estimated prevented volume loss for ATS countries is 40,154 tonnes and the prevented economic loss is \$US 80,307,576. Due to limited information, the study focused mostly on illegal fishing (i.e., the 'I' in IUU Fishing), and strengthened monitoring and reporting would support country-level efforts to address the unregulated and unreported elements of IUU fishing. Further, enhancing and integrating Monitoring, Control and Surveillance (MCS) would help to reduce losses due to IUU fishing. Therefore, at regional level ATSEA-2 will continue to support the RPOA-IUU implementation, while at national/local level ATSEA-2 will strengthen community-based fisheries management arrangements including surveillance and monitoring.

Marine and Land-Based Pollution

The regional marine and land-based assessment identified two main pollution sources with region-wide impacts –oil spills and marine debris. A modelling simulation using GNOME discovered that the Timor Sea is the primary oil spill hotspot in the ATS, with the Southern part of Rote Ndao and Timor-Leste are the most prone to oil spills. Meanwhile, Aru Sea was identified as a seafloor debris hotspot. ATSEA-2 has initiated support to build local capacity in oil spill preparedness and response and to develop pollution prevention and control plans as part of the Integrated Coastal Management (ICM) process in Rote Ndao, Indonesia and Manatuto, Timor-Leste.

Biodiversity Conservation

ATS region hosts numerous Endangered, Threatened and Protected (ETP) species, including 6 species of sea turtles including green turtle, hawksbill, loggerhead, leatherback, olive ridley and flatback turtle. All species are listed as vulnerable, endangered or critically endangered and are subject to protection via national legislations and international conventions. To enhance sea turtle conservation, ATSEA-2 facilitated the development of the Sea Turtle Regional Action Plan which provides guidance to ATS countries with regard to conserving sea turtles. The action plan

has six themes: 1) addressing discards of fishing gear, 2) establishing a funding mechanism, 3) addressing sea turtle bycatch in the Arafura Sea prawn fishery, 4) enhanced conservation of sea turtles in Timor-Leste, 5) in Indonesia with a focus on Aru and 6) in Papua New Guinea.

A valuation of ecosystem services based on data from 2016-2020 data shows that the ATS region contributes approximately \$US 7.3 billion annually to the economies of ATS countries. Further, ATSEA's regional MPA Network Design and Roadmap was endorsed by the 3rd RSC; the network aims to build resilience and enhance ecosystem benefits at regional scale.

Climate Change

ATSEA-2 works toward improving understanding of climate change impact on marine/coastal ecosystems. In 2020, ATSEA-2 facilitated a regional climate change vulnerability assessment. The climate projections for the ATS region are based on the outputs of global climate models on the moderate-emissions scenario RCP4.5 and high-emissions scenario RCP8.5 for 2070.

Regional results of the vulnerability assessment for habitats were spatially variable. Shallow coral reefs are highly vulnerable to climate change, particularly around Barique, Manatuto Municipality, Timor-Leste and Tual, Indonesia. Seagrass meadows were most vulnerable in the Gulf of Carpentaria, Australia due to hotspot of sea surface temperature increase. Lastly, mangroves and estuarine habitats were most vulnerable in Timor-Leste and western Papua New Guinea.

Species vulnerability was also spatially variable, with highly vulnerable and high priority species identified for each sub-region (i.e., Indonesia-Arafura, Timor-Leste, Western Papua New Guinea, Gulf of Carpentaria and Northwest Australia). Green turtle was shown to be a species of high vulnerability across most sub-regions, while dugong, barramundi, black jewfish, Spanish mackerel and mud crab are highly vulnerable in at least 2 sub-regions.

FOREWORD

Covering 167 million hectares and delivering more than USD 7 billion annual value of ecosystem services, the Arafura and Timor Seas (ATS) is undoubtedly a crucial resource that binds the people, history, culture, and economies of Australia, Indonesia, Papua New Guinea, and Timor-Leste. This vast resource is also home to the most pristine and highly diverse coastal and marine habitats and species with national, regional, and global value.

However, decades of overexploitation as a result of over-harvesting and other anthropogenic stresses compounded by global climatic changes have undermined the carrying capacity of the ATS ecosystem and exposed its communities to a myriad of socio-economic and environmental challenges.

Recognising the magnitude of issues at hand, the ATS countries with support from the Global Environment Facility (GEF) and the United Nations Development Program (UNDP) pursued the first ATSEA project in 2009. This landmark project which concluded in 2014 resulted to the region's first Transboundary Diagnostic Analysis (TDA) and Strategic Action Program (SAP) and National Action Programs (NAPs). These foundational results provided a better understanding of the key transboundary challenges of the region and set the motion towards more concrete regional collaboration and on-the-ground implementation of the SAP and NAPs through the second phase of the ATSEA project (ATSEA-2).

The 5-year ATSEA-2 Project, which was initiated in 2019 with GEF, UNDP and PEMSEA support, facilitated the conduct of up-to-date assessments related to fisheries, pollution, habitat and biodiversity, climate change as well as regional ocean governance, and carried out the implementation of integrated coastal management. Building on these efforts and noting the accelerated developments in the region, coupled with persistent and new challenges (i.e., marine plastics, increasing oil and gas investments, rising climate change, and impacts from the COVID-19 pandemic), the ATSEA-2 project embarked on the updating of the ATS TDA.

The ATS countries recognise that achieving the desired long-term objectives and targets of the SAP and NAPs require continuing and concerted actions. Thus, ATSEA-2 Project supported the updating of the TDA to ensure that the region is attuned and guided by up-to-date information on key ecological, socio-economic and governance conditions and priorities. To derive a robust understanding of the status of the ATS coastal and marine ecosystem, country-level TDAs were developed in support of the regional TDA. The new TDA, as presented here, provides the region with a fresh scientific basis in designing the priority targets and corresponding governance and management mechanisms and measures for the next 10-year ATS SAP.

Through these efforts, the region hopes to contribute in achieving the objectives of the Ocean Decade (2021-2030) to strengthen ocean science-policy interface and help countries deliver on commitments to achieving the UN Sustainable Development Goals (SDGs), particularly the SDG14 on Life Below Water and support the implementation of the post 2020 Global Biodiversity Framework. This new TDA was made possible by pursuing a consultative and participatory process and with the strong support from the ATS country and development partners.

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PARTICIPATING INSTITUTIONS

IPB University Indonesia, Conservation and Environmental Protection Authority (CEPA) Papua New Guinea, Ministry of Agriculture and Fisheries (MAF) Timor-Leste, Ministry of Marine Affairs and Fisheries (MMAF) Indonesia, National Fisheries Authority (NFA) Papua New Guinea, Department of Climate Change, Energy, the Environment and Water (DCCEEW), Australia, National Research and Innovation Agency (BRIN) Indonesia, National University of Timor-Leste, UNDP Indonesia, UNDP Timor-Leste, and University of Papua New Guinea.

ABBREVIATIONS AND ACRONYMS

ALDFG	Abandoned, Lost and Discarded Fishing Gear
APEC	Asia Pacific Economic Cooperation
ASEAN	Association of Southeast Asian Nations
ATS	Arafura and Timor Seas
ATSEA	Arafura and Timor Seas Ecosystem Action
ATSEF	Arafura and Timor Seas Expert Forum
CITES	Convention on International Trade in Endangered Species
CMS	Convention on Migratory Species
CPUE	Catch Per Unit Effort
CTI-CFF	Coral Triangle Initiative on Coral Reefs, Fisheries and Food Security
EAFM	Ecosystem Approach to Fisheries Management
ENSO	El Nino-Southern Oscillation
FAO	Food and Agricultural Organization of the United Nations
GEF	Global Environment Facility
ICZM	Integrated Coastal Zone Management
IUU	Illegal, Unregulated and Unreported
LME	Large Marine Ecosystem
MARPOL	International Convention for the Prevention of Pollution from Ships
MCS	Monitoring, Control and Surveillance
M&E	Monitoring and Evaluation
MPA	Marine Protected Area
MPP	Marine Plastic Pollution
MSP	Marine Spatial Planning
NAP	National Action Programme
NAPA	National Adaptation Programme of Action
NBSAP	National Biodiversity Strategy and Action Plan
NPOA	National Plan of Action
NGO	Non-Government Organisation
NPOA-IUU	National Plan of Action to combat IUU fishing
PEMSEA	Partnerships in Environmental Management for the Seas of East Asia
PES	Payment for Environmental Services
POPs/NIPs	Persistent Organic Pollutants/National Implementation Plans
REDD	Reduction of Emissions from Deforestation and Forest Degradation
RBFM	Rights-Based Fisheries Management
RPOA-IUU	Regional Plan of Action to Promote Responsible Fishing Practices including Combating IUU Fishing in the Region
SAP	Strategic Action Programme
SEG	Stakeholder Engagement Group
SSF	Small Scale Fisheries
TDA	Transboundary Diagnostic Analysis
UNCLOS	United Nations Convention on the Law of the Sea
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNOPS	United Nations Office for Project Services

Introduction

A photograph of a blue and white fishing boat on a beach at sunset. The boat is the central focus, with a wooden ladder on its deck. The background shows a forested hillside and a sunset sky with orange and pink hues. The water is calm, reflecting the sky. The boat is moored near the shore, and the beach is visible in the foreground.

Chapter 1

1.1 Context and project background

This Transboundary Diagnostic Analysis (TDA) has been prepared under the auspices of the ATSEA-2 Project, in order to guide the update of the Strategic Action Programme (SAP) for the ATS region in 2023 for a period of 10 years.

ATSEA-2 is the 2nd phase of the GEF-financed, UNDP-supported ATSEA program, and is designed to enhance regional collaboration and coordination in the Arafura and Timor Seas (ATS) region, which is composed of Australia, Indonesia, Papua New Guinea and Timor-Leste. Overall, the project focuses on supporting the implementation of the 10-year ATS Strategic Action Programme (SAP) endorsed through a Ministerial Declaration in 2014.

Under the auspices of the ATSEA-1 project, the first Transboundary Diagnostic Analysis (TDA) for the ATS region was completed in 2011. The first ATS SAP was subsequently developed to address the priority transboundary problems identified in the 2011 TDA. Considering developments in the region over the past 10 years, the updating of the TDA is one of the major project activities of ATSEA-2; revision of the TDA and the priority transboundary issues will support the development of a new 10-year SAP for the ATS region.

1.2 Transboundary Diagnostic Analysis (TDA) purpose and use

TDA is a well-established methodology for conducting technical assessments of water-related environmental issues and problems within transboundary contexts. The TDA is focused on the identification, prioritisation and quantification of transboundary environmental issues (or ‘problems’) affecting the ATS. By incorporating causal chain analysis of priority transboundary issues, the TDA provides a robust technical basis and rationale for the development of the Strategic Action Programme (SAP); in analysing ‘cause-and-effect’ pathways for these issues, the TDA supports an evidence-based pathway to regional action, through the SAP.

This 2023 TDA builds on the findings of the first TDA conducted for the ATS in 2011, which informed the first iteration of the SAP. The revised TDA is intended for the many decision-makers, managers, planners and supporters of integrated marine management across the four ATS littoral countries who are tasked with addressing the problems outlined herewith; both at regional and local levels.

This TDA is focused on reflecting the current state of knowledge in relation to the priority transboundary issues identified, as such it should not be considered comprehensive in terms of the state of knowledge of the entire ATS region. For a comprehensive understanding of the state of the ATS and its many and diverse values, the TDA should be used alongside other key ATSEA-2 documents including the following.

- Regional Profile of Coastal and Marine Ecosystems: Their Connectivity, Ecological Importance, and Socio-cultural Impact on the Arafura and Timor Sea Region (Hakim et al., 2020)
- Atlas of Arafura and Timor Seas (ATSEA, 2022)

- Regional Governance Assessment (Pet-Soede, 2021)
- Fisheries Baselines: An EAFM Plan for Red Snapper in the ATS (Knuckey et al., 2021)
- Assessing the Vulnerability of the Arafura and Timor Seas Region to Climate Change (Johnson et al., 2021)
- Marine and Land-Based Pollution in the ATS (Shin, 2021)
- Valuation of Ecosystem Services in the Arafura and Timor Seas Region (Choesin et al., 2021)
- The Analysis of Threatened, Charismatic, and Migratory Species Distribution Around the Arafura and Timor Seas (Fajariyanto et al., 2020)
- Roadmap for the Establishment of New Marine Protected Areas in the Arafura and Timor Seas (YKAN, 2020)
- Gender Equality and Social Inclusion (GESI) Analysis for ATS Region (ATSEA-2, 2021)
- Country Synthesis Reports and reports from primary data collection undertaken for Indonesia (Yonvitner et al., 2022), Papua New Guinea (Mana and Mungkaje, 2022) and Timor-Leste (Fonseca et al., 2022)

1.3 Description of the system

The ATSEA Program focuses its efforts on the whole ATS region; a vast and semi-enclosed marine area, delineated by a combination of political boundaries and several other ecological considerations.

The southernmost extent of ATS marine territory stretches from Sahul to the Torres Strait, while its western boundaries arch upwards through Rote, Timor-Leste and Yamdena, then continue along the northern territories to Kei and Papua (Figure 1).

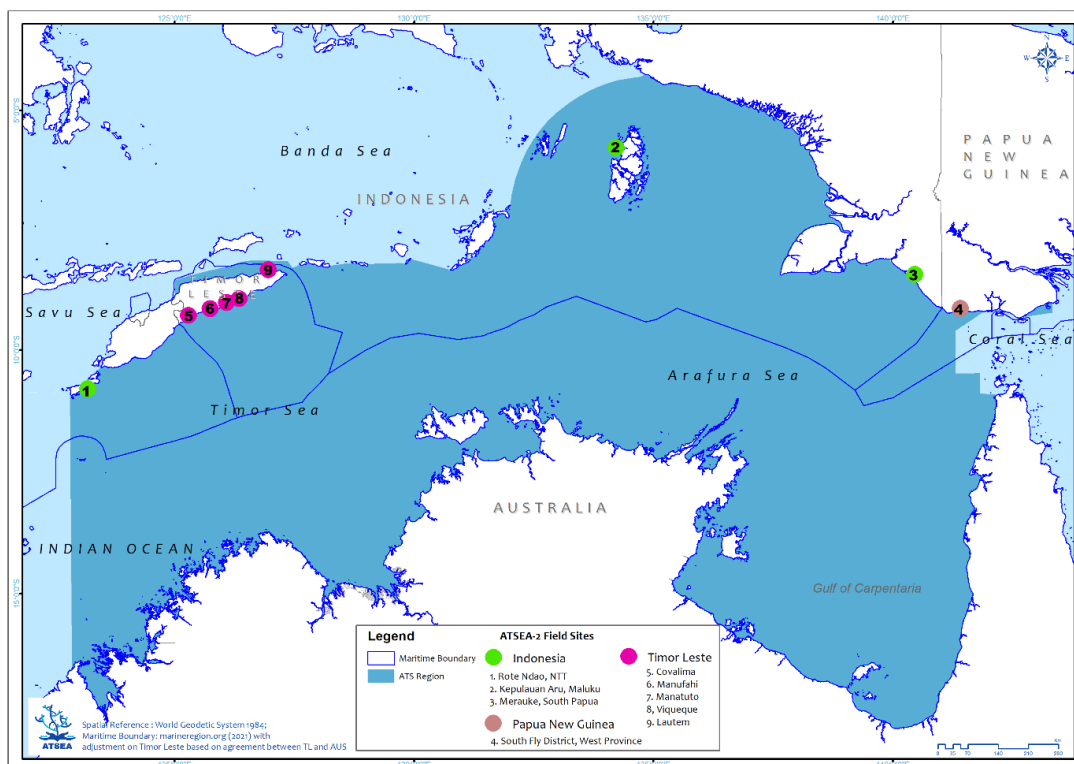


Figure 1 – The ATS Region and boundaries of ATS littoral nations, and sites covered by the ATSEA-2 Project (ATSEA-2, 2022)

The ATS region encompasses marine territories of four littoral nations: Australia, Indonesia, Papua New Guinea and Timor-Leste (Figure 1). The ATSEA partnership is built on a shared commitment by these four countries to manage transboundary issues related to the Arafura-Timor Seas ecosystem, for mutual benefit. Under the ATSEA-2 project, key interventions are limited to selected sites in Indonesia (Aru Archipelago, Merauke of Papua Province, and Rote Ndao of NTT Province), Timor-Leste (South Coast municipalities of Manatuto, Viqueque, Lautem, Manufahi, and Covalima), and Papua New Guinea (South Fly of Western Province).

The current jurisdictions of all four ATS countries are presented in Table 1.

Table 1 – Marine territory intersecting the ATS region*

ATS Country	Total area (km ²)*	Total area (ha)*	% of ATS total area
Australia	1,000,902	100,090,202	59.97%
Indonesia	568,020	56,802,012	34.03%
Papua New Guinea	23,436	2,343,607	1.40%
Timor-Leste	76,799	7,679,920	4.60%
Total	1,669,157	166,915,741	

*Calculated by ATSEA-2 using Web Mercator Auxiliary Sphere projection and coordinate system, based on Flanders Marine Institute (2019) Maritime Boundaries and EEZs, noting that there may be some maritime areas and/or boundaries yet to be formally agreed or resolved.

Based on the 1982 Law of the Sea definition, the Arafura-Timor Seas is a ‘semi-enclosed’ sea. The ATS partially intersects with the Coral Triangle (CT), a region encompassing the EEZs of the ‘CT-6’ countries of Indonesia, Malaysia, the Philippines, Papua New Guinea, Solomon Islands and Timor-Leste.

TDA Methodology and Process



Chapter 2

The following section summarises the methodology, general approach and consultation steps taken to develop this TDA. Additional detail on the TDA methodology (including Causal Chain Analysis) is included in Appendices 2 (table of TDA activities), 3 (Regional Working Group members) and 4 (detailed narrative description of process).

2.1 TDA Methodology

To develop the revised 2022 TDA for ATS, ATSEA-2 followed the methodology and resources developed by the Global Environment Facility/International Waters partnership (GEF/IW: LEARN, 2013).

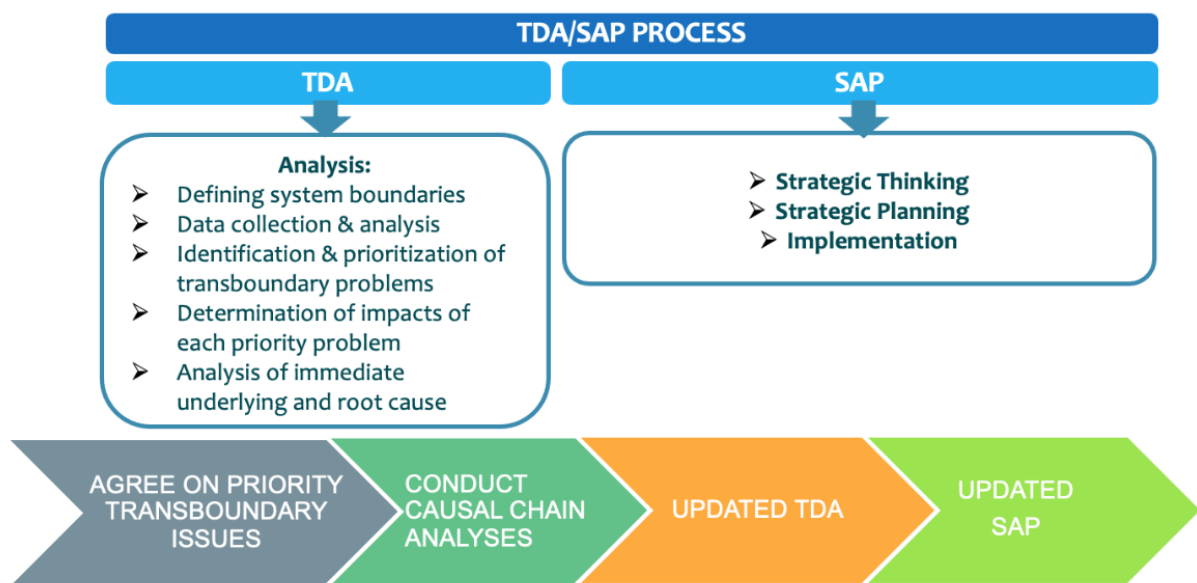


Figure 2 – Schematic of TDA/SAP process (GEF/IW)

As shown in Figure 2, the TDA stage is used to identify, analyse, validate and prioritise the transboundary environmental issues within a defined system, after which a Strategic Action Programme (SAP) is developed and implemented to address them.

Prior to commencing the TDA revision process, a series of issue-specific assessments at the regional (and national levels) was undertaken by RPMU to update information on the status of biophysical, socioeconomic and governance conditions. These ‘regional thematic assessments’ were particularly important, given limitations posed by the COVID-19 pandemic. These assessments consolidated available secondary data/information at the national/sub-national levels, and in some cases saw additional primary data gathering take place for key data gaps.

2.2 Overview of TDA revision process

The broad steps taken by the RPMU to update the ATS TDA included:

1. Review of **thematic technical assessments** developed under ATSEA-2 at the regional and national level
2. Generation of **Country Synthesis Reports**, as well as additional primary data gathering, by Indonesia, Papua New Guinea and Timor-Leste with the support of national working groups (NWGs) and national consultants
3. Establishing a **regional working group (RWG)** and **national working groups (NWGs)** with representation of various sectors and disciplines to determine priority transboundary issues, and facilitate regional and national inputs/perspectives to TDA/SAP updating
4. Conducting **Causal Chain Analysis** for identified issues in order to understand cause-and-effect relationships inherent in each issue.
5. **National consultation workshops** held in Indonesia, Papua New Guinea and Timor-Leste between August and October 2022
6. **Endorsement of priority identified issues** by Indonesia, Papua New Guinea, and Timor-Leste during the 4th Regional Steering Committee Meeting in November 2022 (subject to confirmation by Australia)
7. **Completion of first draft TDA** in November 2022
8. **National validation workshops** in November 2022 to review the first draft TDA
9. **Completion of second draft TDA** in December 2022
10. **Regional validation workshop** in February 2023 to review the second draft TDA
11. **Completion of third draft TDA** in March 2023

Identifying priority transboundary issues for the ATS

As noted in Figure 3, the priority issues for the ATS were identified from multiple sources, including the Country Synthesis Reports, Regional and National Thematic Assessments conducted by ATSEA-2, and from other relevant published source material. The Regional Working Group was invited to propose transboundary environmental issues in a series of regional (remote) workshops. Of the issues raised by RWG members, three groupings emerged; fisheries-related issues were most prevalent (grouping #1, with ~45 responses proposed by workshop participants), followed by issues related to declines in biodiversity and ecosystems (grouping #3 with ~25 responses), and pollution-related issues (grouping #2 with <20 responses).

PROCESS FOR DETERMINING 'PRIORITY TRANSBOUNDARY ISSUES'

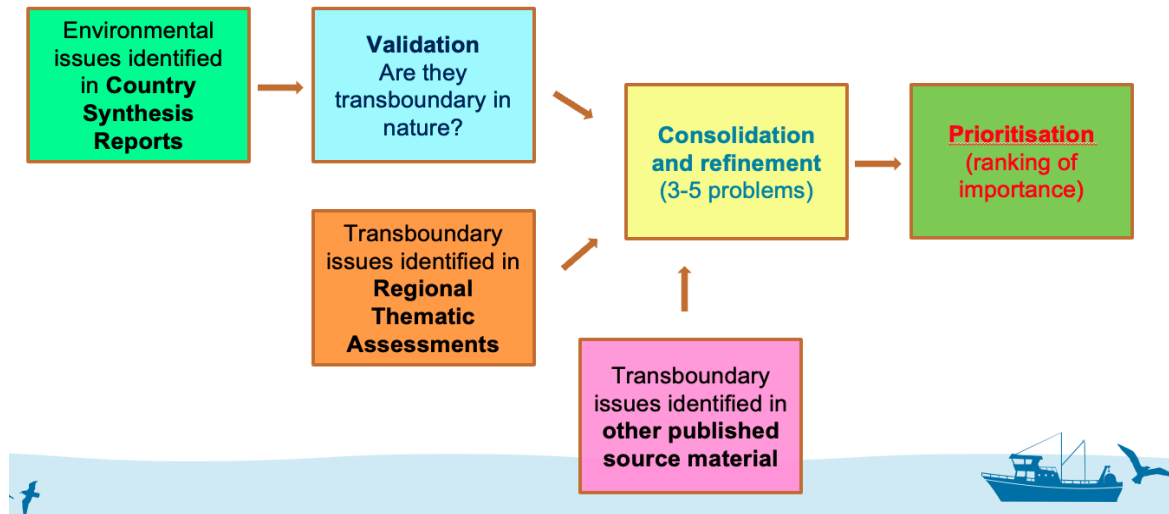


Figure 3 – Process for identifying priority transboundary issues

The group also discussed whether climate change in itself should be included as an issue (as per the 2011 ATS TDA) or whether it was technically a driver of issues. As it was clearly shown to be a driver of all three issues (fisheries-related issues, pollution, and ecosystem and biodiversity decline) and after examination of international best practice, it was agreed that climate change would be treated as a driver of transboundary problems.

In summary, the priority transboundary issues agreed by the RWG were as follows:

Issue #1: Pollution of marine and coastal environment

Issue #2: Ecosystem, habitat and biodiversity decline

Issue #3: Unsustainable capture fisheries

There are differences between the formulation of each issue statement; Issues #1 (pollution) is essentially a set of 'drivers' (causes) of the decline of certain environmental values, #2 (declines in ecosystems, habitats, biodiversity) is focused on the status and trends of certain values, and Issue #3 (unsustainable fisheries) is both a concern on the decline of one set of values (fisheries resources) while also being a driver of declines of other non-target values (such as ETP species). Nonetheless, the framing of the three issues is consistent with international best practice, and the RWG group felt that the proposed format will be expedient in facilitating action.

Causal Chain Analysis for Transboundary Environmental Issues

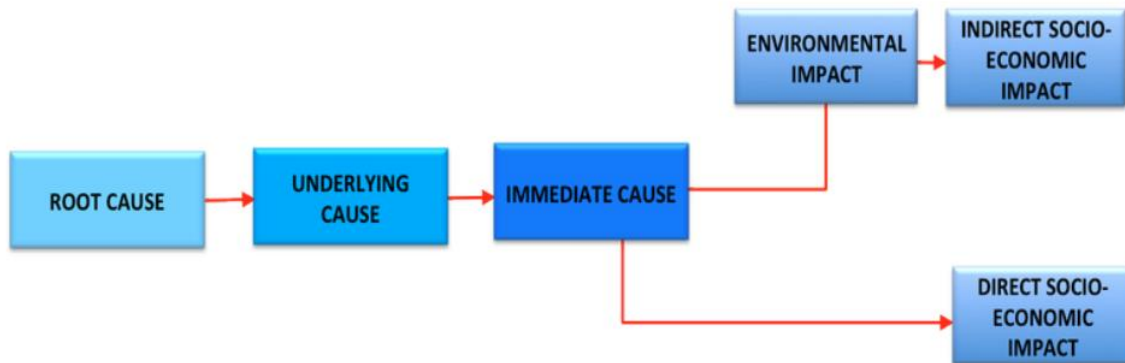


Figure 4 – Causal Chain Analysis (CCA) overview (GEF/IW)

For each of the three issues identified, a participatory process of Causal Chain Analysis (CCA) was then undertaken by the RWG. As shown in Figure 4, CCA supports the systematic analysis of the component parts of Transboundary Issues, in order to support the development of strategies that can systematically address the root causes of issues. The CCA process results in the development of conceptual models for priority issues, which include ‘causal chains’ linking root causes to the main drivers and impacts (or ‘cause-and-effect’). The draft CCA analyses were edited for consistency in language, scale and accuracy and refined CCA diagrams shared back to the RWG for further comment and endorsement, ahead of being tabled at the November 2022 Regional Steering Committee (RSC) meeting for RSC endorsement. Summary tables of the three CCAs are included in this report in Tables 15, 16 and 22.

Review and endorsement by Regional Steering Committee

At the 4th Regional Steering Committee Meeting held in Port Moresby 2-3 November 2022, Indonesia, Papua New Guinea, and Timor-Leste endorsed the three-priority transboundary environmental issues, while Australia required more time to conduct in-country consultations.

Sub-division into fundamental concerns and validation by NWGs

Following discussion with RSC, the TDA consultant developed a first ‘exposure draft’ of the TDA. Within the exposure draft, a further division of the three priority transboundary issues into eleven subordinate ‘fundamental concerns’ was proposed; given that the three issues presented were quite general, division into these fundamental concerns was intended to focus discussions on more specific priority environmental problems. The eleven fundamental concerns proposed for this TDA are presented in Table 2, as follows:

Table 2 – ATS Priority Transboundary Issues and subordinate 'fundamental concerns'

ATS Priority Transboundary Issue	Fundamental concerns ('sub-issues')
Issue #1: Pollution of marine and coastal environment	1.1 Oil spills
	1.2 Harmful marine debris including plastic pollution
	1.3 Abandoned, lost and discarded fishing gear (ALDFG)
	1.4 Land-based pollution and sedimentation
Issue #2: Ecosystem, habitat and biodiversity decline	2.1 Climate impacts on ecosystems, ecological communities and critical habitats
	2.2 Declining populations of endangered, threatened, and protected (ETP) species
	2.3 Deterioration of critical ecosystems and habitats resulting from anthropogenic causes
Issue #3: Unsustainable capture fisheries	3.1 Unsustainable harvest levels (overfishing)
	3.2 Illegal, unreported and unregulated fishing (IUU)
	3.3 Fisheries bycatch
	3.4 Fisheries impacts on habitats

Validation of transboundary nature of issues

These eleven fundamental concerns (sub-issues) were discussed with Indonesia, Papua New Guinea, and Timor-Leste in country level groups to validate the transboundary nature of the concerns, and to identify gaps in the evidence base for each issue. Of the eleven subordinate fundamental concerns shown in Table 2, all three countries agreed that there was sufficient evidence to support a description of the following issues as transboundary in the TDA:

- 1.1 Oil spills
- 1.2 Marine debris and plastic pollution
- 2.1 Climate impacts on ecosystems, ecological communities and critical habitats
- 2.2 Declining populations of endangered, threatened, and protected (ETP) species
- 3.2 Illegal, unreported and unregulated (IUU) fishing

Additional information was requested on transboundary elements of fundamental concerns 1.3 Abandoned, Lost and Discarded Fishing Gear (ALDFG), and 3.1 Unsustainable Fisheries. Further, fundamental concerns 1.4 Land-based pollution and sedimentation, 2.3 Deterioration of critical ecosystems and habitats resulting from anthropogenic causes, 3.3 Fisheries bycatch and 3.4 Fisheries impacts on habitats were shown to be largely localised in nature, with impacts often experienced within sovereign boundaries, and limited evidence of impacts crossing international boundaries (and therefore less consistent with agreed definition of 'transboundary environmental issue').

Regional Transboundary Diagnostic Analysis (TDA) and Strategic Action Programme (SAP) Updating Workshop, Bali, Indonesia on 21-24 February 2023

A Regional Transboundary Diagnostic Analysis (TDA) and Strategic Action Programme (SAP) Updating Workshop was conducted from February 21-24, 2023 at Prama Sanur Beach Bali, Indonesia. The workshop was attended by the National Project Directors/National Focal Point, members of the National Working Group (NWG) and Regional Working Group (RWG) for TDA-SAP updating, and regional and national TDA consultants from Indonesia, Papua New Guinea, Timor-Leste and Australia. The 4-day workshop focused on refinement and validation of the content of this TDA, and strategic thinking in preparation of the next iteration of the SAP.

Representatives of the ATS littoral countries were invited to share the results of a final technical review of the TDA draft, including validation of data contained within. Further, the group held ‘bridging discussions’ linking the processes of TDA and SAP creation; these included further exercises to prioritise transboundary issues to be selected for transboundary action under the next SAP iteration, the identification of ‘leverage points’ for selected issues, clarification of the role and niche of ATSEA and an initial proposal for the inclusion of four priority issues as the focus of the next ATS SAP iteration. The results of these discussions may be reviewed at the following link: [ATSEA-2 Regional TDA-SAP Updating Workshop Report \(21-24Feb2023\)](#).

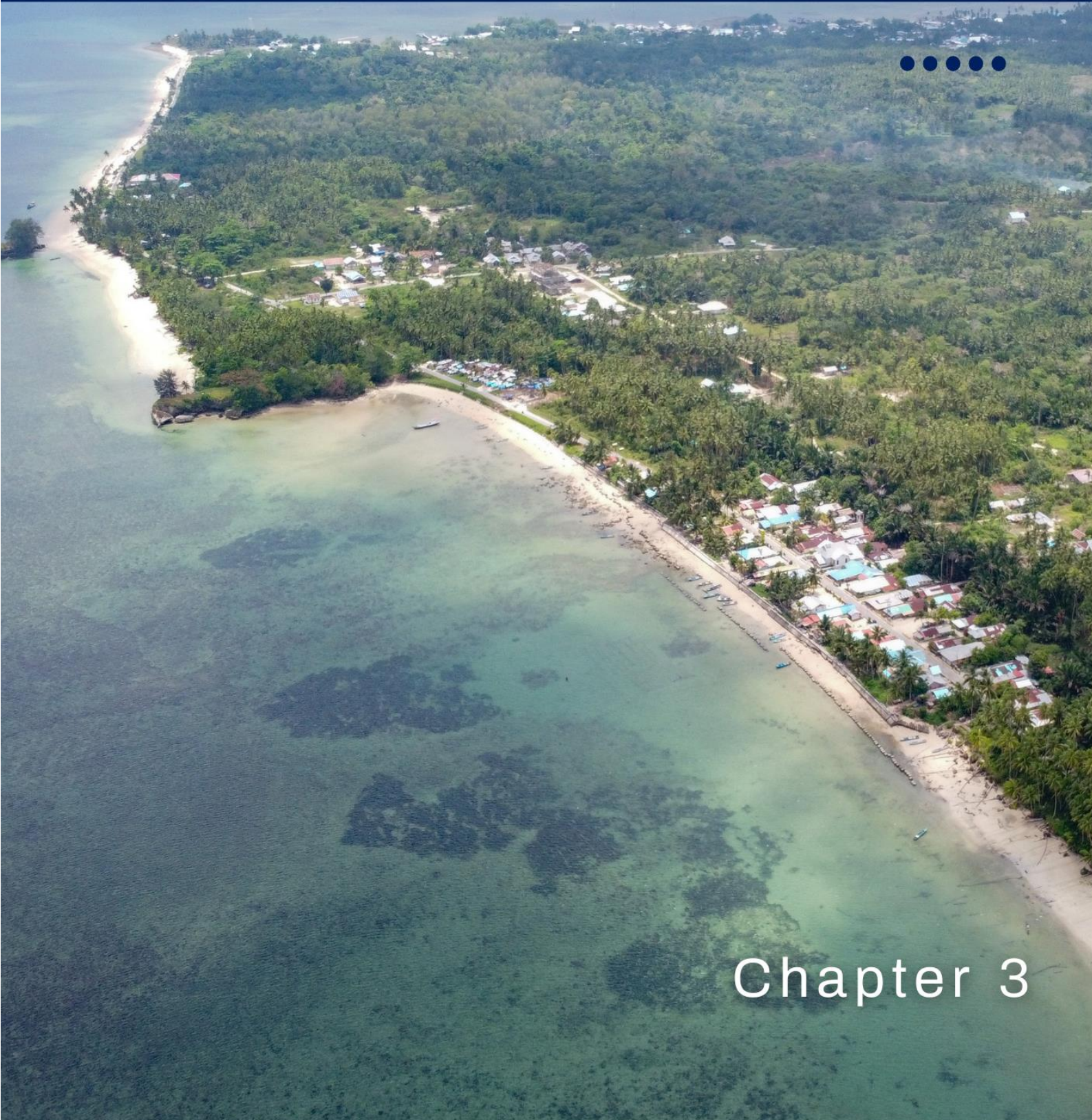
More details on the approach taken by ATSEA-2 to revise the ATS TDA is included in appendices, as follows:

Appendix 1 – List of the Regional Working Group (RWG) members

Appendix 2 – Table of activities undertaken by RWG in support of TDA revision

Appendix 3 - A detailed description of the process undertaken

Regional Baselines



Chapter 3

This Transboundary Diagnostic Analysis builds on the first TDA completed for the ATS in 2012 (ATSEA, 2012); much of the information contained in the initial TDA is still relevant today. The following section provides additional and revised information on the ATS relevant to the 2022 TDA, including important updates on human dimensions and use, climate change projections, and the value of ecosystem services. For a comprehensive background of the ATS, baseline information contained in this 2022 revised TDA should be considered alongside information contained in the first TDA: [Transboundary Diagnostic Analysis for the Arafura and Timor Seas Region, ATSEA Program 2011](#).

Additional detail on baseline and background information on the ATS is also available in numerous thematic assessments completed by ATSEA-2; these assessments include studies on ATS oceanography, ecosystems, human utilisation, key threats, ecosystems, threatened and migratory species, socio-economic and cultural aspects. The following documents provide additional detail on various baselines relevant to this TDA:

- [The Atlas of Arafura and Timor Seas](#) (ATSEA, 2022)
- [Analysis of Threatened, Charismatic, and Migratory Species Distribution Around the Arafura and Timor Seas](#) (Fajariyanto et al., 2020)
- [Regional Profile of Coastal and Marine Ecosystems in the ATS](#) (Hakim et al., 2020)
- [Valuation of Ecosystem Services in the Arafura and Timor Seas Region](#) (Choesin et al., 2021)
- [An Ecosystem Approach to Fisheries Management for Red Snapper in the Arafura and Timor Seas – Fishery Baselines](#) (Knuckey et al., 2021)

Further, country-specific baselines are included in the following ATSEA-2 volumes:

- ATSEA-2 Country Synthesis Report, Timor-Leste (Fonseca et al., 2022)
- ATSEA-2 Country Synthesis Report, Indonesia (Yonvitner et al., 2022)
- ATSEA-2 Country Synthesis Report, Papua New Guinea (Mana and Mungkaje, 2022)

3.1 Geography, oceanography and climate

3.1.1 Geographic features and setting

Covering more than 1.70 million square kilometres, The Arafura and Timor Seas (ATS) region is positioned between the Indian and Pacific oceans, and between the four littoral nations of Australia, Indonesia, Papua New Guinea and Timor-Leste. The system is broadly bounded by the Australian landmass to the south, the island of Timor in the northwest, the island of New Guinea to the northeast, and the southern extent of the Moluccas (the Maluku Islands), including the Tanimbar and Aru Archipelago. At the eastern extreme of the ATS is the Torres Strait, a seagrass-dominated shallow strait with more than 270 islands, connecting Australia's Cape York with Papua New Guinea's Western Province.

It spans two major Large Marine Ecosystems (LMEs); primarily covering the 772,214 km² Northern Australian Shelf (NAS) waters to the south and connecting to the 2.3million km² Indonesian Seas (IS) LME to the north. The convergence of three tectonic plates; the Eurasian, Indo-Australian and Pacific has resulted in a geologically and topographically diverse region. Bathymetric features of the ATS

basin itself include shallow continental shelves especially Australia and Papua, semi-enclosed gulfs (such as Australia’s Gulf of Carpentaria), and a series of deeper bodies to the northwest, including the Timor Trough (a continuation of the Sunda Trench), and the Aru Trough which lies between the Kei and Aru Island groups and connects to the Tanimbar Trough to the south.

Sources: Hakim et al. (2020), ATSEA (2022)

Detailed maps and datasets are incorporated in [The Atlas of Arafura and Timor Seas](#) (ATSEA, 2022).

3.1.2 Oceanography and climate

The Arafura Sea covers the continental shelf and is generally shallow (30-90 m), while the Timor Sea is deeper (50-120m) and includes deep trough waters running parallel to the Island of Timor. Combined, these two seas form the Arafura-Timor Seas ecosystem, situated in the middle of a major oceanic confluence; the Pacific and Indian oceans being connected via the Indonesian Throughflow (ITF). The ITF connects these oceans via a series of currents extending southward from the Philippine Sea, through the Halmahera, Molucca and Banda Seas, before passing through the Timor and Savu Seas to reach the Indian Ocean (Figure 5).

Flowing through a series of deep and narrow straits, the ITF is characterised by strong velocities at depths of about 100 metres, and lower velocities in surface flows. Intense mixing of these strata is believed to contribute greatly to broader climate systems. Described as a ‘coupled ocean-climate system’, the ITF’s resultant upwellings influence sea surface temperatures, wind and precipitation patterns in the region. The mixing of the warmer, lower-salinity waters of the ITF varies with El Nino/Southern Oscillation (ENSO) and the Indian Ocean Dipole, on multi-annual or decadal timescales, slowing during El Nino events (Sprintall et al., 2014). While the ITF’s pathway only partially intersects with the ATS (moving mainly through the Timor Trough), its impact on broader climatic conditions is likely to be more significant.

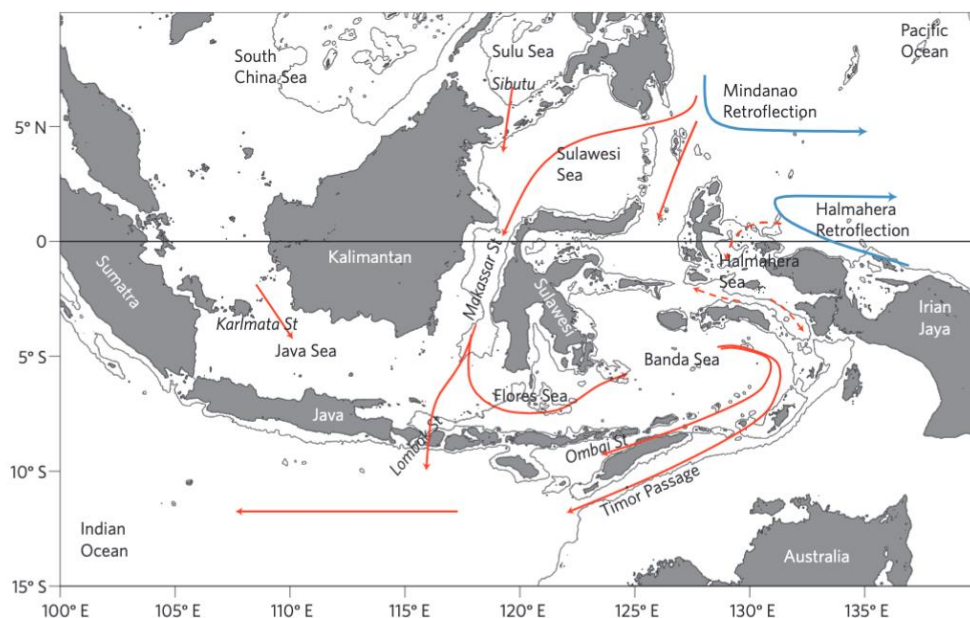


Figure 5 – Bathymetric and geographic features of the Indonesian seas and ATS region, with Indonesia Throughflow shown in red lines (Sprintall et al., 2014)

Other significant water movements in the ATS include the circulation of waters in the Gulf of Carpentaria, which shift with the monsoon season. This results in a seasonal fluctuation of sea level, caused by reversal of seasonal winds. Freshwater inputs into the Arafura Sea primarily come from more than thirty southwest flowing rivers in Papua, and some rivers also flowing into the Gulf of Carpentaria and the North Australia shelf. The Timor Sea is fed by northward flowing rivers in northern Australia during summer, with some southward flows from Timor tributaries (ATSEA, 2012).

3.1.3 Regional climate profile and climate change projections

The climate of the ATS region is tropical maritime, and monsoonal, strongly influenced by the warm ocean which drives global atmospheric circulation and the seasonal monsoon. The north Australian coastal areas of the ATS show a gradation from the semi-arid Western Australian climate to the monsoon-dominated areas in the Northern Territory and Queensland, where a May-October dry season is dominated by southeast trades, and a November-March wet season sees prevailing northwest monsoon flow. Climate further north in the Indonesian archipelago and Timor is similar, while the large landmass of New Guinea has additional influence on precipitation patterns. Catchments feeding the ATS vary from seasonally dry Timor catchments to large, permanently wet catchments in New Guinea, fed by snow-capped mountains of more than 5,000 metres. At 1.2 million km², the Gulf of Carpentaria drainage basin for the ATS is vast, with estimated annual runoff of 64,000 teralitres/year, and mean annual surface runoff from Australia estimated at 173 teralitres/year (Milliman and Farnsworth, 2011; ATSEA, 2012).

Since the 2011 TDA was completed, our understanding of the extent, and likely impacts of climate change have increased significantly. In 2020, ATSEA-2 facilitated a regional climate change vulnerable assessment (Johnson et al., 2021). The climate projections for the ATS region are based on the outputs of global climate models on the moderate-emissions scenario RCP4.5 and high-emissions scenario RCP8.5 ('business as usual') for 2070.

Rainfall

Under the RCP8.5 scenario, Indonesian archipelagic islands and Timor-Leste are projected to see increases in annual average rainfall of 20-30% by 2070, with slight decrease projected for southern Timor-Leste. Rainfall trends for open ocean areas are neutral. Projected trends for northern Australia are less clear, with 20 to +10% projected under RCP4.5 and -30 to +25% under RCP8.5; however, projections of increased intensity of extreme rainfall events have higher confidence.

Air temperature

Projected changes in annual average air temperature for Indonesia and Timor-Leste indicate increases of up to 3.6–3.8 °C by 2070 for archipelagic islands and increases of more than 4 °C by 2070 for West Papua. Projections for Australia suggest an annual average warming of 0.5–1.3 °C by 2030 (for all emissions scenarios) and 2.7–4.9 °C by 2090 under RCP8.5.

Broadly, across the ATS, implications of these changes include increased terrestrial runoff (including freshwater inputs, sediments and nutrients) into marine ecosystems, particularly around West Papua with its larger land mass and more rivers, although the south coast of Timor-Leste may experience reduced terrestrial runoff. Altered conditions on coastlines may also impact coastal species, such as sea turtles.

Sea Surface temperatures (SST) and oceanic PH

Figure 6 shows that under a business-as-usual SSP5-8.5 emissions scenario, SST increases are expected across the ATS region, with highest increases likely to be experienced in northern Australian coastal waters including the Indian Ocean, the Timor Sea and including the Gulf of Carpentaria.

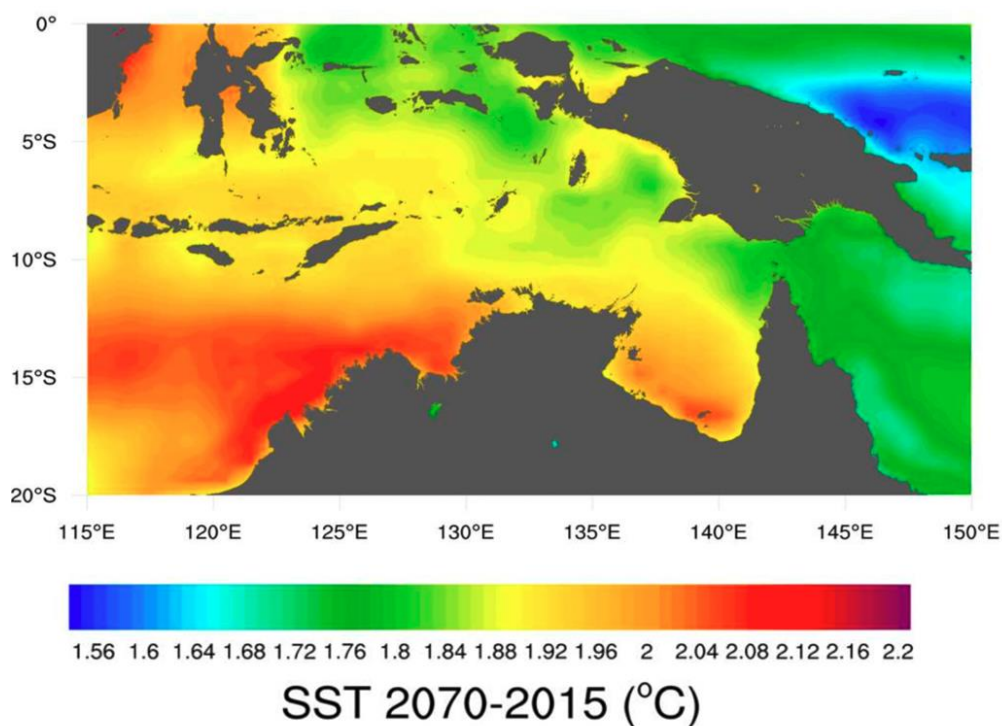


Figure 6 – Sea surface temperatures (SST) differences between 2015 and 2070 under SSP5-8.5 (high emissions) scenario (Source: Van Hooijdonk in Johnson et al., 2021)

All emission scenarios indicate a net decrease in pH in the ATS region; under the SSP5-8.5 high emissions scenario a spatially averaged decrease of 0.227–0.212 units are projected by 2070 relative to 2015, with effects most pronounced in the east of the ATS, between West Papua and the Gulf of Carpentaria.

Sea Level

Observational data has shown that sea levels have risen in the ATS at an average rate of 2.1mm/year over 1966-2009, and 3.1mm/year over 1993-2009; consistent with global average rises. Projections for ATS suggested that under RCP8.5 high emissions scenario, the Indonesian archipelago and Timor-Leste will experience increases of 0.5-0.6m by 2070, and the Gulf of Carpentaria and West Papua coast will experience increases of about 0.4m (Johnson et al., 2021).

Based on these data, Johnson et al. (2021) assessed the vulnerability of habitats in the ATS to climate change. The regional results of the vulnerability assessment for habitats were spatially variable. Shallow coral reefs are highly vulnerable to climate change, particularly around Manatuto and Barique Municipalities, Timor-Leste and Tual, Indonesia. Seagrass meadows were most vulnerable in the Gulf Carpentaria, Australia due to hotspot of sea surface temperature increase. Lastly, mangroves and estuarine habitats were most vulnerable in Timor-Leste and western Papua New Guinea.

Detailed information on the climate change vulnerability is included in the [Climate Change Vulnerability Assessment for the ATS](#) (Johnson et al., 2021).

3.2 Ecology

3.2.1 Key ecosystems and habitats

Located in the Indo-West Pacific centre of biodiversity, the ATS supports very high diversity including more than 600 species of reef-building corals, 2,500 species of marine fish, 47 species of mangroves and 13 species of seagrass (Roberts et al., 2002; Tomascik et al., 1997; Veron 2000; Spalding et al., 2010; Johnson et al., 2021). The ATS ecosystems and habitats support globally important populations of charismatic marine animal species such as cetaceans, dugongs, marine reptiles, and elasmobranchs, as well as extensive capture fisheries.

From deepwater troughs to extensive shallow shelf areas and embayments, the unique and diverse marine habitats of the ATS include extensive mangrove systems, corals and seagrass beds. As shown in Figure 7, coral reefs and seagrass are widely distributed in clearer waters (East Nusa Tenggara – Maluku), meanwhile mangroves are primarily in Papua and on the north coast of Australia.

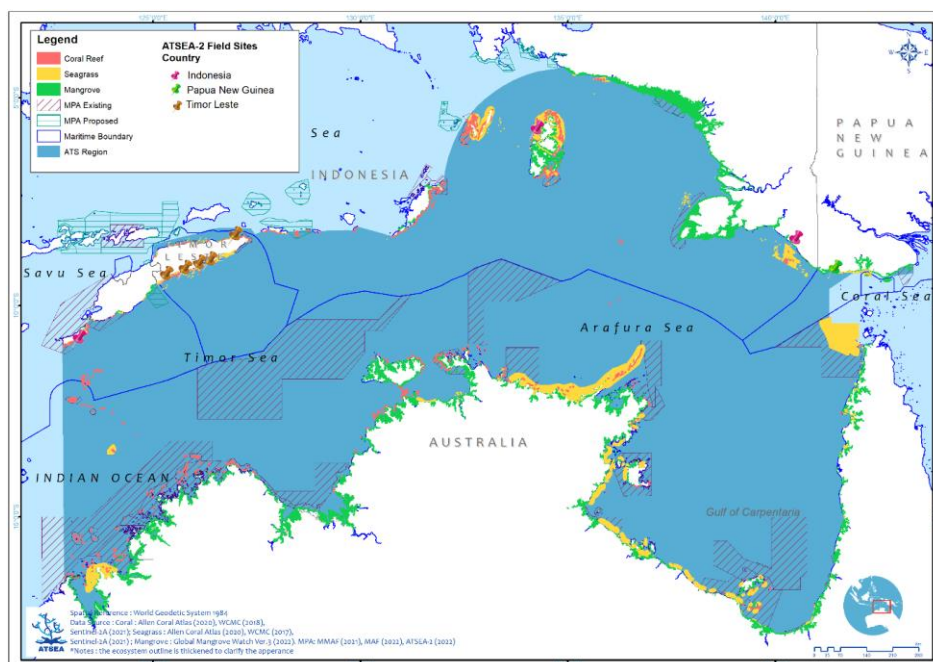


Figure 7 – Key coastal ecosystems and siting of MPAs (ATSEA-2, 2022)

Table 3 highlights total area of marine territory, area under management as MPA, and area coverage of shallow water critical habitats in the ATS including coral reefs, mangroves and seagrasses for the ATS littoral countries. Australia has the largest marine territory intersecting the ATS, and Indonesia has the largest extent of seagrasses (64% of ATS total), coral reefs (68% of ATS) and mangroves (68%) in the ATS. The largest single area of seagrass is found in the Torres Strait between Papua New Guinea and Australia, supporting important species including dugong and green turtle, and providing important carbon capture services.

Table 3 – MPA coverage and shallow water habitats in the ATS by country

ATS Country	Marine Protected Area (MPA) coverage* (km ²)	Coral habitats in ATS** (km ²)	Mangrove habitats in ATS*** (km ²)	Seagrass habitats in ATS** (km ²)
Australia	249,802.10	1,616.70	7,927.35	17,697.05
Indonesia	11,674.79****	3,638.92	8,587.28	5,132.09
Papua New Guinea	806.39	52.57	317.67	895.95
Timor-Leste	935.23	45.91	9.60	367.44
Total	263,218.51	5,354.10	16,841.90	24,437.55

Sources: *Fajariyanto et al., 2021 **UNEP WCMC Ver.7 (2021); Seagrass in Timor Leste with Sentinel 2A (acquired in 2022); Seagrass in Rote Ndao with Sentinel 2A (acquired in 2021), ***Bunting et. al., 2018/Global Mangrove Watch. ****Updated considering Marine Affairs and Fisheries Ministerial Decree No. 64 Year 2014 on Aru Tenggara MPA Management Plan and Zonation, Marine Affairs and Fisheries Ministerial Decree Year No. 5 Year 2023 on Pulau Kolepom MPA Establishment

Detailed descriptions of key habitats including mangroves, corals, seagrasses is included in the [Regional Profile of Coastal and Marine Ecosystems in the ATS](#) (Hakim et al., 2020)

3.2.2 Ecological connectivity

The ATS has been described as a major biogeographic crossroad, where biota is affiliated with the Timor-Indonesian-Malay region (Australia Government, 2022a). The region displays high levels of ecological connectivity resulting from the shallow continental shelves and semi-enclosed gulfs, and shared oceanographic processes. In this context, ecological connectivity includes considerations of genetic flows among and between populations, the migratory patterns and pathways of highly mobile species (including cetaceans, some elasmobranchs and marine reptiles), shared populations and stocks of marine organisms that span territorial boundaries, marine and coastal ecosystems habitats that span territorial boundaries, and transboundary environmental flows and oceanographic currents, such as the Indonesia throughflow (Choesin et al., 2021).

Pelagic dispersal is aided by the currents emanating from the Indonesian throughflow, transporting warmer water southward from the Pacific Ocean into the Arafura and Timor Seas. This pelagic dispersal is thought to aid the distribution of larvae, juvenile and adult migrating organisms (Australia Government, 2022a).

The ATS hosts regionally connected populations of endangered, threatened and protected species; numerous cetaceans, sea turtles and elasmobranchs are known to utilise parts of the

ATS including migratory pathways. Six of the world’s seven sea turtle species occur in the ATS and use well-established migratory pathways (Hakim et al., 2020).

Transboundary genetic connectivity between populations of fish species important for commercial and artisanal fisheries including demersal snapper species *Lutjanus malabaricus*, *L. erythropterus* and *L. argentimaculatus*, as well as elasmobranch species *Prionace glauca*, and *Sphyrna lewini* has previously been established, suggesting opportunities for co-management of those stocks (Blaber et al., 2005, Blaber et al., 2009, Salini et al., 2006, Ovendon et al., 2009 cited by ATSEA, 2012). Other studies have suggested stocks of red snapper utilise numerous separate spawning grounds throughout the Arafura Sea, and therefore represent separate stocks (Badrudin and Aisyah, 2009). The ATS also includes spawning grounds for other commercially valuable species including Yellowfin tuna (*Thunnus albacores*). Connectivity between stocks of barramundi (*Lates calcarifer*) in the Indonesia-Papua New Guinea transboundary area also seems likely but requires further investigation.

3.2.3 Threatened, charismatic and migratory species

Due to its unique connectivity and relative remoteness, the ATS is a globally significant area for a range of important marine and coastal species, including globally and regional rare, threatened, endangered and vulnerable species, migratory species, charismatic megafauna and locally endemic species.

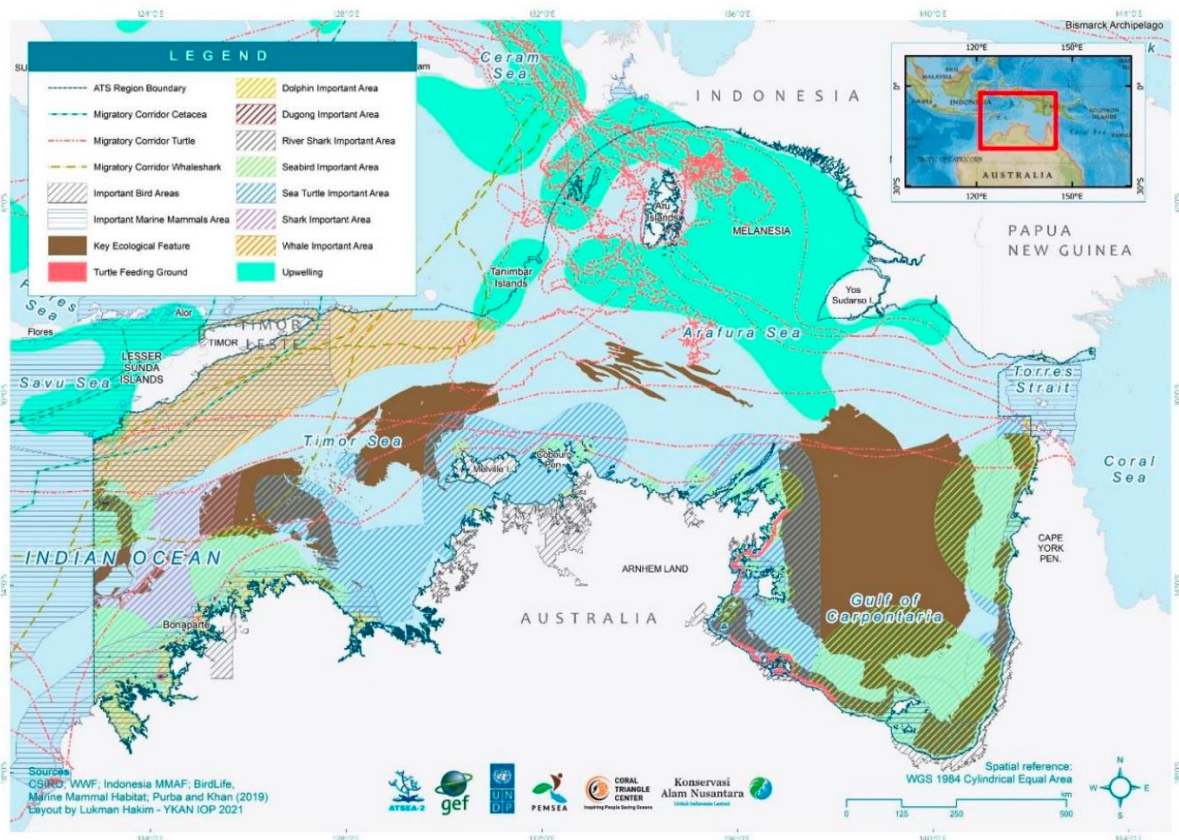


Figure 8 – Conservation features of the ATS including ecological features, important areas for ETP species and migratory corridors (Fajariyanto et. al., 2022)

Of the six sea turtle species known to occur in the ATS, at least three have been shown to use transboundary feeding, nesting habitats and/or migratory pathways (Figure 8 and Figure 9). Green turtles follow established migratory pathways between shallow feeding and nesting habitats in eastern Indonesia, islands of the Torres Strait, and all along Australia’s northern shores. Critically endangered Leatherback turtles from the west Pacific population use foraging grounds in the Arafura Sea, with a small number known to nest in northern Australia (while others nest in the north of the Papuan Birds Head, to the north of the ATS region). Olive ridleys are relatively abundant in the ATS, nesting on beaches in Australia, Indonesia and Timor-Leste; there are records of movements from West Papua into the Arafura Sea, and of olive ridleys remaining within Australian waters. Comprehensive data on the migratory patterns of the remaining three species (hawksbill, loggerhead and flatback turtle) is not available, although it is likely that some transboundary movement of all species occurs within the ATS region.

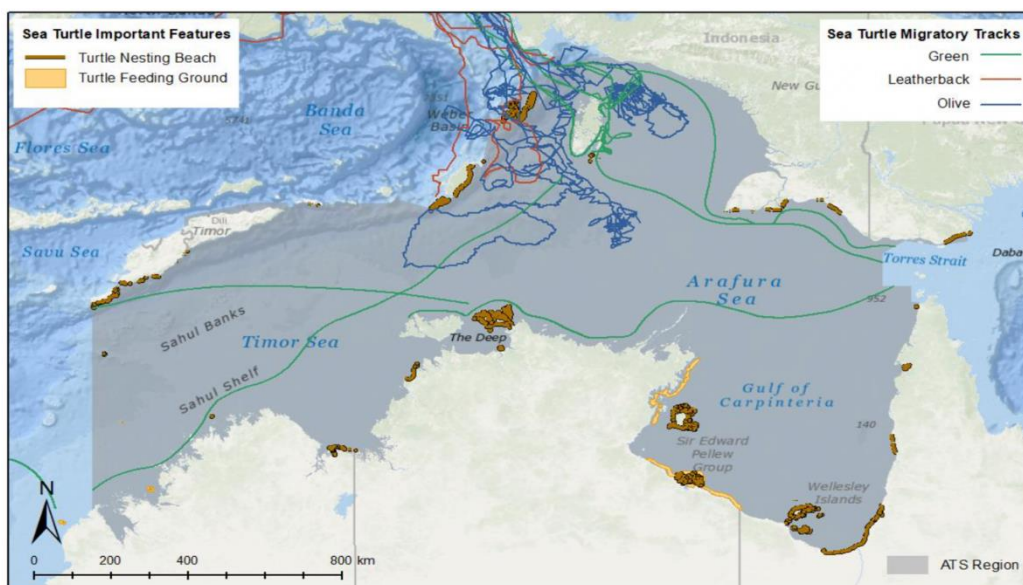


Figure 9 – Sea Turtle migratory pathways, nesting and foraging habitat distribution in the ATS (Fajariyanto et al., 2020)

ATS is similarly important to marine mammals; the IUCN Marine Mammal Protected Areas Task Force has identified six Important Marine Mammal Areas (IMMAs) within ATS system boundaries, of which two are transboundary and four are within Australian waters (Figure 10, Table 4). IMMAs are selected on the basis of their importance for the survival or recovery of threatened and declining species, their importance to small or residence populations or aggregations, their importance to life cycle activities including reproduction, foraging or migration, or distinctiveness or diversity of species.

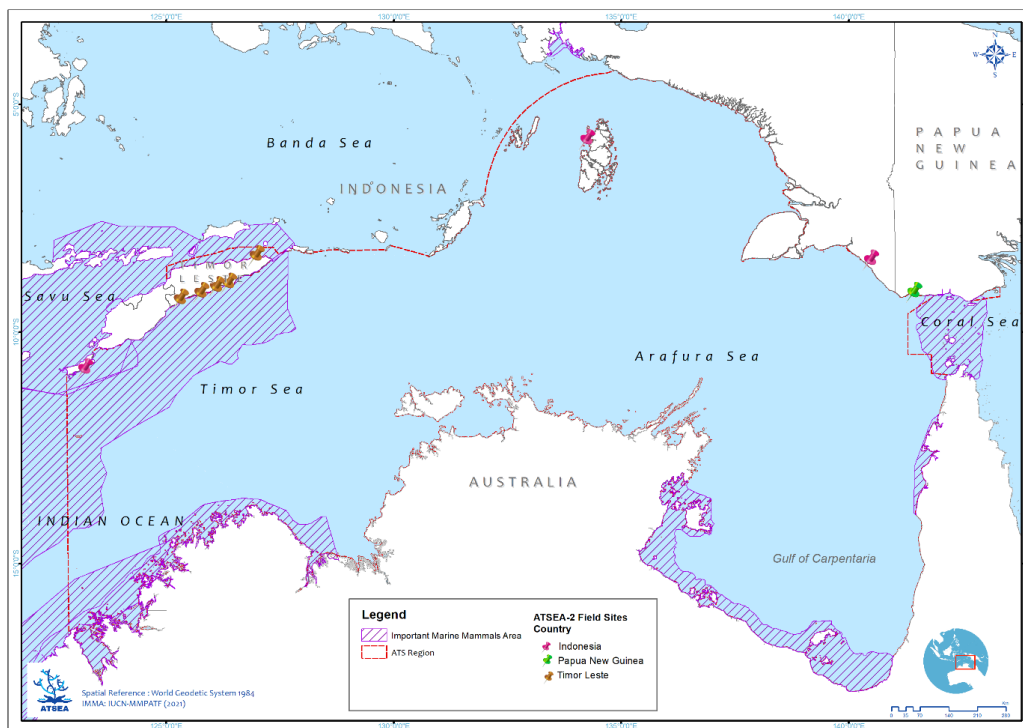


Figure 10 – Important Marine Mammal Areas (IMMAs) in the ATS region (IUCN-MMPATF, 2022)

The Central and Western Torres Strait (Australia-Papua New Guinea transboundary area) has been identified as a candidate IMMA on account of it being considered the single most important area globally for dugong habitat, containing one fifth of the global range (Grech et al., 2011). The Eastern Indian Blue Whale Migratory Route IMMA encompasses a migration corridor through Australian, Indonesian and Timor-Leste waters recognised as important for Pygmy blue whale. (IUCN-MMPATF, 2022)

Table 4 – Important Marine Mammal Areas (IMMAs) in the ATS Region (IUCN-MMPATF, 2022)

IMMA	ATS Territories	Key species	More information
Eastern Indian Ocean Blue Whale Migratory Route IMMA	Australia (Western Australia, Commonwealth) Indonesia, Timor-Leste	Pygmy Blue whale (<i>Balaenoptera musculus breviceauda</i>)	https://www.marinemammalhabitat.org/portfolio-item/eastern-indian-ocean-blue-whale-migratory-route/
Gourdon Bay to Bigge Island IMMA	Australia (Western Australia, Commonwealth)	Humpback whale (<i>Megaptera novaeangliae</i>)	https://www.marinemammalhabitat.org/portfolio-item/gourdon-bay-bigge-island/
Southern Gulf of Carpentaria IMMA	Australia (NT, Queensland, Commonwealth)	Dugong (<i>Dugong dugon</i>) Australian snubfin dolphin (<i>Orcaella heinsohni</i>)	https://www.marinemammalhabitat.org/portfolio-item/southern-gulf-carpentaria/

Mapoon to Aurukun IMMA	Australia (Queensland)	Australian humpback dolphin (<i>Sousa sahulensis</i>) Australian snubfin dolphin (<i>Orcaella heinsohni</i>)	https://www.marinemammalhabitat.org/portfolio-item/mapoon-aurukun/
Northern Territory cIMMA (candidate area - pending assessment)	Australia (Northern Territory)	Australian snubfin dolphin (<i>Orcaella heinsohni</i>) Australian humpback dolphin (<i>Sousa sahulensis</i>) <i>Tursiops aduncus</i> <i>Pseudorca crassidens</i>	Pending assessment
Central and Western Torres Strait (Area of Interest)	Australia (Queensland), Papua New Guinea	Dugong (<i>Dugong dugong</i>) Australian snubfin dolphin (<i>Orcaella heinsohni</i>) Australian humpback dolphin (<i>Sousa sahulensis</i>)	https://www.marinemammalhabitat.org/portfolio-item/central-western-torres-strait/

Whale sharks (*Rhincodon typus*) are a large, charismatic shark species important to tourism industries in Australia and Indonesia. Tracking of individuals undertaken by Conservation International (CI) since 2016 provides a clearer picture of their use of the ATS region. Between May 2016 and October 2022, at least six individuals from a total of 22 fitted with fin-mount pop-up satellite archival tags (PSAT) moved through the ATS region (Figure 11). These individuals moved between coastal and offshore waters of Australia, Papua New Guinea, and Timor-Leste, with one apparent corridor following the deeper waters of the Aru Basin with the northern side of the Timor Trough.

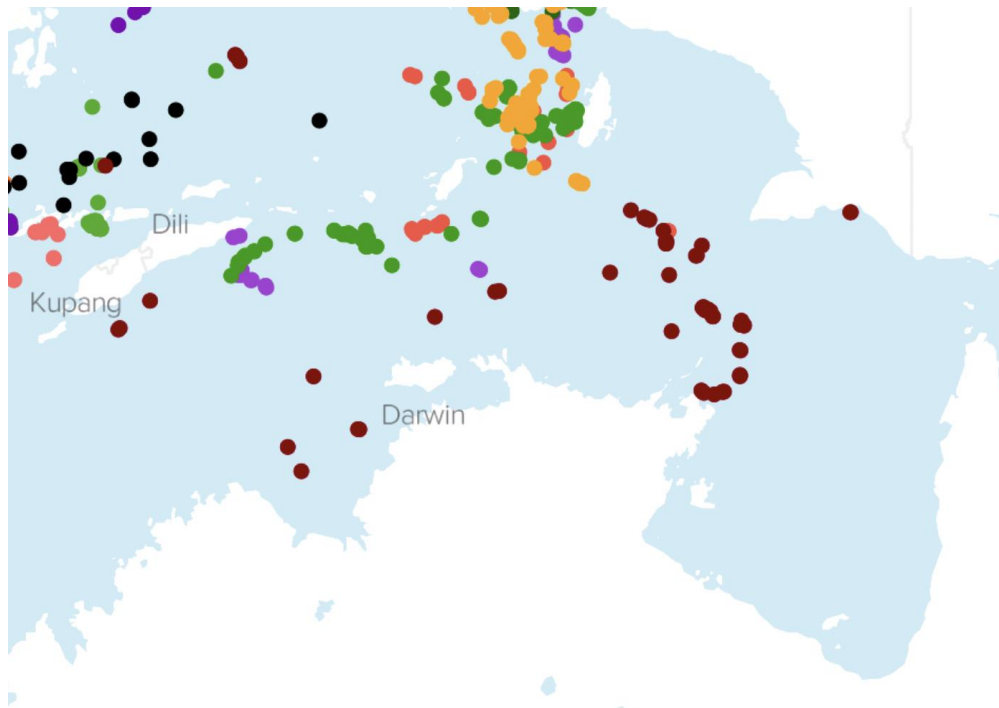


Figure 11 – Movement of tagged Whale sharks throughout the ATS region – each colour dot represents a PSAT data transmission from a unique tagged individual (Source: Conservation International, 2022)

The walking sharks of the genus *Hemiscyllium* are endemic species found in the waters of the Indonesian provinces of Papua, West Papua, Maluku, North Maluku, and Papua New Guinea and Australia. There are nine species of walking sharks uniquely distributed across the waters of the Aru Islands and northern Australia, as shown in Figure 12.

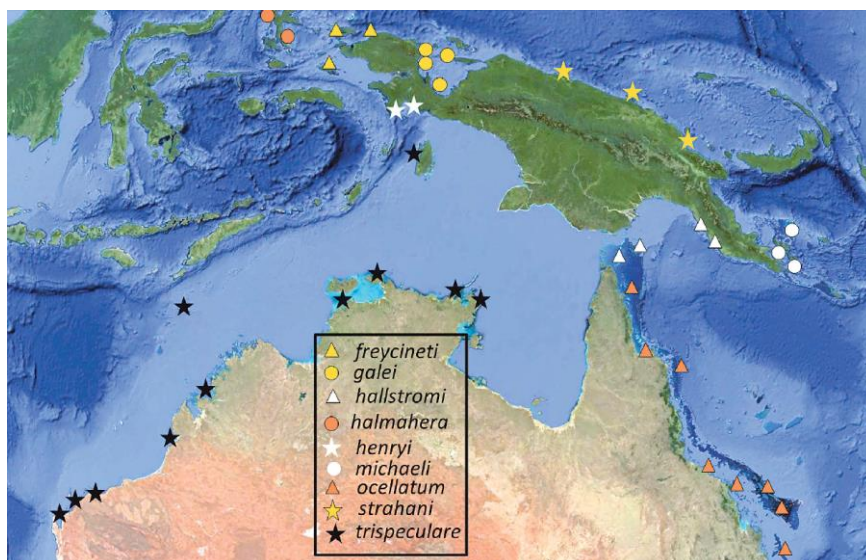


Figure 12 – Distribution of walking shark species, *Hemiscyllium* spp. (Allen, 2016)

The walking shark species *Hemiscyllium trispeculare* has been entered into the IUCN red list with the category of Least Concern. Several factors have contributed to the decline in walking shark populations including habitat degradation, fishing pressure, illegal trade, and climate change. The walking shark is fully protected in Indonesia through Decree of the Minister of Marine Affairs and Fisheries Number 30 of 2023 concerning Full Protection of Walking Shark (*Hemiscyllium* spp.)

Fajariyanto et al. (2021) notes a total of 12 species of seabird occurring in the ATS region, where small islands and mangroves serve as important sanctuaries for many seabird species. A total of 49 Important Bird and Biodiversity Areas (IBAs) intersect the ATS, with a majority of these in Australia. In addition to resident populations of seabirds, migratory shorebird species also utilise wetlands and floodplains in the coastal zone fringing the ATS.

More information is included in the ATSEA-2 [Analysis of Threatened, Charismatic, and Migratory Species Distribution Around the Arafura and Timor Seas](#) (Fajariyanto et al., 2020)

3.2.4 Introduced and invasive species

Introduced and invasive species in marine environments (commonly referred to as ‘marine pests’) have the potential to cause ecological and economic impacts by competing with native and important commercial species. They may be spread by various means including on ship hulls, or in ballast water.

Mana and Mungkaje (2022) identified several invasive species of finfish in Papua New Guinea’s coastal freshwater and estuarine ecosystems, including snakehead (*Channa striata*), walking catfish (*Clarias batrachus*), climbing perch (*Anabas testudineus*), common carp (*Cyprinus carpio*), tilapia (*Oreochromis mossambicus*) and a small mudfish species.

Black striped false mussel (*Mytilopsis sallei*) is native to eastern Pacific waters which may be spread on the hulls and internal ballast water of vessels. Once established it may multiply rapidly and outcompete native species. It had established in the Northern Territory waters in 1999 but was successfully eradicated. It is established in Indonesian ports, but its status in Papua New Guinea and Timor-Leste is unknown. Asian green mussel (*Perna viridis*) has been detected previously in the port of Darwin and in the Gulf of Carpentaria but to date has not successfully established. Other species of concern noted by the Northern Territory government include charru mussel (*Mytilopsis strigata*), American slipper limpet (*Crepidula fornicata*) and the Asian bag mussel (*Arcuatula senhousia*).

3.2.5 Ocean health

The Ocean Health Index (OHI) provides a useful independent comparative measure of overall ocean health of 220 coastal nations and territories. Scores are based on assessment of indicators related to OHI goals, including fisheries production, biodiversity and habitats, food provision, tourism and recreation, and an index score; an average of present status and likely future status which considers trends, pressures, and resilience. Table 5 indicates positive trends in Indonesia and Papua New Guinea, and negative trends in Australia and Timor-Leste.

Table 5 – Ocean Health Index scores, ATS littoral nations (2021)

	OHI Score (2021)
Australia	74 ↓
Indonesia	65 ↑
Papua New Guinea	67 ↑
Timor-Leste	61 ↓

The average 2021 Index score for countries was 70/100, with less densely populated countries generally achieving higher scores. Lower scores may be an indication that more (or more equitable) benefits could be gained from oceanic resources, or that current management or utilisation is not maximising the delivery of benefits to future generations. OHI does not reflect the status or trends specific to the Arafura or Timor Seas specifically.

3.3 Human dimensions

The ATS is among the most ethnically, culturally and linguistically diverse areas on earth, defined by the indigenous and non-indigenous ethnic groups, numerous languages and unique cultures across the four littoral countries. Strong transboundary connections, including economic, familial and cultural links exist between many of these groups. The region is also one of human need, with poverty and food insecurity persistent problems among many communities today. These factors continue to influence the way that marine and coastal resources are utilised today.

3.3.1 Demographics

Table 6 highlights the human population in ATS littoral countries. Australia has the largest EEZ portion, but a relatively small human population in the region. Indonesia’s population dominates the Arafura Sea region, with almost 3 million people living in ATS coastal areas. While Timor-Leste is a relatively small country, it is highly connected to the Timor Sea and its economy is highly dependent on the gas and oil sectors contained within its EEZ. Papua New Guinea’s ATS region is a small part of that country’s EEZ, and is quite remote, with low population density (Table 6).

Table 6 – Demographics and general information on ATS littoral countries

ATS Country	ATS Human population (%ATS)	Population density (people per sq.km)	Area of EEZ (km ²) (% of ATS)
Australia	195,288 (5.56%)	0.2	1,749,432 (67%)
Indonesia	3,083,379 (87.76%)	15.2	773,319 (30%)
Papua New Guinea	29,000 (0.82%)	1.5	30,364 (1%)
Timor-Leste	205,806 (5.86%)	67.6	54,335 (2%)
Total	3,513,473		

Adapted from Shin, 2021; Mana and Mungkaje, 2022; Yonvitner et al., 2022; Fonseca et al., 2022

Within Indonesia, three provinces intersect the ATS; East Nusa Tenggara (with 7 regencies/cities), Maluku (with 5 regencies/cities) and the recently declared South Papua province (with 4 regencies). In Australia, the states of Queensland and Western Australia, and the Northern Territory (NT) all intersect with the ATS. In Timor-Leste, the southern coastline faces the Timor Sea, and includes the municipalities (from west to east) of Covalima, Ainaro, Manufahi, Manatuto, Viqueque and Lautem. In Papua New Guinea, the South Fly district of Western Province is the only sub-national jurisdiction within the ATS, along with several of the 13 ‘Treaty Villages’ within the Protected Zone of the northern Torres Strait. Further information on sub-national jurisdictions and populations is included in Appendix 5.

3.3.2 Ethnicity and culture

Indonesia

Eastern Indonesia is culturally and ethnically diverse, strongly influenced by both the Pacific and Asian regions. Ethnicities within the ATS region of Indonesia include the indigenous Melanesian ethnicities of Asmat, Marind, Korowai, of the recently declared province of South Papua (some of which have strong cultural ties to communities in the South Fly district of Papua New Guinea's Western Province). In West Timor (East Nusa Tenggara province), the most populous ethnic group is the Atoin Meto, or Dawan people; other groups include the Sabu, Rote, Semaun and Ndaonese and Kemak people, all considered part of the Austronesian language group. In Maluku province, the Moluccans are the indigenous inhabitants of the island groups of Aru, Kei, and Tanimbar islands, and include descendants of both Austronesian and Melanesian lines. Non-indigenous ethnic groups in the ATS region of Indonesia are also diverse and include Javanese, Bugis, Butonese, Chinese and Makassarese; many have settled in the region in the larger population centres over previous centuries (Stacey, 2011). Religion across the region is dominated by Islam, which arrived in the region in pre-colonial times from the sultanates to the north and west of Indonesia, and Christianity (including Catholics and Protestants), which was introduced to indigenous populations in the pre-independence Dutch and Portuguese colonies. Some traditional communities also maintain elements of their pre-colonial animist belief systems, many of which are reflected in traditional practices used to manage marine resources, as outlined in Chapter 6.

Timor-Leste

Timor-Leste is a young country, with a young population; it has a total population of 1.3 million people and a median age of 17.4 years. Most of the population (74%) is under the age of 35, and the ratio between men and women is 50.54 and 49.46 respectively. High fertility (4.1 children per mother) has significant impacts on public health, and on the employment sector; unpaid work is high in rural areas, where 70% of Timorese live. The country has a high dependence on the agricultural sector, and to a lesser extent fisheries and forestry. Agriculture is predominantly smallholder, while fisheries are dominated by small-scale (often unpowered vessels) coastal multi-species, multi-gear fisheries, which are highly seasonal. Seasonality of fishing reflects agricultural seasons as much as oceanic conditions. Ethnically, Timor-Leste is a diverse mix of several groups including the Tetun (from whom the national language comes), Mambae and Tukudede (Fonseca et al., 2022).

Papua New Guinea

The South Fly district is the Papua New Guinean eastern sector of the Trans-Fly region of the south of the New Guinea island, situated in Western province. Precolonial times saw South Fly communities living in temporary settlements, but over time communities have settled in permanent villages, made up of different clans. Eleven language groups exist in the region, and language is closely linked to culture and the natural environment. Traditional customs, customary law and local trade and tenure systems have been in place for millennia, and only recently impacted by modern systems of government and external relations. Resource rights are generally patrilineal, and marine tenures typically extend seaward from land-based tenure

divisions. Strong transboundary cultural ties to indigenous communities in Merauke district (Indonesia) remain, and continue to inform trade, as well as familial and cultural values. Livelihood strategies include subsistence agriculture, including sago, coconut, sweet potato, banana, and cassava. Subsistence fisheries form an important dietary component, and small-scale fisheries for beche-de-mer, lobster, barramundi and fish maw provide cash income to some families, via markets in either Daru or Merauke (Mitchell et al., 2021).

3.3.3 Gender and social inclusion

Gender Equality and Social Inclusion (GESI) studies carried out by ATSEA-2 provides a contemporary picture of equality and inclusion issues in the region.

Despite progress over the past decade, many minorities in Indonesia, Timor-Leste and Papua New Guinea continue to face barriers to the full realization of their rights, affecting their ability to develop and thrive. Economic growth has not always translated into improved wellbeing for the most marginalized groups; while outcomes vary by geographic areas and by different social groups, people with disabilities, the poor, indigenous communities, rural and LGBTIQ generally face more challenges accessing social and economic needs. Women and minorities continue to face constraints such as lack of education, and unequal burden of unpaid care work. Some customary practices and traditional patriarchal relations in families and communities still discriminate against women.

Environmental issues including declining fish catch, environmental degradation, and climate change may have a disproportionate impact on the lives of women and minorities due to these traditional roles and existing biases. However, efforts to increase participation of women without addressing gender stereotyping may lead to additional burden for women. In terms of solutions to gender inequality, communities themselves were able to propose ideas: Indonesian respondents proposed increasing gender equality campaigns, socialising gender balance issues, involving more women, and providing training. Timor-Leste respondents suggested communication with family, increasing gender equality campaigns, government playing an active role in limiting restrictions, socialising gender balance issues, involving more women, providing training, and providing training to transport fish. Papua New Guinea respondents suggested that men supply good fishing gear to women, law enforcement and counselling for abusive partners, and providing training.

Source: [ATSEA-2 Gender Equality and Social Inclusion Analysis for ATS Region, 2021](#)

3.3.4 Traditional and cultural marine resource utilisation

The ATS region includes some of the world's oldest continuous cultures; today's socio-cultural system includes traditional knowledge and culture-based governance systems that influence the use and management of marine and coastal resources. Formal management frameworks across the ATS recognise these traditional systems, and in many cases enshrine them in Rights-based Management (RBM) approaches. The following information summarises known knowledge on traditional and cultural practices, and RBM approaches observed across the ATS.

Australia

With >65,000 years of continuous inhabitation and close connections to coastal resources in particular, Australia has some of the world's oldest natural resource management practices. In the Northern Territory, or NT (in the ATS region) about 50% of lands and up to 84% of the coastline is owned by Aboriginal communities through the aboriginal land rights system. Use of marine resources may be for traditional or commercial purposes; under section 183 of NT's Fisheries Regulations (1992), Aboriginal people may hold limited commercial licenses to catch and sell fish. In Western Australia (which faces the ATS region to its north) customary fishing is managed as a separate sector according to specific regulations.

Papua New Guinea

Papua New Guinea communities maintain strong tenurial systems over marine and coastal areas and natural resources. Kinch (2003) notes the complexity and fluidity of these marine tenure systems, and that ownership of sea and reef by individuals, families and clans may lack clearly defined boundaries. Papua New Guinea recognises customary and traditional systems (including customary tenurial rights, and approaches to resource management) in the Constitution and their importance in integrated marine management is noted in the National Oceans Policy. In the South Fly fore-coast, there is a traditional closure (or 'no-take') system known as *sabi*, which can serve as protection for important or vulnerable species and has the potential to be utilised for modern marine resource management (Mitchell et al., 2021).

Indonesia

Traditional or customary management of marine resources may be permitted under *hukum masyarakat adat*, or traditional law. Traditional approaches to the management of marine resources are still used in eastern Indonesia and include the Malukuan traditional tenure system called *petuanan laut*, which is described as an 'estate or territory of a particular social group' (Satria and Adhuri, 2010). *Petuanan laut* may extend as far as the eye can see, or as far as where shallow water meets deep water. Different rights may be assigned including *hak makan* (the right to collect food resources in the area), and *hak milik* (the right of ownership) which may allow rights-holders to lease their rights to another party. In some cases, *hak milik* is used by a community to sell or lease fishing rights to commercial interests such as fishing countries, but this interpretation is considered by some contrary to fisheries law. Among Papuan cultures, *sasi* is described as 'a system of beliefs, rules and rituals pertaining to temporal prohibitions on using a particular resource or territory' (Satria and Adhuri, 2010). *Sasi* is applied by 'closing' access to a resource, during which time it is protected. It may be applied to a marine area (known as '*sasi laut*'), such as a reef after which it becomes a territorial regulation. Rules may be developed to limit particular gear types to be used during the harvest, and how the harvest is distributed among the rights-holders. Often, *sasi laut* is seen as a form of 'village savings bank', whereby an infrequent opening of a resource may generate a cash benefit that may be used to pay for weddings, education, or other capital expenses (Fox et al., 2021).

Timor-Leste

Timor-Leste maintains a range of traditional, cultural and customary practices and rights systems (collectively termed 'Lisan' in Tetun) that are relevant to fisheries management today.

Tara Bandu is the most widely known of these traditional approaches in Timor-Leste and is a form of social contract usually reached by community consensus. It typically has the functions of regulating 'people-to-people' and 'people-to-environment (including natural resources)' relations and has been revived since independence in marine and coastal settings.

3.3.5 Social and cultural transboundary connectivity

The ATS region is one of strong social connection, with a long history of regional trade, including links with indigenous Australia. The contemporary governance arrangements of the region by ATS littoral countries are very much influenced and informed by these social, cultural and economic links, as further outlined in further sections. Recognised social and economic transboundary connections include the following examples:

Merauke-South Fly (Indonesia and Papua New Guinea): typified by strong cultural ties, economic links include trade between Indonesian middlemen and Papua New Guinea fishers, and provision of gears and other goods into Papua New Guinea.

Timor and adjacent islands (Indonesia and Timor-Leste): Indonesia and Timor-Leste share a 125km international boundary, as well as the Timor-Leste enclave of Oe-Cusse located on the north coast of Indonesian (i.e., western) portion of the island of Timor. Since independence of Timor-Leste in 2002, many long-standing cultural and economic connections persist; in the maritime domain, this includes the unregulated trade of fish, fuel and other locally important goods in the Ombai Strait and vicinity of Wetar Island (Fonseca et al., 2022).

MoU Box (Indonesia and Australia): a bilateral fisheries agreement covering a 50,000km² area near the Cartier and Ashmore Islands recognises the long-standing traditional practices of Indonesian fishers in modern Australian waters, targeting beche-de-mer, lobster and shark using unpowered vessels.

Torres Strait (Australia and Papua New Guinea): on the very eastern boundary of the ATS region, the Torres Strait is governed according to an AUS-PNG Treaty, which sets out fisheries management arrangements and benefit sharing arrangements.

3.3.6 Economic and development indicators

Table 7 highlights the economic and livelihood gains made by ATS countries in the last decade. Although not entirely consistent across the region, generally there has been a positive trend of improved economic performance and of human development. In the past decade, Indonesia and Timor-Leste have made significant gains in poverty reduction.

The table also highlights the high level of economic disparity between ATS nations. In the region, Australia and Indonesia remain relatively wealthy nations with similar sized national economies, although Australia has a significantly higher GDP per capita. Timor-Leste is one of the world's youngest nations and is still in its early stages of economic development. 42% of the Timorese

people live beneath the poverty line, although a reduction in the poverty rate has been achieved in recent years. While a high proportion of Papua New Guinea’s population lives below the poverty line, it derives significant export revenue from its resources sector.

Table 7 – Economic indicators for ATS countries

ATS Country	GDP *		GDP per capita*		Poverty* (Poverty headcount ratio at national poverty lines, % of population)		Human Development Index** (HDI)	
	(USD)		(USD)					
	2011	2021	2011	2021	2011	2022	2011	2021
Australia	1.397T	1.39T	54,103	58,780	0.3 (2010)	-	0.926	0.951
Indonesia	893B	1.12T	2,849	3,855	12.5 (2011)	9.8 (2020)	0.671	0.705
Papua New Guinea	17.98B	26.59B	2,211	2,655	39.9 (2009)	-	0.504	0.558
Timor-Leste	1.04B	1.96B	1,234	1,626	-	41.8 (2014)	0.638	0.607

Source: World Bank (2019)*, UNDP Human Development Index (2022)**

3.3.7 Regional trade

Australia enjoys strong trade partnerships with Indonesia and Papua New Guinea; residents move relatively freely between these countries to participate in tourism, mining and education markets. Indonesia and Timor-Leste’s economies remain closely linked after independence, with the local informal market a significant influence on the use patterns related to natural resources. Similarly, in the southern region of New Guinea, there are significant formal and informal economic links spanning the borderlands of Papua New Guinea’s South Fly and Indonesia’s South Papua province.

The following bilateral trade and economic agreements exist between the ATS countries:

- Papua New Guinea- Australia Comprehensive Strategic and Economic Partnership (CSEP) 2020
- Indonesia-Australia Comprehensive Economic Partnership Agreement (IA-CEPA) 2020
- Australia-Timor-Leste 2022 bilateral agreement (as part of Timor-Leste’s accession to the World Trade Organisation)
- Indonesia and Papua New Guinea launched negotiations on a Preferential Trade Agreement in 2019

3.4 The Blue Economy

The ATS regional maritime economy is well-established; there are documented trade links between the Macassan people and the Yolngu people of northern Australia, dating back to the early 1700s. More broadly, transboundary trade has contributed to the development of region’s unique social and economic fabric for centuries.

UNDP defines the modern ‘blue economy’ concept as the “sustainable use of ocean resources for economic growth, jobs and social and financial inclusion, with a focus on preservation and restoration of the health of ocean ecosystems and the services they provide”. The concept also considers green infrastructure and technologies, innovative financing, and proactive institutional arrangements (PEMSEA, 2018a), adapting to climate change, generally, coupling environmental sustainability outcomes with social and economic outcomes.

The Blue Economy concept has been embraced by all ATS counties over the past decade and tied to this is the value of goods and services derived from marine and coastal ecosystems. Important marine and coastal economic sectors outlined in this section include capture fisheries, aquaculture, marine tourism, maritime industries including shipping and transportation and the gas and oil sector. It is noteworthy also that informal economy activities (such as subsistence fishing) are often underrepresented in descriptions and valuations of the blue economy, despite their importance to impoverished coastal communities.

Table 8 – Key segments of national ocean economies for ATS countries

	Australia (AUD, 2018)*	Indonesia (USD, 2015)**	Papua New Guinea	Timor-Leste (USD, 2015)**
Fisheries and aquaculture (marine coastal)	2.81B	15B	Data unavailable	7.1M
Offshore oil and gas	37B	22.75B	Data unavailable	1.496B
Tourism (marine coastal)	30.7B	19.93B	Data unavailable (Total 2018 tourism was valued at USD 4.23M***)	19.6M
Shipping and transport	6.95B	2.23B	Data unavailable	66.7M
Other (incl. construction, manufacturing and government sectors)	3.74B	128.55B	Data unavailable	370M
TOTAL VALUE	AUD 81.2B (USD 54.52B)	188.46B	17.76B****	1.96B

*AIMS, 2020

**PEMSEA, 2018b

***World Tourism Organisation, 2018

****WWF, 2016

In 2019, the World Bank estimated Indonesia’s ocean economy to be \$256billion annually (the largest in ASEAN), with the sector having ‘tripled in span’ in five years, and contributing 28% of GDP (WB, 2019).

Related to this, some ATS countries are adopting ocean accounting to better quantify and track benefits from marine and coastal ecosystems, and to link financial and environmental reporting. The Global Oceans Accounts Partnership notes that Australia has piloted ocean accounting in

Western Australia, including aspects of blue carbon accounting, and valuation of fisheries and tourism sectors, while Indonesia is conducting a national pilot on ocean accounts that links to its National Oceans Policy. A subset of ocean accounting is the valuation of ecosystem services, outlined in the following section. Papua New Guinea is currently undertaking a fact-finding mission to identify potential reef-friendly and fisheries-friendly opportunities for developing MPAs; this work is being led by CEPA with GEF support.

3.4.2 Ecosystem services from the ATS

The ecosystems of the ATS support numerous forms of commercial and non-commercial activities that are undertaken by communities and industries from all four littoral countries; some of these contributions (e.g., fisheries) are included above in ‘blue economy’ valuations, while others may be less tangible, or not monetised. The following section briefly highlights the array of ecosystem services derived from the ATS, with particular focus on those relevant to the identified transboundary priority issues outlined in subsequent chapters.

Table 9 summarises ecosystem services provided by the Arafura-Timor Seas ecosystems. Broadly, services fall into four categories; provisioning (goods derived from nature), cultural (goods and services derived from nature that support cultural or social activities), regulating (the natural processes supported by ecosystem function), and supporting (those ecosystem services that support the production of all other ecosystem services).

Table 9 – Summary of ecosystem services provided by the ATS

Ecosystem service type	Services provided
Provisioning	Capture fisheries products
	Aquaculture and mariculture products (seaweed, pearls, finfish, other)
	Other foods and medicines derived from marine and coastal ecosystems
	Genetic resources
	Other useful species (e.g., ornamental fish, traditionally hunted species)
	Fibres and plant materials including woods, mangroves, seagrasses, shells, corals
Cultural	Reef fisheries livelihoods
	Spiritual and tourism values (natural vistas, engagement with nature, etc.)
	Populations of ETP species including culturally important species
Regulating	Carbon sequestration and storage in coastal ‘blue carbon’ ecosystems
	Stabilization of the coastal zone
	Coastal protection /resilience from natural disasters
	Regional climate regulation from oceanographic processes (e.g., Indonesian Throughflow)
Supporting	Marine and coastal food webs
	Reef building corals
	Critical habitats for ETP species
	Nutrient cycling

Valuation of Ecosystem Services for the ATS (Choesin, et al., 2021) was conducted in 2020 for ATSEA-2 and provides a comprehensive assessment of ecosystem services identified for the region including capture fisheries, aquaculture, marine tourism, regulating services including carbon sequestration and cultural services.

The study concluded that the total value of ecosystem goods and services provided by the ATS's ecosystems to the four ATS littoral countries was USD 7.3 billion. Annual value derived from key categories of ecosystem goods and services is as follows:

- Fisheries** – USD 742 million
- Marine aquaculture** – USD 640 million
- Marine tourism** – USD 4.9 billion
- Carbon sequestration** – USD 625-664 million
- Cultural services** – USD 263-898 million
- Biodiversity** - \$81.3 million

(Source: Choesin, et al., 2021)

More detail on these sectors is provided in subsequent sections.

PEMSEA's State of the Coast (SOC) report highlights the relative contribution of ecosystem services to overall ocean economy, and to GDP. Indonesia's ocean economy has been valued at an estimated \$US182.54billion, 27% share of GDP; of which, \$105billion was considered to be the value of (marine) ecosystem services (PEMSEA, 2018b).

Marine Spatial Planning (MSP) is a useful tool for analysing and allocating or distributing human activities within a marine system and may incorporate both spatial and temporal dimensions. As a planning tool, it can help to underpin these sectors by ensuring ecosystem function, and the suite of ecosystem services they provide.

In the past decade, Indonesia and Australia have both made efforts to introduce and expand Marine Spatial Planning (MSP) approaches in order to improve environmental, social and economic outcomes from their marine areas. By 2020, 27 Indonesian provinces had enacted MSP, while in Australia the North Network Bioregional Marine Area provides an MSP framework for Australia's portion of the ATS with a focus on ecosystem protection through MPAs.

3.4.3 Capture fisheries

Fisheries are considered the most important economic sector in the ATS, with their combined value estimated at between \$742 million to \$1.2 billion, with reported landed volume between 809,816-2.2 million tonnes (Shin, 2021; ATSEA, 2012). These capture fisheries are the lifeblood for many ATS communities; broadly they include coastal, small-scale fisheries that contribute to daily subsistence and local markets, and larger-scale industrial fisheries that feed regional and global seafood markets. Key commercial fisheries in the ATS include barramundi, shrimp, demersal species including red snappers, groupers, croakers, grunts, emperors, small and large pelagic fishes, and invertebrates including shrimp, lobster, crab, sea cucumber. The demersal fishery alone is believed to catch up to 300 different species (Green and Tjandra, 2022).

Table 10 presents estimated landed catch (2009) and estimated value of landed catch (2020), divided by country. It is likely that subsistence and small-scale fisheries landings are underrepresented; these fisheries in the coastal zone tend to be multi-species and multi-gear in nature, and likely encompass hundreds of species harvested for local use, and often not reported.

Regardless, fisheries are the largest and most valuable economic sector in the ATS, providing employment and important food security within and beyond the region, and having important cultural value also.

Table 10 – Estimated landings in ATS, 2009 (ATSEA- 2021, cited by Shin, 2021)

ATS Country	Estimated landed catch, 2009 (t) (Shin, 2021)	Estimated value of ATS marine capture fisheries in 2022 (USD) (Choesin et al., 2021)
Australia	13,340 (1.65%)	144,277,474
Indonesia	793,410 (97.9%)	581,164,652
Papua New Guinea	Data not available	Data not available
Timor-Leste	3,066 (0.38%)	16,581,234
Total	809,816	742,023,360

Australia overview

Australia’s commercial fisheries in the ATS include state and federally managed fisheries, for shrimp, finfish and shark. Combined, the commercial finfish fisheries across Queensland, Northern Territory and Western Australia produce between 6,000-7,000 tonnes annually (Knuckey et al, 2021). The Northern Prawn Fishery (NPF) operates within the Australian Fishing Zone (Commonwealth waters), with 52 licensed vessels in 2021 landing 5,371 t (Patterson et al., 2022). A Joint Authority Northern Shark Fishery (JANSF) also operates across the three Australian ATS jurisdictions, although volumes are not known.

Subsistence fisheries are important to indigenous communities on Australia's northern shores. Up to 50% of lands and 84% of coastline in the Northern Territory is under indigenous ownership, and communities use fisheries resources for both subsistence and limited commercial purposes, managed under co-management arrangements. Customary fishing in Western Australia is managed under a separate, rights-based regime which is separate to commercial fisheries. And Queensland provides for traditional fishing practices within aboriginal reserves, outside of the usual provisions of the Fisheries Act.

Indonesia overview

Indonesia is the world's third biggest seafood producer, with over 2million active fishers. It also has the most productive fisheries in the ATS region. Indonesia manages its fisheries using an ecosystem-based approach, incorporating Fisheries Management Areas (FMAs); two FMAs intersect with the ATS region, FMA573 and FMA 718. FMA718, the Arafura Sea ecosystem, is considered the most productive of Indonesia's 11 FMAs, and in 2018, total production reached 257,376t, with the demersal fishery the largest sector. Important demersal species include snappers, groupers, croakers and emperors. Indonesia divides its fishing areas; from the coast to 12nm into a coastal fisheries zone, for the benefit of small-scale fishers using vessels smaller than 10GT, and beyond which vessels 10-30GT are permitted to fish throughout Indonesia's EEZ. In 2018, more than 3,000 vessels above 10GT operated in WPP718. Most productive fishing grounds include the waters around Aru, Merauke and the Tanimbar Islands.

Papua New Guinea overview

In Papua New Guinea's South Fly region, fisheries are the mainstay of local livelihoods; species important for subsistence include barramundi, mud crab, lobster, bivalve molluscs and reef fishes, and turtles and dugong are delicacies for communities on the Fore Coast South Fly (Mana and Mungkaje, 2022). Commercially valuable species and products include beche-de-mer, shark fins, fish maws; they provide the majority of household cash (Busilacchi, et al., 2021). Other commercially important species include mangrove crab, barramundi, and lobster. A trial fishery was conducted by NFA in 2017 to assess the feasibility of the fishery in the dogleg area, which indicated good commercial potential for mackerel, trevally, bream, snappers and squid (Mana and Mungkaje, 2022).

FAO estimated the value of the entire (national) coastal fisheries subsistence production to be USD 34m (NFA, 2021), although the portion of that total relevant to the ATS is assumed to be relatively small.

Timor-Leste overview

Timor-Leste's coastal fisheries are currently exclusively small-scale, and they play an important role in providing food security, protein and livelihoods to coastal communities (Fonseca et al., 2022). Coastal fisheries tend to be seasonal, and often form part of a more diverse livelihood strategy involving agriculture. Many fishers still use unpowered vessels, and rudimentary gear types including gillnet and hook-and-line. Surveys conducted by ATSEA-2 in 2021 showed at least 668 fishers operating from four south coast municipalities of Lautem, Viqueque, Manatuto and Manufahi. 88% of these were primarily demersal fishers, targeting a range of reef and reef

associated species including red snappers and groupers. Most fishing grounds were within 1.8km of landing sites, with most fishing done in waters less than 25m in depth, and a quarter of fishing grounds more than 5km in distance. The greatest distance travelled to fish was 21.65 km. Favoured fishing grounds included seagrasses, coral and rocky reefs, mangroves and mud and sand substrates (Knuckey, 2021a). With approximately 3,000 fishers nationally, the Timor Sea fishery may represent up to a third of production although more data is required to validate this.

Transboundary fisheries

Despite fisheries typically being managed within EEZ limits, fisheries may be considered transboundary for several reasons; known or suspected transboundary stock or habitat interaction, known (legal or illegal) transboundary trade or supply chains, or being recognised under bilateral or regional fisheries agreements or bodies. Table 11 highlights known transboundary fisheries in the ATS.

Table 11 – Matrix showing recognised transboundary fisheries in the ATS region

	Indonesia	Papua New Guinea	Timor-Leste
Australia	<p>‘MoU Box’ fisheries in Australian waters by traditional Indonesian fishers, targeting beche-de-mer, trochus, reef fish.</p> <p>Indian Ocean Tuna Commission (IOTC) – Australia and Indonesia are both contracting parties to IOTC</p>	<p>Torres Strait Treaty fisheries including lobster, beche-de-mer, trochus, finfish including Spanish mackerel.</p> <p>Western and Central Pacific Fisheries Convention (WCPFC, or the ‘Tuna Commission’) – Australia and Papua New Guinea are both contracting parties to WCPFC</p>	None known
Indonesia	-	<p>South Fly-Merauke borderland fishing and trade of fish maw (barramundi, croaker, jewfish, catfish), shark fin, beche-de-mer</p> <p>*</p>	Numerous small-scale fisheries in transboundary areas
Papua New Guinea	see *box	-	(no shared boundary)

3.4.4 Aquaculture

The ATSEA-2 Valuation of Ecosystem Services (Choesin et al., 2021) estimated the value derived from aquaculture in the ATS region is over USD 640 million per year; this includes USD 480 million per year generated in Indonesia; USD 159.8 million in Australia; and USD 23.2 million in Timor-Leste.

Indonesia's main industries in the ATS include seaweed farming, milkfish and other species. Australia's main industries include finfish production, crustaceans and molluscs. Timor-Leste's aquaculture sector in the ATS is growing steadily, with seaweed farming the main sector. Papua New Guinea communities also practice marine and coastal aquaculture but not within the ATS region.

3.4.5 Marine Tourism

The combined value of marine and coastal tourism in the ATS region per year is USD 4.97 billion, of which 4.4 billion is generated in Indonesia, \$500 million in Australia, and \$64.6 million in Timor-Leste.

Across the ATS region of Australia, marine tourism plays an important role in the regional economies of Western Australia, Northern Territory and Queensland. Overall, based on data from 2018 and 2020, marine tourism was valued at USD 501.7 million per annum. This includes three main sectors; recreational fishing (USD 158.7 million), marine and coastal tourism (USD 284.34 million), and ship cruises (USD 59.7 million).

As the newest country in the ATS, Timor-Leste's marine tourism sector is in its early stages, with tourism combined (including marine and coastal) contributing 0.5% of GDP in 2020 (Asia Foundation, 2021).

Indonesia is regarded as a premier tourism destination, and eastern Indonesia has globally recognised marine and coastal tourism destinations. Within the ATS, tourism contributed USD 4.39b to the economy of Nusa Tenggara Timur in 2020.

While Papua New Guinea offers world class marine tourism experiences, there are few established attractions in the ATS region, and access remains limited.

3.4.6 Climate regulating services

Carbon-rich coastal ecosystems, including mangroves, seagrass meadows and coastal saltmarshes perform important carbon sequestration and storage functions; these 'blue carbon' ecosystems fix carbon through photosynthesis, which is stored in plant biomass and growing substrates. These important carbon sinks are capable of sequestering at rates several times that of equivalent areas of terrestrial ecosystems. Indonesia's blue carbon accounts for roughly 17% of the world's current blue carbon reservoir, despite half of the nation's mangroves and 30-40% of seagrasses having been lost since the 1960s (Alongi et al., 2015).

Considered a 'nature-based solution' to mitigating climate change, this function is of significant economic value. Blue carbon sequestration by Indonesian mangrove ecosystems accounts for about 52.85 tonnes of CO₂ /hectare/year (Wahyudi et al., 2018), and 6.32-12.70 tonnes of CO₂ /hectare/year in Australia. ATS seagrass ecosystems sequester large amounts of CO₂; 24.13

tonnes per hectare per year in Indonesia and 1.98 tonnes per hectare per year in Australia. Combined, the value of these critical regulating ecosystem services is calculated to be worth between USD 625 million and USD 664 million each year (Choesin et al., 2021).

In Papua New Guinea, one study estimated the (national) value of soil erosion prevention services derived from its coastal mangroves to be USD 314,186,860 (Chaiechi et al., 2011).

The Arafura and Timor Seas themselves also perform critical carbon sequestration roles; globally, the oceans act as carbon sinks, absorbing roughly a third of human-produced emissions (NOAA, 2022).

3.3.7 Financing the Blue Economy

The Blue Economy concept has brought new financing opportunities to ATS countries over the past decade, particularly for Indonesia, Papua New Guinea, and Timor-Leste. The field of ‘blue finance’ is a fast-evolving space that blends public and private fund sources and mechanisms, and brings together diverse approaches including climate, infrastructure, investment capital and sustainable development.

The IUCN-managed Blue Natural Capital Financing Facility (BNCFF) is supporting the management of Forest Carbon in Indonesia project, protecting 18,000 hectares of mangrove forests (ROCA, 2021).

Globally, the World Bank’s oceans portfolio is worth over USD 9 billion currently, and includes investments in fisheries, pollution reduction, sustainable maritime industries and marine energy. In 2018 it created the PROBLUE multi-donor trust fund to support countries to ‘chart a course towards a Blue Economy Approach’. In the ATS, the program has supported Indonesia’s Sustainable Oceans Program, an integrated approach to sustainable use of marine and coastal resources.

The Asian Development Bank (ADB) supports various aspects of the Blue Economy, including collaboration on “South-South and Triangular Collaboration” on the reduction of marine plastics debris in Indonesia and throughout ASEAN.

UNDP supports the blue economy in the ATS. In Papua New Guinea, UNDP supported the formation of a Blue Economy Enterprise Incubation Facility, which is providing capital and early-stage support for enterprise development in coastal communities. The Facility is supported by the Global Fund for Coral Reefs (GFCR), a blended finance instrument providing grants and capital in support of ‘reef-positive’ interventions. In Timor-Leste, UNDP has supported government to create its first Blue Economy Financing Roadmap, a strategic document that explores finance for sustainable blue growth, within its broader Integrated Financing Framework.

3.5 Marine Protected Areas (MPAs)

The use of Marine Protected Areas (MPAs) is one strategy to safeguard the continued supply of ecosystem services within the blue economy context; MPAs can help to ensure healthy ecosystem function in the face of threatening processes acting more broadly within a system.

They may have multiple objectives, including the protection of representative areas and biodiversity values, or the sustained provision of ecosystem services to communities.

In relation to the transboundary issues identified in this TDA, MPAs may act to protect ecological values within area boundaries from threatening processes including fisheries, industrial activities or land-based impacts, while securing important genetic reserves and providing ‘spill-over’ of individual organisms beyond area boundaries, benefiting ecosystems more broadly.

Table 12 and Figure 13 summarise the status of MPA establishment in the ATS. Across the ATS there are currently 86 MPAs in place, with a further seven proposed and 20 areas of interest (Aoi) identified that may present opportunities for new MPAs. These proposed and Aoi sites are outlined in the ATSEA-2 [Roadmap for the Establishment of New Marine Protected Areas in Arafura and Timor Seas](#).

Table 12 – Existing and proposed marine protected areas (MPAs) in the ATS

Country	Existing MPAs*	Proposed MPAs	Aoi	Unprotected*	Total km ² *
Australia	249,802.10	-	1,489.58	749,610.34	1,000,902.02
Indonesia	11,674.79	6,180.62	8,151.50	542,013.21	568,020.12
Papua New Guinea	806.39	-	-	22,629.68	23,436.07
Timor-Leste	935.23	83.17	4,971.98	70,808.82	76,799.20
Total	263,218.51	6,263.79	14,613.06	1,385,062.05	1,669,157.41

Source: Fajariyanto et al. (2021); *Updated from Fajariyanto et al. (2021)

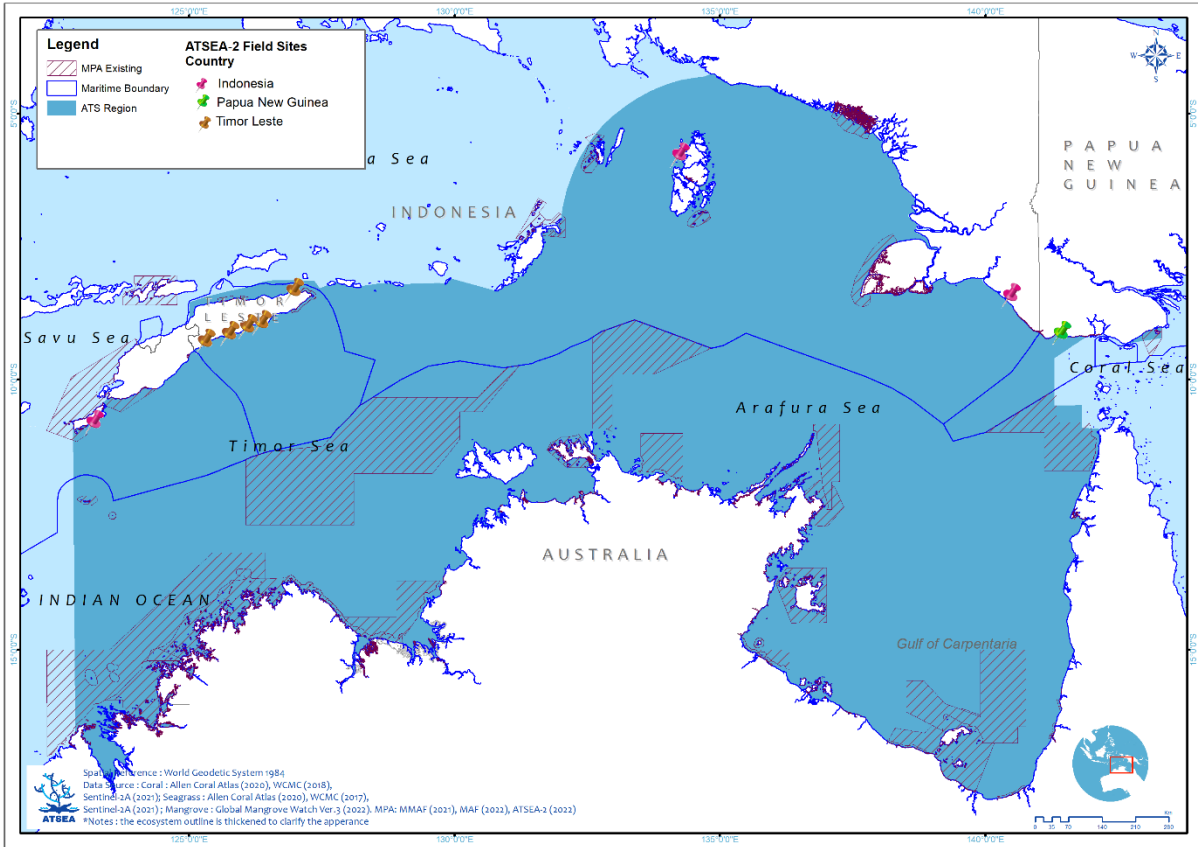


Figure 13 – Existing MPAs in the ATS region (ATSEA-2, 2021)

In addition to this, ATS countries have broader aspirations in relation to expansion of MPA networks. In its 2050 Vision, Papua New Guinea has committed to establish at least one million hectares of marine protected areas. Australia committed to ‘30x30’, although this would not require an expansion of area under MPA coverage.

With revised protected area ambitions to be set by the Post-2020 Global Biodiversity Framework on Biological Diversity in the near future, it is expected that each country will formally commit to higher levels of ambition. It may also be expected that the role of ‘other effective site-based conservation measures’ (OECMs) will be elevated in the new CBD targets; this will enable the inclusion of different types of conservation sites towards national targets, including indigenous or traditionally managed areas, fisheries exclusion zones, conserved water catchment areas, locally managed marine areas (LMMAs) and conservation on private property and traditional or sacred sites.

Priority Transboundary Issues



Chapter 4

4.1 Introduction to Priority Transboundary Issues

The RWG adopted the following definition of Transboundary Environmental Issue, as adapted from GEF/IW:

An environmental issue (or ‘problem’) originating in, or contributed to by one or more countries and affecting (impacting) one or more other countries.

4.2 Summary of Priority Transboundary Issues

Table 13 presents the three priority transboundary issues selected for development under this TDA: pollution of marine and coastal environment, ecosystem, habitat and biodiversity decline, and unsustainable capture fisheries.

Beneath the three key issues are a number of subordinate issues, hereby referred to as ‘fundamental concerns’. These subordinate issues are more specific in nature, in terms of their source (e.g., the sector from which they derive, or their main ‘drivers’), or the types of impacts they generate. These fundamental concerns are intended to support SAP planning by focusing on coherent issues. For each of the fundamental concerns, key causal factors are presented in summary form; these are further elaborated in the Causal Chain Analysis results presented for each issue in Section 4.

Table 13 – Summary of priority transboundary issues, fundamental concerns, and key causal factors

ATS Transboundary Issue	Fundamental concerns ('sub-issues')	Key causal factors (primary cause)
Issue #1: Pollution of marine and coastal environment	1.1 Oil spills	Accidental/operational discharge of crude oil from offshore platforms and wells, tankers and pipelines. Inputs from other maritime industries (e.g., shipping, fishing)
	1.2 Harmful marine debris including plastic pollution	Debris entering from land or marine sources from within or beyond ATS region
	1.3 Abandoned, lost and discarded fishing gear (ALDFG)	Gears (including trawl and gillnets) abandoned, lost and discarded in marine environment
	1.4 Land-based pollution and sedimentation	Sedimentation, nutrients, land-based contaminants
Issue #2: Ecosystem, habitat and biodiversity decline	2.1 Climate impacts on ecosystems, ecological communities and critical habitats	Increased sea-surface temperature, sea level rise, ocean acidification, altered oceanographic and climatic conditions

	2.2 Declining populations of endangered, threatened, and protected (ETP) species	Fisheries bycatch, unsustainable harvesting, habitat loss, impacts from maritime industries
	2.3 Deterioration of critical habitats, ecosystems and communities resulting from anthropogenic causes	Adverse impacts from maritime industries, coastal development, land-use on habitats
Issue #3: Unsustainable capture fisheries	3.1 Unsustainable harvest levels (overfishing)	Exploitation of target stocks beyond ecological limits
	3.2 Illegal, unreported and unregulated (IUU) fishing	Overexploitation of resources, inequitable distribution of resources
	3.3 Fisheries bycatch	Unselective fishing practices and gears
	3.4 Fisheries impacts on habitats	Unsustainable fishing practices and gears

In addition to the proposed framework above, the RWG proposed inclusion of the following additional points:

- As noted in Section 2.3, the RWG decided to treat climate change as a cross-cutting concern, noting its strong relevance to each of the priority issues and many of the fundamental concerns included above.
- It was noted by the RWG that the socio-economic impacts of transboundary issues may be disproportionately experienced by women, and that women may disproportionately shoulder the burden of responding to transboundary issues. While technically an ‘impact’ and not an issue, the RWG agreed that it should be treated as a cross-cutting concern in SAP discussions.
- Governance frequently emerged during prioritisation discussions as a driver of transboundary environmental issues (i.e., poor governance) and as an enabling factor (relevant to SAP).

Each of the three agreed transboundary issues above is elaborated in Sections 4.4, 4.5 and 4.6.

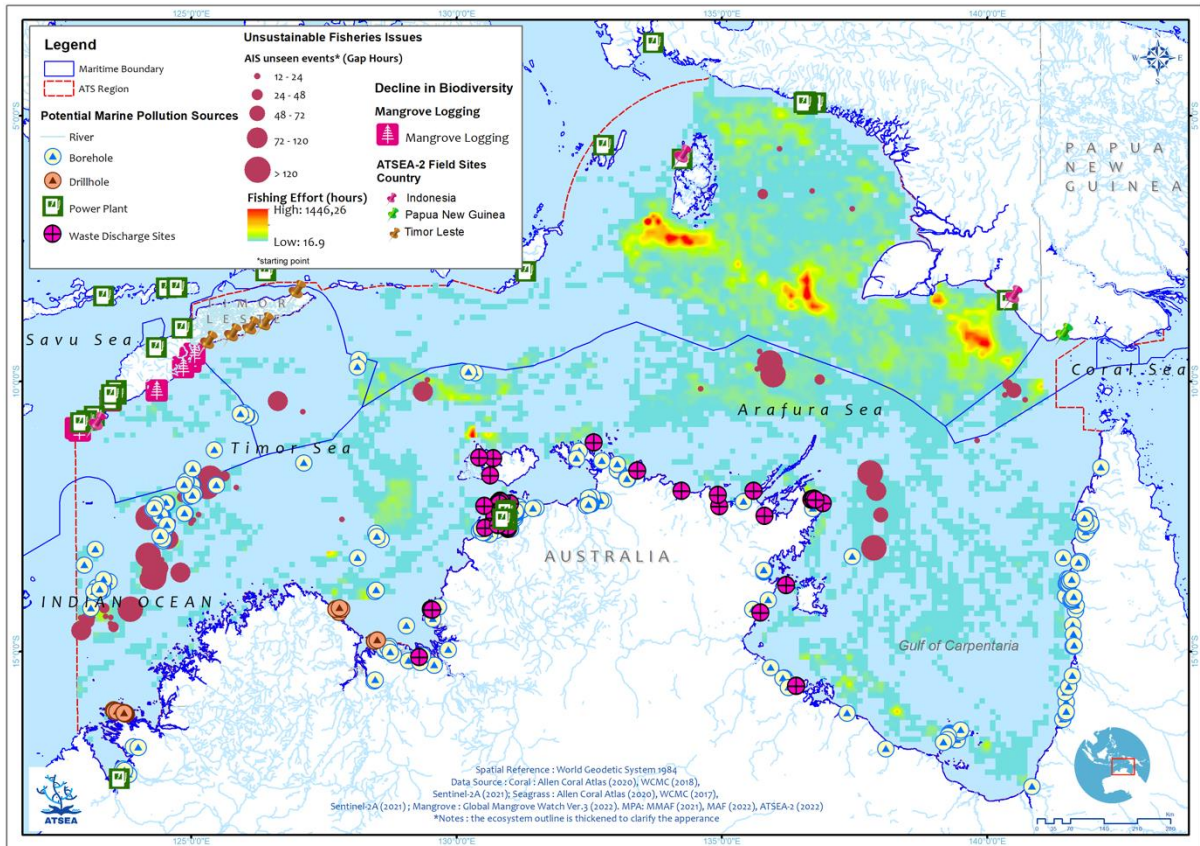


Figure 14 – Map showing ATS priority transboundary issues in relation to maritime jurisdictional boundaries

Source Data: Fishing Effort, Global Fishing Watch (2021) and automatic identification system (AIS) disabling events (Welch et al., 2022).

Notes on data sources:

Fishing Effort: This dataset contains the Global Fishing Watch AIS-based fishing effort and vessel presence datasets for 2012-2020.

AIS unseen event: This dataset includes data on suspected AIS disabling events by commercial fishing vessels between 2017-2019 and extracted from the 2022 publication in Science Advances titled "Hotspots of unseen fishing vessels" by Welch et al., (2022). AIS disabling events are restricted to waters greater than 50 nautical miles from shore with sufficient satellite AIS reception. The data that is shown, is the starting point and how long they turn off the AIS (hours).

4.3 Key changes since 2011 TDA

Table 14 below includes the headline groupings of Priority Transboundary Issues identified in the initial ATS TDA of 2011, and the revision process of 2022. The 2011 TDA was designed around five agreed priority issues (or groups of issues), whereas the 2022 update sees this number reduced to three.

Table 14 – Comparison of Priority Transboundary Issues identified in 2011 and 2022

Priority Transboundary Issues: ATS Transboundary Diagnostic Analysis, 2011	Priority Transboundary Issues: ATS Transboundary Diagnostic Analysis, 2022 (draft)
<ul style="list-style-type: none"> - Unsustainable fisheries and decline and loss of living coastal and marine resources - Modification, degradation and loss of marine and coastal habitats - Marine and land-based pollution (e.g., marine debris, sediments, oil spills) - Decline and loss of biodiversity and key marine species - Impacts of climate change 	<ul style="list-style-type: none"> - Unsustainable capture fisheries - Ecosystem, habitat and biodiversity decline - Pollution of marine and coastal ecosystems

Within this revised framework are the following key changes:

- The 2011 fishery-related ‘Unsustainable fisheries and decline and loss of living coastal and marine resources’ priority issue has been simplified; (2022) Unsustainable fisheries priority issue now only considers fisheries-related issues, while previous issues related to loss of living coastal and marine resources are now considered in (2022) ‘Ecosystem, habitat and biodiversity decline’.
- The 2011 TDA prioritised the impacts of climate change as a stand-alone issue. The 2022 Regional Working Group process considered climate change a cross-cutting issue, and a root cause of all three issues identified in 2022. This decision is strongly supported by GEF/IW technical guidance, which sees climate change impacts as drivers of many issues at the ecosystem or species level, rather than a transboundary environmental issue in its own right.
- There was little change to the marine and land-based pollution issue identified in 2011; all key elements of the 2011 issue designation remain intact within the 2022 revision.
- Earlier issues of ‘Modification, degradation and loss of marine and coastal habitats’ and ‘Decline and loss of biodiversity and key marine species’ are essentially combined in the 2022 Issues analysis (partly on the basis that they are driven by many of the same indirect and direct drivers).

4.4 Transboundary Issue 1 - Pollution of marine and coastal environments

4.4.1 Description of the problem and its transboundary importance

Regional Assessment on Land and Marine-based Pollution in the ATS region by Dr. Won-Tae Shin (Shin, 2021) highlighted region-wide pollution concerns including oil spill and marine debris, and localized concerns including nutrients, sedimentation from mining, and toxic substances from agricultural activities. Shin notes that the two most serious driving forces of pollution issues in the ATS region are vessels (including those associated with capture fisheries), and oil extraction.

As mapped by the RWG, the ATS priority issue ‘pollution of marine and coastal environments’ consists of the following four fundamental concerns:

#1.1: Oil spills

#1.2: Harmful marine debris including plastic pollution

#1.3 Abandoned, lost and discarded fishing gear (ALDFG)

#1.4: Land-based pollution and sedimentation

Fundamental concern #1.1: Oil spills and related pollution

The ATS is rich in gas and oil reserves, which have the potential to provide high value to the communities of the ATS (Yonvitner et al., 2022). However, the sector carries intrinsic risks; accidental discharge or loss of crude oil from offshore platforms and wells, tankers and pipelines may result in significant environmental impacts. There is precedence for this in the ATS region; the 2009 Montara oil leak in the Timor Sea resulted in environmental damage, economic losses and adverse impacts for communities. Shin (2021) notes several oil spill ‘hotspots’ in the ATS region; primarily the area formally known as the Joint Petroleum Development Area (JPDA), as well as the Ashmore and Cartier Islands Adjacent Area; and for ‘practical purposes, it is necessary to identify the entire Timor Sea as the oil spill hotspot for the ATS Region’. Modelling of spill scenarios from these hotspots demonstrates the transboundary nature of this risk; a spill modelled in the Timor Sea demonstrated the potential to impact the southern coast of Timor and Rote Islands.

Fundamental concern #1.2: Harmful marine debris including plastic pollution

The landmark Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) Global Assessment Report on Biodiversity and Ecosystem Services found that globally, plastic pollution had increased tenfold since 1980 (IPBES, 2019). Within this context, marine debris is an emerging global issue; for the ATS region. The most significant types of marine debris include floating debris (mostly plastics originated from both land-based and marine sources) and deposited debris, including derelict fishing gears (see fundamental concern #1.3, ALDFG). Shoreline debris hotspots identified for the ATS include Rote Ndao, and the south coast of Timor-Leste. (Shin, 2021). The direct drivers include the ‘direct action’ of polluting, including purposeful or accidental discarding of fishing nets and other gears at sea, the dispersal of solid or plastic wastes from port facilities, coastal communities or land-based refuse dumps, and coastal watersheds. Indirect drivers may include inadequate coastal sanitation infrastructure or waste disposal facilities in port facilities, and the legality of certain operations-related discharge of waste (e.g., by shipping industry).

Fundamental concern #1.3: Abandoned, lost and discarded fishing gear (ALDFG)

Related to the problems associated with marine debris above is the incidence of ‘abandoned, lost and discarded fishing gear’ (ALDFG). Commonly referred to as ‘ghost-fishing’ (by ‘ghost gears’ or

‘ghost nets’) the issue relates to the ongoing catch of marine life by discarded or lost gears, most commonly trawl gears, and to a lesser extent, gillnets. ALDFG represents a significant threat to certain groups of marine species, including sea turtles. Arafura Timor Sea is recognised as a global hotspot for ALDFG (Edyvane and Penny, 2017), and the transboundary nature of the problem relates to the origin of ALDFG inputs into the ATS system. In Australian waters, there is evidence that ALDFG from the region has continued to amass in the Gulf of Carpentaria over the past decade (Hardesty et al., 2021); this is despite reductions in IUU and trawl fishing in the region over that time.

Fundamental concern #1.4: Land-based pollution and sedimentation

A fourth fundamental concern relates to those sources of pollution originating on land, which are often associated with agriculture, forestry, industrial or mining sectors, and in developing countries may be exacerbated by development and land-use intensification in the coastal zone. The first TDA (2011) noted that coastal development in the region had increased sediment runoff into the ocean, along with land degradation and toxic waste from mining projects. The impacts of land-based pollution tend to be localised in nature, and solutions are more likely to be at national or sub-national level. However, the cumulative impacts on critical ecosystems and habitats in the region such as mangroves, seagrasses and coral reefs may be a transboundary concern, especially when considered alongside other drivers of decline. There is some evidence of transboundary pollution of Torres Strait waters from mining operations originating inside Papua New Guinea but outside the bounds of ATS; at present, these impacts appear to be slow-acting and currently at low levels (Wolanski et al., 2021, Apte et al., 2019).

4.4.2 Progress in Addressing the problem since 2011

- In relation to oil spills, a significant event was the settlement of the Australia-Timor-Leste maritime boundary, through the 6 March 2018 ‘Maritime Boundary Treaty’, which clarifies ownership rights of oil and gas fields in the Timor Sea. This may result in the accelerated development of new petroleum resources (Shin, 2021).
- In May 2022, the National Directorate of Maritime Transport of Timor-Leste with support from the Global Initiative for Southeast Asia (GISEA) conducted a national OPRC workshop, to raise awareness on the ratification and implementation of OPRC 1990.
- In 2021, Timor-Leste joined the global marine debris project IMO/FAO/Norad GloLitter Partnership Project as one of the 20 partnering countries. This project aims to build national awareness of marine debris issues.
- Creation of the Plastics Upcycling Alliance in Timor-Leste (USAID, 2022).
- Plastic bag and single-use plastic bans in Australia; Northern Territory (2022), QLD (2018) and Western Australia (2019).
- Banning of single-use non-biodegradable plastic shopping bags in Papua New Guinea (2020).
- Banning of single-use plastic bags in Timor-Leste (2021).
- Support local investments to reduce import of plastic (TRADEINVEST) – Timor-Leste.
- Parliament resolution no. 10/2022 ratify for accession to international convention for prevention of pollution from ships 1973-1978 (MARPOL) and protocol 1997 (Timor-Leste).

- Indonesia ban on trawl and seine gears was enacted 2015-2021 by Ministerial Regulation (Peraturan Menteri KP No. 2 Tahun 2015 Tentang Larangan Penggunaan Alat Penangkapan Ikan Pukat Hela dan Pukat Tarik). Based on new regulation - **Ministerial Decree #18/2021** these gears were allowed to resume operation under tighter controls achieved by increasing gear selectivity, capacity and fishing ground restrictions.
- Indonesia **Presidential Decree No.83/2018 on** Marine Debris Handling (Plan of Action on Marine Plastic Debris 2018–2025).
- Indonesia **Minister of Marine Affairs and Fisheries Regulation No. 26/2021** concerning Prevention, Rehabilitation, and Improvement of Fisheries Resources and Environment.
- Indonesia **28/2021** concerning the Implementation of Marine Spatial Planning.
- Indonesia **Minister of Marine Affairs and Fisheries Regulation No. 28/2020 concerning** Dispute Settlement Procedures in the Management of Coastal Zone and Small Islands.
- **Presidential Decree No. 27/2021** on Business Process in the Maritime and Fisheries Sector, including a mandate to prevent the occurrence of ownerless / unmarked nets.
- Parks Australia Ghost Nets Initiative- Indigenous Rangers Coastal Clean-ups Program (IRCCP); the IRCCP funds Indigenous Rangers to undertake ghost net and marine debris monitoring, collection, and disposal in northern Australia.
- National Plastics Plan (2021) Australia – defines Australia’s approach to reducing impact of plastic on the environment, including a proposed partnership with Indonesia on a Systemic Innovation Lab on Marine Plastic Waste (CSIRO/MMAF).
- Threat Abatement Plan for the impacts of marine debris on the vertebrate wildlife of Australia’s coasts and oceans (Australia, 2022).

4.4.3 Emerging problems

Generally, significant changes observed by RWG members since the first TDA was conducted in 2011 include the expansion of some land-based activities in eastern Indonesia including oil palm plantations, further oil/gas exploration activities in Arafura and Timor Seas (including seismic testing), and an increase in issues related to sewage and sanitation in coastal settlements. The growth of tourism in ATS coastal communities in recent decades may have exacerbated some aspects of the problem, including land-based plastic waste and sanitation issues in coastal settlements.

In relation to oil spills, resources at the Buffalo and Greater Sunrise Oil Field are currently under development, with Sunrise being developed under an Australia-Timor-Leste joint venture; these new developments may present an emerging risk for the region.

Technologies and processes for seabed mining have developed rapidly in the past decade and may represent a new threat to some benthic habitats in the ATS; more information is required to understand this threat.

4.4.4 Causal Chain Analysis, including causes and impacts

Table 15 highlights the root causes, indirect drivers, direct drivers, and impacts of this issue.

Table 15 – Causal chain analysis of Priority Transboundary Issue #1: Pollution of marine and coastal environments

Priority Transboundary Issue: #1. Pollution of marine and coastal environments				
>	>	>	>	>
ROOT CAUSES	INDIRECT DRIVERS	DIRECT DRIVERS	ECOLOGICAL IMPACTS	SOCIO-ECONOMIC IMPACTS
Global demand for seafood	Inadequate waste disposal facilities at port and in coastal communities	Discarding of fishing nets and other gears at sea or Abandoned, Lost or Discarded Fishing Gears (ALDFG)	'Ghost fishing' leading to mortality of vulnerable species including Green turtle.	Reduced consumer confidence in seafood product
Inadequate regulatory mechanisms	Lack of capacity and mechanisms for pollution monitoring and reporting	Plastic and other marine debris originating from port facilities, or disposal from vessels	Accumulation of gears on reef structures	Reduced income from coastal tourism
Global demand for shipping			Altered marine and coastal food webs	Human health impacts of bioaccumulation in consumed fish
			Impact on ETPs; leatherback consuming plastic waste, entanglement impacts on cetaceans, seabirds	Reduced income from coastal tourism
	SECTORS: Fisheries, Shipping/Transport	SECTORS: Fisheries, Shipping/Transport	Ingestion of micro-plastics by marine organisms	
	Legal and illegal operations-related discharge of waste (e.g., by shipping industry)	Inappropriate discarding of fuels and oils at sea	'Oiling' impacts on marine and coastal ecosystems and organisms	Impact on seaweed and mariculture businesses
	Poor law enforcement of environmental laws and regulations	Accidental discharge of oil from rigs, shipping and infrastructure (oil spill)	Introduction of exotic and invasive species	Impact on capture fisheries
		Produced water entering marine environment from gas/oil extractive industries		Cost of managing impacts / removal of exotic species
		Ballast water discharge		
		Hull biofouling		
	SECTORS: Oil and gas, Shipping/Transport	SECTORS: Fisheries, Shipping/Transport		
Population growth in the ATS region	Inadequate coastal sanitation infrastructure	Direct dumping of household waste in coastal communities	Declines in coastal ecosystems including coral reefs, mangroves and seagrasses	Reduced income from coastal livelihoods
Tourism growth in the ATS region	Inadequate waste facilities in tourism areas	Sewage discharge in coastal zone	Reduced carbon storage and sequestration	Aesthetic impacts of plastic waste
Lack of knowledge or education of marine resources		Plastic waste and sanitation issues related to tourism sector	Impact on fish populations	Marine tourism impacted Reef fisheries decline

Natural Disasters Climate change Land use change / intensification	SECTORS: Government, Community, Tourism	SECTORS: Government, Community, Tourism		Carbon sequestration capacity reduced Human health impacts Increased insurance cost Community disruption / relocation
	Poorly regulated commercial-scale agriculture, inadequate EIA outcomes Widespread land-clearing for agricultural concessions Deforestation and forestry activities Unregulated small-scale mining activity Poorly regulated mining concessions Improper discharge of mining waste / tailings SECTORS: Agriculture, Forestry Mining	Erosion in the coastal zone and catchments Sedimentation from river systems Increased nutrient inputs from agricultural sector Pesticide inputs from agricultural sector Direct discharge of heavy metals, toxic chemicals and waste from industrial sources Permitted discharge of mining waste from river system into marine environment SECTORS: Agriculture, Forestry Mining	Water contamination Coral reefs are smothered Mangrove decline Reduced productivity / lower photosynthesis Toxicity (e.g., fish kills) hypoxia harmful algal blooms (HAB) Disruption to marine food chains Impacts on mesophotic reefs Ingestion of micro-plastics	Decline in reef fisheries productivity Food security impacts Loss of coastal protection Reduced income diversity in coastal communities Cost of infrastructure maintenance Reduced income from coastal livelihoods Reduced income from commercial fisheries

Summary of Impacts and Drivers:

The key outputs of causal chain mapping of pollution-related issues by the RWG are summarised in Table 15. Further information on key drivers and impacts is elaborated below:

Fundamental concern #1.1: Oil spills and related pollution

Direct drivers of oil spills and leaks include accidental or operational discharge of crude oil from offshore platforms and wells, and from tankers and pipelines. Indirect drivers may include extreme weather events, accidental operational failures or deliberate breaches of regulation. Potential impacts related to oil spills are issues related to the return of ‘produced water’ from gas and oil extractive industries to the marine environment; these waters may be hyper-saline, contaminated, or heated. The return of heated water may impact coastal ecosystems including seagrasses (Yonvitner et al., 2022). Oil and petroleum products may also leak or spill from non-related maritime industries, such as shipping or fisheries.

Fundamental concern #1.2: Harmful marine debris including plastic pollution

Research at global level estimates that there is already 150million tonnes of plastic in the marine environment (World Economic Forum, 2016). Direct drivers of this issue include the disposal or accidental loss of waste at sea, and the discarding or accidental discharge of plastic and other marine debris originating from port facilities, inappropriate onshore waste facilities, or legal or illegal disposal from vessels. Similar to ALDFG, Indirect drivers may include inadequate infrastructure for waste disposal facilities (e.g., at port facilities).

The ecological impacts of marine debris (particularly non-biodegradable plastic debris) may include the aesthetic impacts of plastic waste on beaches and coastlines, ‘ghost fishing’ of discarded gear (e.g., turtle), specific impacts on seabirds (entanglement, plastic consumption), plastic bag consumption by marine turtles (especially critically endangered Leatherback), the ingestion of microplastic particles by fishes and other animals, or bioaccumulation of toxic substances in animal populations. The socio-economic impacts of this issue can include reduced confidence in maritime industries, reduced share of tourism markets, increased cost of clean-up operations, the risks to human health, and increased navigational and operational risk to maritime traffic.

Fundamental concern #1.3: Abandoned, lost and discarded fishing gear (ALDFG)

Direct drivers of ALDFG include the ‘direct action’ of fishers purposely discarding fishing nets and other gears at sea, or operational reasons contributing to the loss of gears, such as ‘snagging’, or extreme weather events causing gears to become dislodged. Other factors influencing ALDFG include behavioural aspects, such as the level of awareness of crew, and who has the responsibility to pay for lost gear (e.g., skipper or crew, or vessel owner), and operational aspects including trip length, soak time, maintenance frequency, and available on-vessel storage (Richardson et al., 2021). Indirect drivers may include inadequate infrastructure for waste disposal facilities (e.g., at port facilities).

Noted also during causal chain discussions were specific ecological impacts of ALDFG on ETP species, including sea turtles (although these are assessed separately in Priority Issue #2, Section 4.5), and on benthic habitats.

ALDFG may have the impact of causing additional mortality of target and non-target species for extended periods following the loss of gears, commonly referred to as ‘ghost fishing’. This, in turn, undermines consumer confidence in the seafood sector, and can create diplomatic tension, and significant costs associated with clean-up, mitigation and education related to the issue.

Fundamental concern #1.4: Land-based pollution and sedimentation

Drivers of these issues may include the direct discharge (legal or illegal) of chemical pollutants and contaminants from city-based industrial activity; catchment-based discharge of excessive amounts of nutrients, fertilisers, pesticides or increased frequency or intensity of sedimentation plumes originating from agricultural, forestry or disturbed areas, or the permitted or illegal

discharge of wastes from mining operations. Indirect drivers may include a lack of capacity and mechanisms for pollution monitoring and reporting, poor law enforcement of environmental laws and regulations, poorly regulated commercial-scale agriculture, inadequate environmental impact assessment (EIA) frameworks and outcomes, widespread land-clearing for agricultural concessions, deforestation and forestry activities and a general intensification of land-use in some coastal areas.

The impacts of land-based pollution on coastal and marine ecosystems and species can include the ‘smothering’ of coral reefs and seagrasses which can reduce photosynthesis and productivity in these ecosystems, affecting recruitment of species and larval dispersal through the deterioration of coastal nursery habitats. Direct contamination of water can cause mangrove die-offs, or fish kill events. Harmful algal blooms (HABs) may be caused or exacerbated by excessive nutrient loads from coastal catchments. Socio-economic impacts of these issues are broad but include reduced carbon storage and sequestration capacity of blue carbon coastal ecosystems (in turn, exacerbating climate change), the economic effects of direct toxicity on biodiversity (e.g., the cost of fish kills, or mangrove die-off), and aesthetic and human health impacts in coastal settlements. Impacts are more likely to be localised in nature than other pollution issues.

Root causes:

The RWG identified several root causes that contribute to marine pollution issues, including climate change impacts on ecosystems, regional population growth, poverty and food insecurity in the region, growing global demand for seafood products, and natural disasters. Climate change was also identified as a root cause of land-based pollution in particular; related pressures such as long-term changes in climatic conditions (e.g., storm frequency) and coastal processes (e.g., erosion) may exacerbate the impacts of land-based pollution. While many of the direct and indirect drivers summarized in Table 15 are mostly local in nature, most, if not all of these root causes are regional (i.e., transboundary) or global.

4.4.5 Linkages with other transboundary issues

The drivers of marine and coastal pollution are, in effect, also drivers in the declines in critical habitats and biodiversity (outlined in Issue #2), and to unsustainability of fisheries (Issue #3) where sought-after stocks, or their habitats may be adversely affected.

While often coastal in nature, land-based impacts can contribute to broader cumulative and flow-on regional-level (i.e., transboundary) impacts on marine ecosystems and regional populations of species.

4.4.6 Supporting data

Fundamental concern #1.1: Oil spills and related pollution

Figure 15 illustrates the proximity of Timor-Leste’s gas and oil fields from the island of Timor. There is precedence for oil spills in the region; in 2009, the Montara wellhead spill resulted in the

output of an estimated 30,000 barrels that impacted an area up to 90,000km². 15,000 Indonesian seaweed farmers from Rote Ndao and other affected localities successfully mounted a class actions suit which saw the Australia Federal Court order compensation of 252million IDR to the lead plaintiff, with other claims yet to be resolved. A further 7,000 Indonesian fishers claimed that their livelihoods had been reduced as a result of impacts to fish stocks. Costs from the spill continue to accrue, as legal action continues more than a decade later. While difficult to quantify, the costs of clean-ups, subsequent investigations, and the associated diplomatic efforts between Indonesia and Australia are likely to have been significant also. At least one other spill event in the ATS is known to have occurred, in Betano, Manufahi municipality, Timor-Leste (Fonseca et al., 2022).

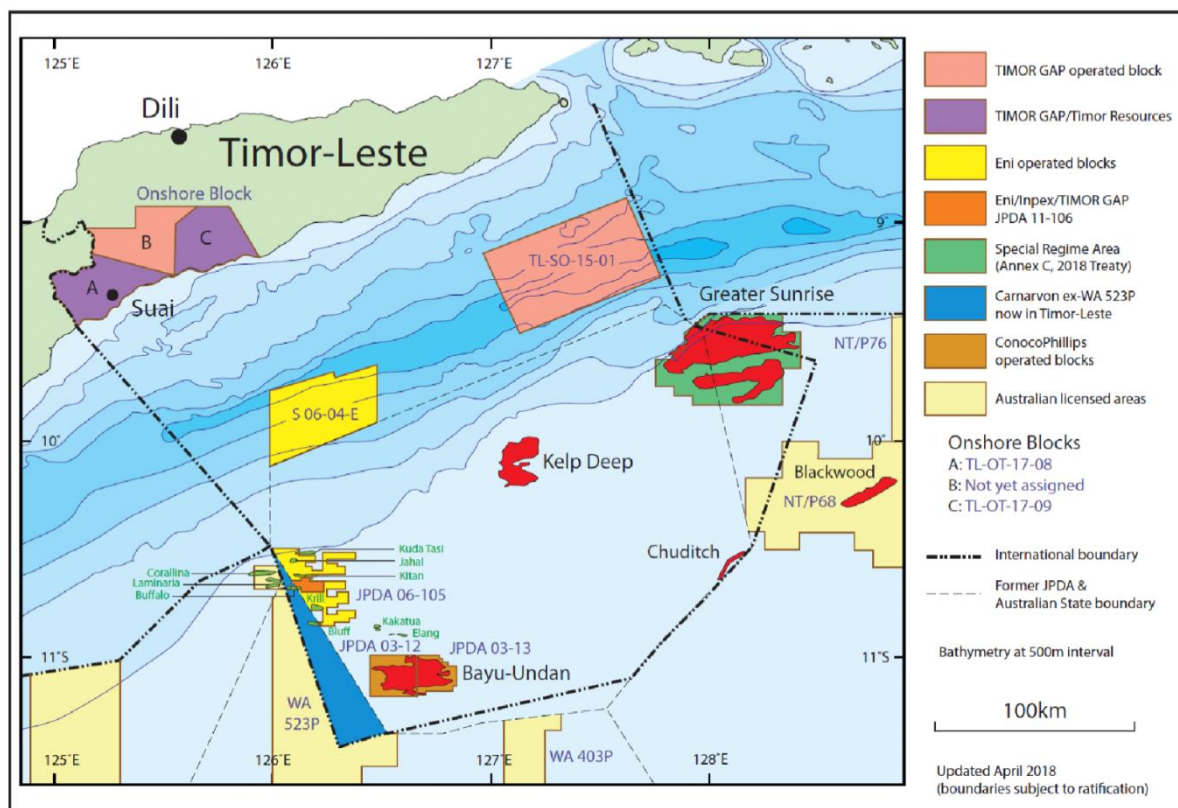


Figure 15 – Timor-Leste Petroleum license areas, 2018. Oil fields shown in green, gas fields in red (Source: Charlton et al., 2018)

In recent independent modelling of oil spills in the ATS (Shin, 2021, Figure 16), one scenario modelled involving a 300 barrel/day spill at Buffalo, for 90 days at different times of the year. Results varied across the year according to prevailing oceanographic conditions, but each scenario demonstrate the potential to impact the southern coast of Timor and Rote Islands. The potential cost of such impacts, as well as mitigation costs (including oil spill preparedness and response) must therefore also be considered alongside upside revenue projections from new gas and oil projects. At 70% of GDP, the sector is the largest single contributor to Timor-Leste’s economy, and these ongoing risks present challenges for Timor-Leste in terms of its management of its EEZ.

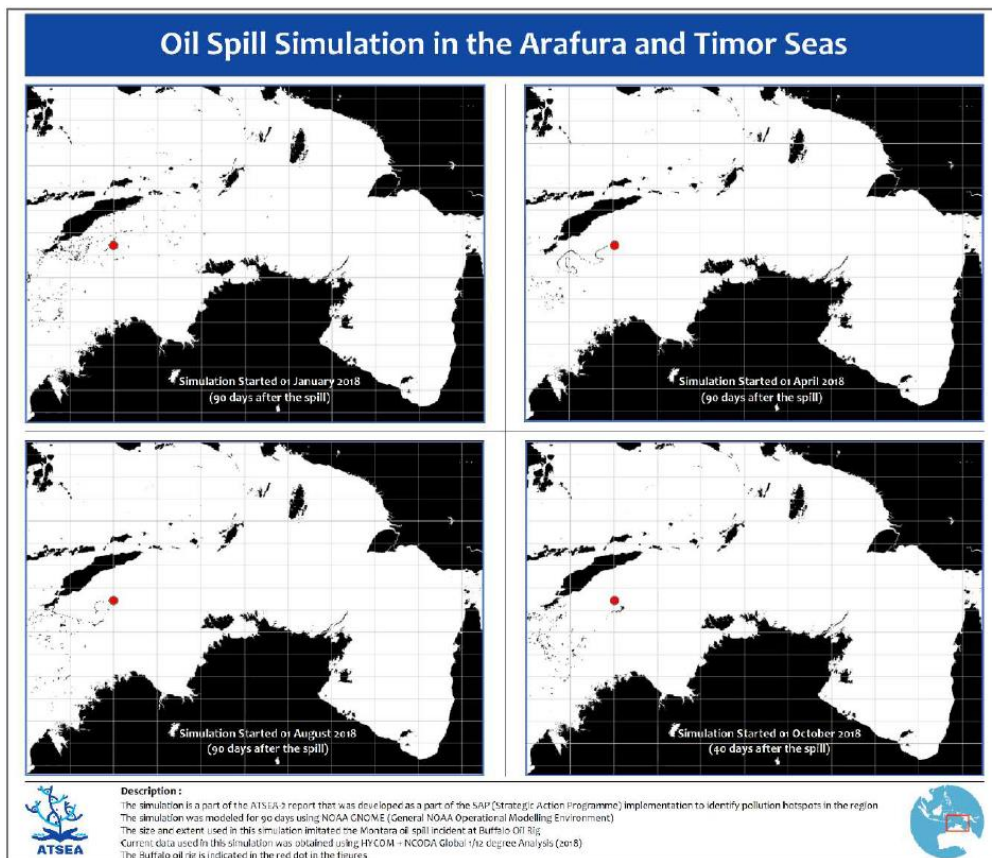


Figure 16 – Oil spill simulation in the ATS (ATSEA, 2022)

Fundamental concern #1.2: Marine debris including plastic pollution

‘Marine debris’ refers to a group of issues that are also variously described as ‘harmful marine debris’, ‘marine litter’, plastic litter, and ‘marine debris including plastic pollution’. Many definitions of marine debris include ALDFG (a type of ‘seafloor debris’), but due to its clearly defined sources in the ATS (as identified in CCA) and the need to facilitate targeted action, ALDFG is treated separately in this study (see ‘fundamental concern #1.3: ALDFG). Microplastics are produced as plastic debris breaks down over time; as these attach to algae, they may be digested by marine animals, interfering with reproductive cycles. (Fonseca, et al., 2022). Studies in Makassar showed microplastics in 29% of individual fish and 55% of fish species sampled in markets (Rochman et al., 2015). The annual global damage of plastics to marine ecosystems is estimated at USD 13 billion, and costs to Asia-Pacific Economic Cooperation (APEC) region estimated at USD 1.3 billion annually (Raynaud 2014, cited by World Bank, 2019). The global context of these issues is further explained in ATSEA-2 Pollution Assessment for the ATS, including commonly encountered sources, and litter pathways (Shin, 2021).

Globally, mismanaged municipal solid waste is considered to be the largest single source of marine debris (World Bank, 2019). Shin (2021) identifies two main types of marine debris; shoreline debris and seafloor debris and notes the difficulties in identifying plastic waste sources, particularly in Indonesia, which may cause challenges in responding to the issue. Indonesia has conducted numerous studies into marine litter; at least 26 research papers were published

between 2014 and 2018. Research in East Nusa Tenggara province reported average marine debris on shoreline transects was between $4.447 \pm 1.131 \text{ kg/m}^2$ and $215.417 \pm 35.609 \text{ item/m}^2$, particularly in Tiang Bendera showing the highest abundance.

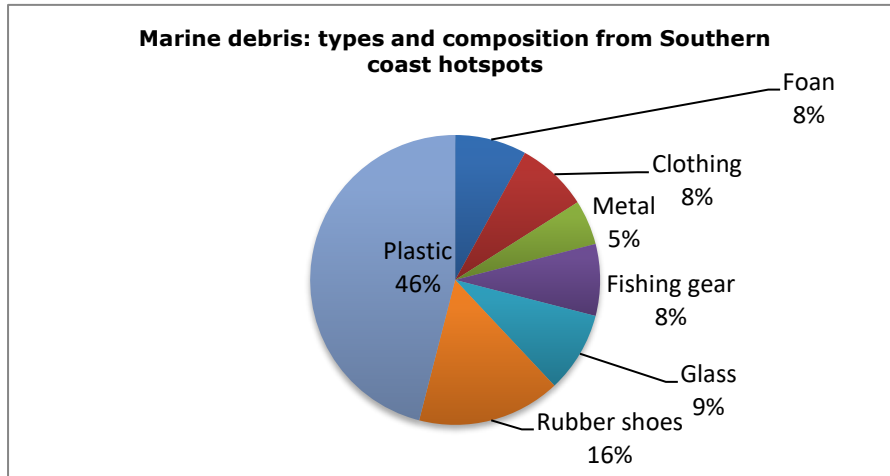


Figure 17 – Composition of marine debris observed on Timor-Leste southern coast (Fonseca and Spiller, 2021)

In Timor-Leste, ATSEA-2 studies showed that marine-based pollution was highest on the Timor Sea-facing south coast (Fonseca and Spiller, 2021) and that plastics constituted almost half of waste encountered (Figure 17). ATSEA-2 identified challenges in identifying hotspots, although it may be safely assumed that marine debris hotspots are located within or around large population centres, and that marine debris originates ‘mostly from localised sources’ (Shin, 2021). Figure 18 shows a simulation of particle dispersal (marine debris transportation) in the ATS, with seasonal influences caused by prevailing current and wind movement.

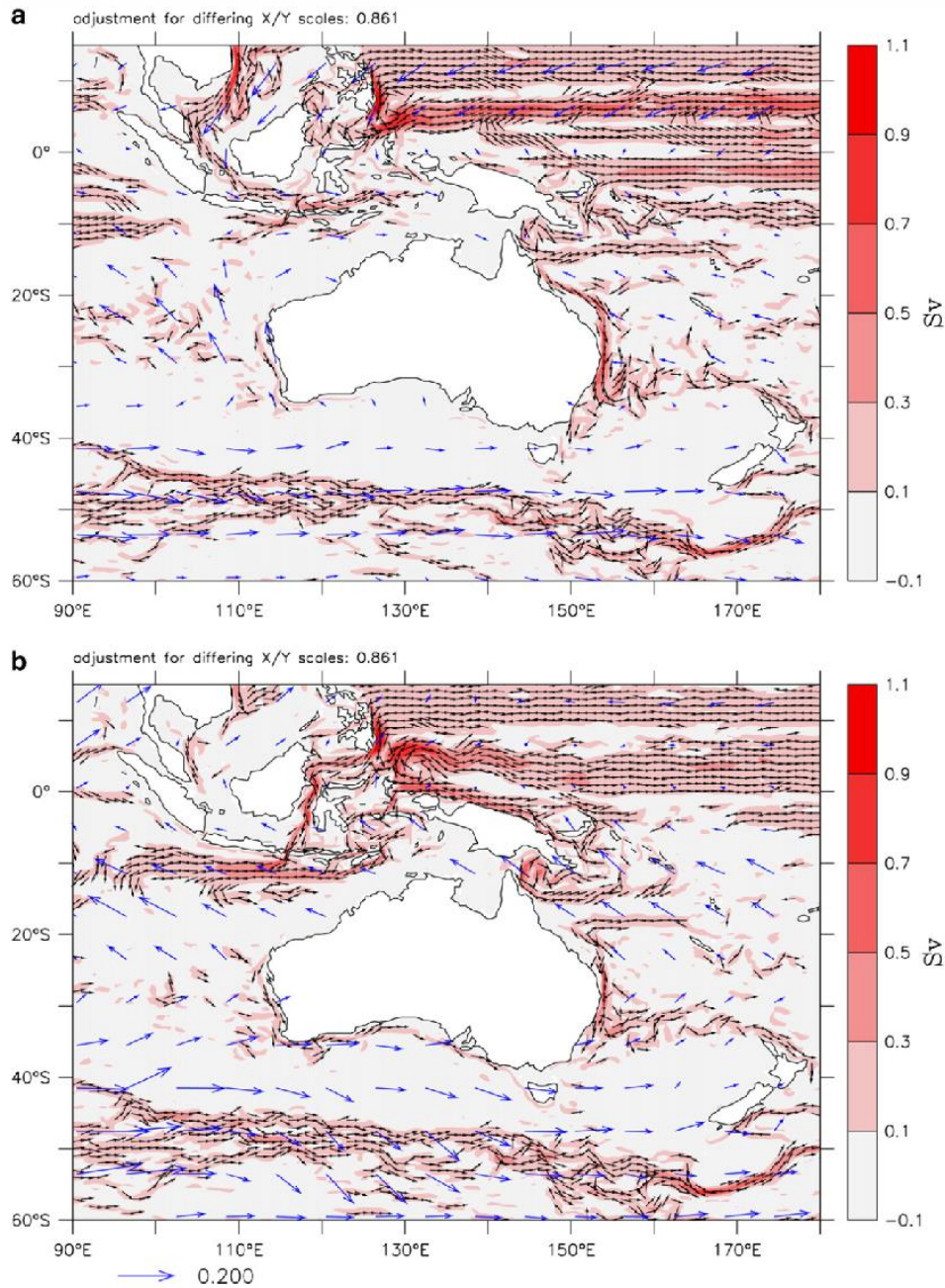


Figure 18 – Volume transport modelling of particle tracking; black arrow showing direction, red showing amplitude, blue showing climatological surface wind stresses; a-January, b-July (Hardesty, et al., 2011)

Australia has prioritised the issue of marine debris in recent years, with several government initiatives launched in 2022, and strong support from community organisations such as Tangaroa Blue over the past decade or two. Hardesty and Wilcox (2011) identified that debris in remote areas (across Australia) tended to be dominated by fishing gear waste and to some extent shipping, while closer to urban areas saw a greater component of consumer items. Marine debris identified during clean-up operations identified the types of waste that have been shown to impact wildlife such as plastic bands from bait boxes.

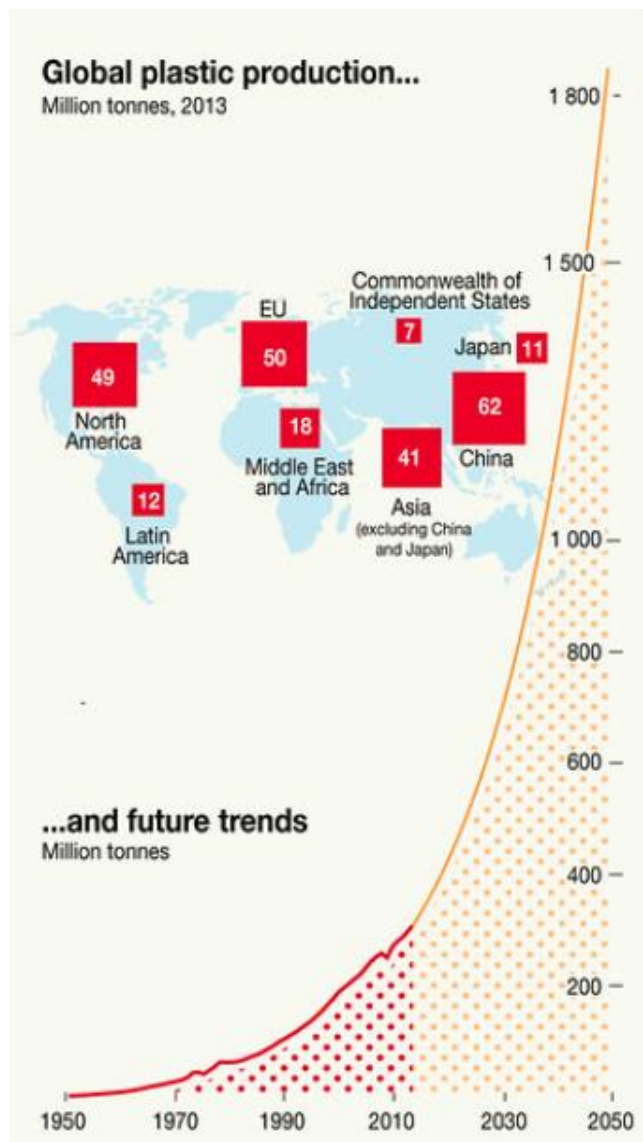


Figure 19 – Global trends in plastic production (GRID, 2018)

Shin (2021) states that it can be said ‘with confidence’ that marine debris is an emerging issue with to a certain degree deteriorating trend in the ATS region. A major concern for the ATS is the projected growth in global plastic production. Figure 19 shows a steep increase in projected production in coming decades, with much in proximity to the ATS. Despite the efforts of ATS governments to institute single-use plastic bans, it should be expected that marine debris inputs will continue to increase for some time.

Fundamental concern #1.3: ALDFG

ALDFG has been identified as an important and ongoing threat to biodiversity in the Arafura and Timor Seas (Wilcox et al., 2015). Northern Australia has among the highest density of ghost nets anywhere in the world. Estimates of total turtle mortality between 2005-2012 in these nets (estimated to be ~9,000 nets) was between 4,866 and 14,600 animals, with species including flatback (9.19%) green (13.8%), hawksbill (32.6%), loggerhead (1.1%) and olive ridley (42.5%) (Wilcox et al., 2015, as cited in Pilcher, 2021). An Australian NGO, GhostNets Australia claims that ALDFGs are ‘devastating endangered marine life’ in Australia, with particular reference to the Gulf of

Carpentaria (Shin, 2021). Edyvane and Penny (2017) observed that the major sources of ALDFG in the ATS in the early 2000s were foreign industrial trawl fisheries (including IUU fisheries) and small-scale fishers targeting shark with gillnets. At that time, 71% of gears recovered were trawl nets, and 12% gillnets.

In 2015, the Indonesian government banned the use of demersal ‘cantrang’ trawl on the basis that it resulted in high levels of bycatch and discard. Trawl fishing was then reinstated under tighter controls in 2021 by Ministerial Decree #18/2021 (Gokkon, 2021). Despite these improvements, Shin (2021) notes that IUU is ‘not eradicated’ and identifies ALDFG hotspots based on fishing activity intensity; with the Aru Sea identified as the highest risk on the basis that it is the most heavily fished site in the ATS. Hardesty et al. (2021) notes that densities in the Gulf of Carpentaria continued to increase over the past 15 years, and that the current input of ALDFG into the system ‘currently overwhelms net removal activities’. Indonesia’s own studies into ALDFG are limited to pilot studies in Java: one study of the spiny lobster fishery in Sadeng estimated 35,000 lost pieces of gear each year, and noted that higher rates of gear loss were observed in the deeper waters of the Indian Ocean where weather conditions were less favourable (Global Ghost Gear Initiative, 2018).

A 2021 study of marine debris conducted in Timor-Leste under the auspices of ATSEA-2 determined that 21% of shoreline debris encountered on the Timor Sea coast was derived from fishing gears (ALDFG). ALDFG encountered included nets and floats, believed to be from both inshore and offshore fisheries. With the domestic fleet entirely inshore, and no offshore vessels licensed at the time of the survey, the study considered that all offshore boats detected (via Global Fishing Watch) were most likely foreign IUU vessels (Fonseca et al., 2022).

A global assessment by Gilman et al. (2021) quantified gear-specific risks and found that mitigating highest risk derelict gear from gillnets, purse seine with fish aggregating devices (FADs) and demersal trawl would achieve maximum conservation gains. Richardson et al. (2021) noted that gear maintenance, followed by crew training were the most effective gear loss prevention measures across five gear types including gillnets, purse seines, trawls, longlines and pots/traps. They also noted other actions including reducing financial and administrative burdens for port (waste) reception facilities, gear-marking, reducing trip length, and targeted education and gear stewardship programs. In Southeast Asia, a number of NGO-led programs have monetised the recovery and recycling of the waste gears, particularly nylon fishing nets; this has provided new revenue streams for poor fishers.

Fundamental concern #1.4: Land-based pollution and sedimentation

Shin (2021) notes that pollution from land-based sources is classified as a ‘localised pollution concern’, and includes nutrients (animal manures) sewage, sedimentation from local mining activities, and toxic substances from agricultural practices. Impacts may be severe at the site of pollution and solutions may be localised in nature.

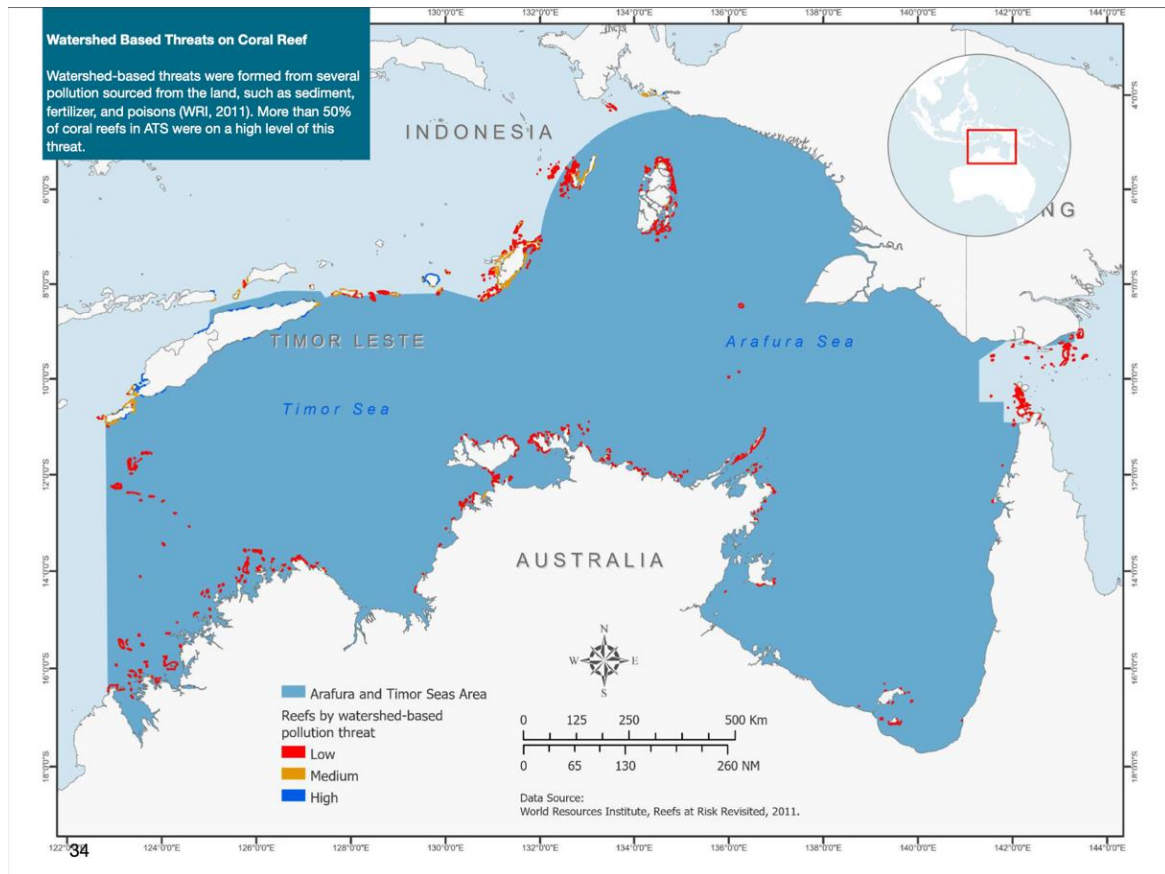


Figure 20 – Watershed threats to coral reefs (ATSEA, 2022)

As shown in Figure 20, ATS Coral reefs and seagrass communities are vulnerable to multiple watershed-borne pressures, including sedimentation (which may reduce photosynthesis), fertilisers inputs and high nutrient loads, unusually high inputs of freshwater, and of toxins derived from multiple sources including agriculture and industry. Related pressures identified in the ATS include untreated animal manures running into coastal areas, and excessive use of chemicals for monocrop plantation; these can lead to eutrophication of coastal waters (Shin, 2021). Eutrophication can contribute to harmful algal blooms (HABs), likely to be localised in nature (i.e., not transboundary) but nonetheless endangering life of humans, wild populations of animals and livestock through the transmission of neurotoxins. ATSEA-2 Country Synthesis Report for Timor-Leste (Fonseca et al., 2022) notes specific risks from HABs, however visual survey did not detect their occurrence in the Timor-Leste southern coast. Sedimentation inputs in coastal river systems may derive from other sources, including agriculture and coastal development (Milliman and Farnsworth, 2011, cited by Fonseca et al., 2022).

In Papua New Guinea, modelling of mud transport dynamics along the southern Papua New Guinea coast was undertaken to assess concerns related to mine-derived polluted mud deposited by the Fly River. While outside ATS boundaries, that study demonstrated an annual westward movement of polluted mud progressively intruding into Torres Strait (i.e., back towards the ATS), with predictions that it may take a century for polluted mud to reach significant quantities in the nearest Australian island, Saibai (Wolanski et al., 2021). CSIRO also notes transboundary concerns related to the transport of metal contaminants into the Torres Strait. CSIRO studies funded under the National Environment Science Program (NESP) Tropical Water Quality (TWQ) Hub conducted

water quality surveys across the Torres Strait and determined that; trace metal concentrations in waters and sediment were highest in the northern Torres Strait, and the most likely source of contaminated sediments was Papua New Guinea, that trace metal concentrations were generally low (and comparable to open ocean waters), and that 85% of community members surveyed identified that muddiness of coastal waters has increased after changes in weather conditions (Apte et al., 2019).

Within Indonesia, animal husbandry activities of the communities of Rote Ndao were identified as a source of land-based pollution, with identified hotspots including Batatua village, and the coastal area of Rote Barat Daya (Shin, 2021 cited by Yonvitner et al., 2022). That study identified fisheries, oil spills, animal husbandry and plantation activities as potential sources of pollution in Rote Ndao.

4.4.7 Knowledge gaps

- Seabed mining
- Impacts of mining on benthic habitats (Papua New Guinea)
- Fine-scale information on sources of plastic pollution

4.4.8 Key references and relevant ATSEA-2 regional assessments

- Marine and Land-based Pollution Assessment in the Arafura and Timor Seas Region (Shin, 2021)
- Marine and Land-based Pollution Assessment on the Southern Coast of Rote Ndao Regency, Indonesia (Shin, 2021)
- Marine Pollution in Timor-Leste: Gaps in Legislation, Regulations, Information and Awareness (Fonseca et al., 2022)
- Marine and Land-based Pollution Study on the Southern Coast of Timor-Leste (Fonseca and Spiller, 2021)
- Oil Spill Response Ltd. (OSRL) for the Arafura and Timor Seas Ecosystem Action Phase 2: ATSEA-2 Regional Exchange Event Summary Report, September 2022

4.4.9 Recommendations to guide SAP update

Possible priorities for consideration in TDA/SAP updating process as suggested by RWG:

- Immediate oil spill preparedness and response actions are needed for Rote and Timor Islands (Shin, 2021)
- Applicable technologies for 3Rs from land and sea-based sources
- Consider bans on single use plastics within the ATS countries
- Amend laws allowing discharge of mine tailings into river systems (Papua New Guinea)
- Establish a regional monitoring program on marine debris, which would also provide a legal and technical basis for future collaboration
- Ratify 'OPRC 1990' for countries which have not done so; Indonesia, Papua New Guinea, Timor-Leste
- Develop a regional platform for oil spill response
- Build national capacity to respond to oil spills and marine debris

4.5 Transboundary issue #2 – Ecosystem, habitat and biodiversity declines

4.5.1 Description of the issue and its transboundary importance

This issue consists of three fundamental concerns that relate to the health of ecosystems and biodiversity in the ATS: climate impacts on ecosystems and critical habitats, declining populations of ETP species, and deterioration of critical ecosystems and habitats from anthropogenic causes.

Fundamental concern #2.1: climate impacts on ecosystems and critical habitats

IPBES (2019) reported that since 1980 greenhouse gas emissions had doubled, which has led global temperatures to increase by at least 0.7 degrees Celsius, and with this, nature has already been impacted from the ecosystem level to the genetic level.

Ecosystems in the ATS have evolved to function within a specific range of climatic conditions (the coping range) and changes to this prevailing range of conditions can influence habitats and the species they support long-term (Johnson et al., 2021). These changing conditions may include increased sea surface temperature (SST), sea level rise (SLR), ocean acidification, altered storm frequency and/or intensity, and changes in rainfall and hydrological cycles on land altering the patterns of sediment and nutrient discharge. In the ATSEA-2 Regional Climate Change Vulnerability Assessment, Johnson et al. (2021) assessed the vulnerability of the region and its ecosystems, habitats and species to climate change, and identifies the sources of vulnerability and possible adaptation actions. The Assessment identifies specific vulnerabilities of key habitats including mangroves, seagrasses and coral reefs. Based on modelled scenarios, mangroves are expected to decline in condition and area in Western Papua New Guinea, Timor-Leste and Indonesia/Arafura, and likely to remain stable in NW Australia. Seagrasses are expected to decline in condition and area in the Gulf of Carpentaria, Indonesia/Arafura, and western Papua New Guinea, decline in area in Timor-Leste, and remain stable in NW Australia. Coral reefs are expected to decline in condition, diversity and area in Timor-Leste, Indonesia/Arafura and Papua New Guinea, and remain stable declining in NW Australia (Johnson et al., 2021).

Fundamental concern #2.2: declining populations of ETP species

The importance of the ATS region for ETP species is clearly established. Fajariyanto et al. (2020) outlines the distribution of key groups of threatened, charismatic and migratory species across the ATS; regionally, the ATS supports six of the world's seven species of marine turtles, 30 species of cetaceans, dugong, numerous elasmobranchs including endangered, and charismatic species (including sawfishes, whale shark, river sharks), and at least 14 seabird species. Threats are numerous and varied but include direct (unsustainable) exploitation for local and commercial use, habitat loss and climate change impacts on habitats, and impacts from fisheries (direct and indirect). Data deficiencies across many species groups presents challenges to conservation managers; for instance, it was not possible to establish population trends for six of the seven sea turtles known to exist in the ATS.

Fundamental concern #2.3: Deterioration of critical ecosystems and habitats resulting from anthropogenic causes

This fundamental concern is concerned with a wide range of anthropogenic threats that serves to reduce ecosystem resilience and function. Aside from issues outlined elsewhere in this document (pollution, climate change and fisheries), other drivers of ecosystem and habitat decline noted in the ATS include cutting of mangrove, the impacts of shipping and maritime industries, the introduction of invasive species (such as snakehead and tilapia in Papua New Guinea coastal wetlands) and the impacts of coastal development on critical coastal ecosystems (including coral reefs, mangroves and seagrasses), the impacts of mining and of coastal industry. These anthropogenic impacts tend to be felt on coastal ecosystems in areas where human habitation and industry prevail.

4.5.2 Progress in Addressing the issue since 2011

Responding to climate change

Addressing the root causes of climate change in order to reduce the risk and severity of climate impacts is not achievable at the ATS level; it will require all industrialised nations to reduce carbon emissions. However, since 2011 the four ATS countries have progressed in terms of increasing decarbonisation ambitions. All four countries are signatories to the 2015 UNFCCC Paris Climate Agreement. Australia's revised October 2021 Nationally Determined Contribution (NDC) adopts a net zero by 2050 target and commits to interim decarbonisation targets and goals around low emission technology. Indonesia's October 2021 NDC commits to 2030 interim emissions reductions targets of 29% (unconditional) and 41% (conditional on international assistance) and pre-empts a '2060 or sooner' net zero ambition. Timor-Leste has approved a National Climate Change Policy and National Adaptation Plan (NAP) and will update its NDC in the near-term. Papua New Guinea updated its NDC in 2020, which sets out an overall target of full carbon neutrality by 2050, with focus on energy carbon neutrality by 2030 and reductions in emissions from deforestation and forest degradation. In 2020, Papua New Guinea also launched a partnership with UNDP to develop its first National Adaptation Plan (NAP).

Climate change adaptation is typically incorporated into national and sub-national development planning across the ATS. Under ATSEA-2, local-level integrated coastal management (ICM) plans were developed for Barique, Timor-Leste and Rote Ndao, Indonesia, based on climate change vulnerability assessments, and incorporating adaptation strategies and nature-based solutions (NBS). In the 'Treaty Villages, Australian and Papua New Guinea governments collaborated on sanitation adaptation through the 'Building Resilience in the Treaty Villages (BRTV) Program. In Timor-Leste, the Green Climate Fund approved a USD 22.4 million six-year project to advance climate change adaptation priorities and strengthen local infrastructure development planning processes at the six at-risk municipalities of Baucau, Ermera, Aileu, Viqueque, Lautem and Liquiça.

Fundamental concern #2.2: declining populations of ETP species

Under ATSEA-2, a Regional Plan of Action (RPOA) for Sea Turtles has been prepared for the ATS region and endorsed by the 3rd Regional Steering Committee (RSC).

Since 2011, the following National Plans of Action (NPOA) have been created for sharks:

- Australia National Plan of Action for the Conservation and Management of Sharks 2012 (Shark-plan 2)
- Papua New Guinea National Plan of Action on Sharks and Rays (2021-2014)
- Indonesia National Plan of Action for Conservation and Management of Sharks and Rays (2016-2020)
- Indonesia Sea Turtle National Action Plan (KepMen KP No. 64 Tahun 2022 Rencana Aksi Nasional Konservasi Penyu Tahun 2022-2024)

Expanded CITES listing of elasmobranch species

Since the first ATS TDA (ATSEA 2012), numerous elasmobranch species have been listed on CITES, and subsequently reflected in various national legislation. Species likely to be relevant to ATS include Mantas (*Manta* spp.), Devil rays (*Mobula* spp.), Thresher sharks (*Alopias* spp.), Hammerheads (*Sphyrna* spp.) and Silky shark (*Charcharhinus falciformis*). Whale shark (*Rhincodon typus*) and sawfishes (*Pristidae* spp.) were listed prior to the first ATS TDA prepared in 2011.

With regard to declining populations of ETP species, Australia reported the following current or recent initiatives in relation to this issue:

- Tapping into the knowledge of professional fishers and management of sawfish and river sharks. Working with professional fishers, this project aims to improve knowledge of Sawfish and River sharks in northern Australia. Fieldwork will include collection of water samples to extract DNA, structured fishing surveys, genetic sampling, and tagging of sawfish encountered.
- NESP Northern Australia Environmental Resources Hub project 3.6: Vulnerability of migratory shorebirds in the Gulf of Carpentaria
- NESP Marine and Coastal Hub Project: Dugong and turtle grazing in the Torres Strait (noting that dugongs and turtles from the Torres Strait migrate in the ATSEA-2 area)
- Vulnerability assessment of marine turtles at greatest risk from climate change
- NESP Marine Biodiversity Hub project A12: Scoping a Seascape Approach to Managing and Recovering Northern Australian Threatened and Migratory Marine Species - with themes such as population connectivity, and marine species distributions
- Support to the recovery of Raine Island turtle and seabird rookery (Although Raine Island is in the Great Barrier Reef and outside the ATSEA-2 area, turtles from Raine Island migrate to the ATSEA-2 area).

Timor-Leste reported the following legislative and policy developments:

- Joint Ministerial Order No 18/ II/2017 (MAF, MTCI): Protection of aquatic animals
- NBSAP 2011-2020
- Program of Work on Protected Areas (PoWPA)
- Decree Law no 6/2004: 21 April

Fundamental concern #2.3: Deterioration of critical ecosystems and habitats resulting from anthropogenic causes

At the regional level, ATSEA-2 has led the Development of MPA Network Design and Roadmap process, endorsed by the 3rd RSC.

With regard to declining critical habitats, Australia reported the following current or recent initiatives in relation to this issue:

- Seagrass monitoring in the Gulf of Carpentaria
- National Environmental Science Program (NESP) Northern Australia Environmental Resources Hub project 1.4: Contribution of rivers to the productivity of floodplains and coastal areas of the southern Gulf of Carpentaria
- NESP Marine and Coastal Hub project 1.13: Synthesizing three decades of seagrass spatial data from Torres Strait and Gulf of Carpentaria

Indonesia reported the following recent initiatives in relation to this issue:

- Establishment of new Kolepom Island MPA as described by Keputusan Menteri Kelautan dan Perikanan No. 5/Tahun 2023 Kawasan Konservasi di Perairan di Wilayah Pulau Kolepom Provinsi Papua Selatan
- With regard to management of introduced and invasive species (IAS), since 2015 the Ministry of Marine Affairs and Fisheries carried out 21 risk analysis studies, issued regulations prohibiting the entry of 152 invasive alien species into Indonesia (Minister of Marine Affairs and Fisheries Regulation Number 19 of 2020 renewal of the Minister of Marine Affairs and Fisheries Regulation Number 14 of 2014), collaborated with the Ministry of Environment and Forestry to control the spread of *Arapaima gigas*, strengthened data and information regarding invasive alien species (IAS) in Indonesia, and conducted assessments of 285 alien species of which 209 were confirmed invasive. Future targets for the management of IAS in Indonesia include strengthening of existing biosecurity measures (including at outermost islands), and identifying and monitoring distribution of IAS species and trafficking and wildlife trade.

4.5.3 Emerging problems

Ocean acidification is already detectable and will continue to accelerate as atmospheric CO₂ increases (Figure 21) and oceans continue to absorb it; CO₂ levels about 500ppm will severely compromise coral viability and impair the survivability of species with calcareous shells, resulting in reduced abundance and trophic impacts (Hobday et al., 2006). Australia Government's threats database notes that acidification is of particular concern for the North Marine Region. Of major concern is the potential impact on coral reefs, and the food security and livelihood implications for ATS communities.

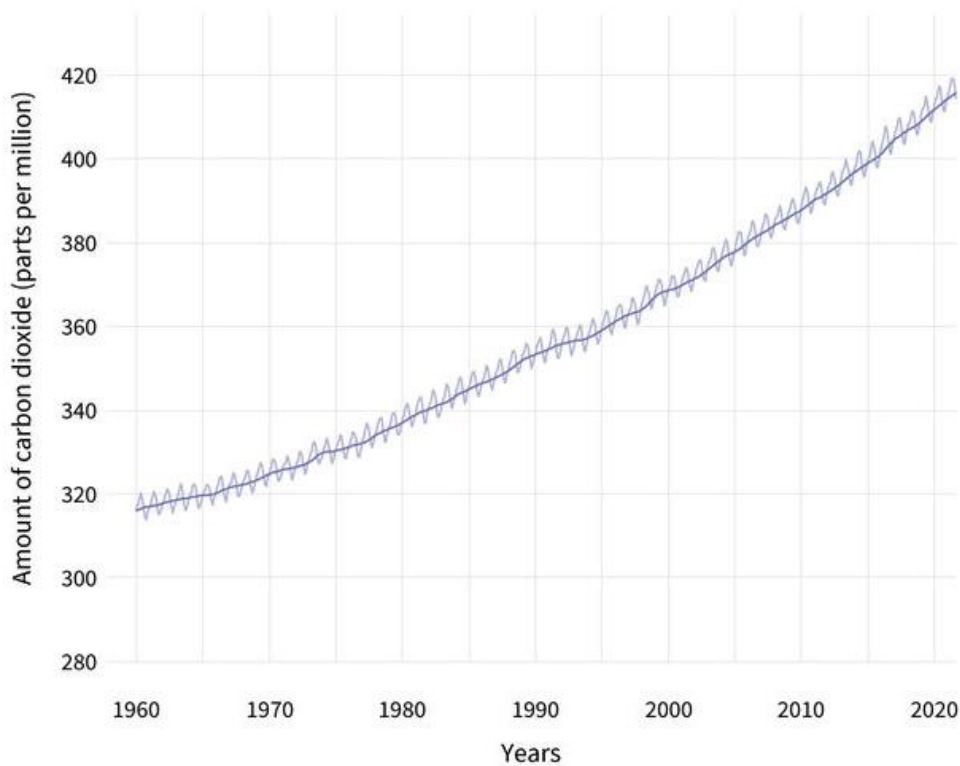


Figure 21 – Atmospheric CO₂, 1960-2021 (NOAA)

4.5.4 Causal Chain Analysis, including causes and impacts

Table 16 highlights the root causes, indirect drivers, direct drivers, and impacts of this issue and its three subordinate fundamental concerns including: Climate impacts on ecosystems, ecological communities and critical habitats; Declining populations of endangered, threatened, and protected (ETP) species; and Deterioration of critical habitats.

Table 16 – Causal chain analysis of Issue #2: Ecosystem, habitat and biodiversity decline

Priority Transboundary Issue: #2. Ecosystem, habitat and biodiversity decline				
>	>	>	>	>
ROOT CAUSES	INDIRECT DRIVERS	DIRECT DRIVERS	ECOLOGICAL IMPACTS	SOCIO-ECONOMIC IMPACTS
Climate change	Ineffective MPA management / Inadequate protection of critical ecosystems	Bleaching of shallow water coral reefs Increased sea surface temp. (SST), acidification, sea level rise, changes to oceanographic conditions Accelerated abrasion/accretion	Loss of critical habitats; mangroves, coral reef, seagrasses Destabilisation of the coastal zone Declines in populations of useful species (e.g., commercially)	Reduced coastal protection/resilience of coastal communities from natural disasters Reduced fishery productivity

		<p>on small island ecosystems</p> <p>Changes in hydrological cycles in small island ecosystems</p> <p>Sedimentation exacerbated by deforestation of catchments</p>	<p>important fish stocks),</p> <p>Reduced carbon sequestration in coastal ‘blue carbon’ ecosystems</p> <p>Climate impacts on ETP species (e.g., changes to sea turtle nesting success due to environmental factors)</p> <p>Altered species distribution (e.g., ‘poleward shift’, new habitats, deeper water, etc.)</p>	<p>Loss of coral reef fisheries livelihoods</p> <p>Loss of fisheries incomes and employment</p> <p>Declines in fish catch / food security</p> <p>Public health and human health issues</p>
	<p>SECTORS: Government</p>	<p>SECTORS: Government</p>		
<p>Poverty and food insecurity in ATS region</p> <p>Lack of livelihood opportunities in coastal communities</p> <p>Global demand for new marine products (including ETPs)</p> <p>Global demand for seafood</p> <p>Global demand for shipping</p>	<p>Poor, ineffective or inconsistent monitoring and enforcement regimes</p> <p>Emerging illegal markets for threatened marine species</p> <p>Well-established regional/cultural trade networks</p> <p>Transboundary market connectivity among ATS countries</p> <p>Organised illegal trade / crime networks</p> <p>Regulatory gaps around use of seismic tests</p> <p>SECTORS: Fisheries, Shipping/Transport</p>	<p>Illegal harvest of ETP species driven by global trade (e.g., shark finning, dugong rib/tusk, poaching of turtles)</p> <p>Traditional / local subsistence harvest of some ETP species (marine mammals, turtles, turtle eggs)</p> <p>Use of seismic testing in gas/oil exploration</p> <p>Accidental capture, or ‘bycatch’ mortality of ETP species in fishing gears (see Issue#3)</p> <p>Unsustainable fisheries)</p> <p>ETP species habitat loss (e.g., development on turtle nesting beaches)</p> <p>SECTORS: Fisheries, Community, Oil and Gas, Shipping and Transport</p>	<p>Altered marine and coastal food webs</p> <p>Declines in local and regional populations of ETP species</p> <p>Disturbances to migratory movements of cetaceans and other highly mobile species</p>	<p>Reduced income from marine and coastal tourism</p> <p>Declines in mariculture productivity</p> <p>Reduced seafood supply / reduced affordability</p> <p>Costs of climate change adaptation</p> <p>Increased cost of managing coastal</p>

Population growth in the ATS region	Gaps in regulation and compliance	Land-based pollution (see Issue #1; Pollution)	Loss of reef building corals	erosion, storm impacts
Tourism growth in ATS	Poor application and regulatory gaps related to EIA	Land clearing, and land-use change in coastal zone	Reduced carbon sequestration in coastal 'blue carbon' ecosystems	Loss of productive land in coastal zone due to salt intrusion
Land use change & intensification in ATS region	Poor or inconsistent governance of marine biosecurity	Cutting of mangroves for fuelwood	Deforestation and degradation of mangroves	Financial burden of managing invasive species
	Deforestation from forestry and agricultural industries	Introduction of invasive species through hull biofouling	New populations of invasive species in ATS region	
	Cultural practices, norms and factors	Introduction of invasive species through improper discharge of ballast water	Loss of seagrass in coastal zone	Impacts to delivery of ecosystem services
	Low education / awareness about conservation status of species, ecosystems	Damage to reefs and seagrasses by shipping and boating accidents, mooring, marina development	Reduced resilience to climate change impacts	
	SECTORS: Government, Community, Agriculture, Forestry, Shipping and Transport	SECTORS: Community, Fisheries, Agriculture, Forestry, Shipping and Transport	Destabilisation of the coastal zone including erosion, vegetation loss and/or increased sedimentation	

Drivers of the transboundary issue

Table 16 illustrates the wide range of direct and indirect drivers that contribute to the issue. In terms of direct drivers, some relate to the unintended, accidental or unregulated impacts of human activity. These include the impacts of shipping and maritime industries, including the introduction of invasive species, and damage to sensitive reefs by shipping and boating activity. Direct drivers of ecosystem and species decline may operate within the ATS region and may be intentional activities (such as the commercial exploitation or subsistence utilization of resources) or unintentional impacts of other economic activities. Drivers may be confined to maritime jurisdictions (such as fishing, or gas exploration using seismic testing), or may be land-based, such as the unintentional discharge of fertilisers, pesticides or nutrients into the marine environment from coastal catchments. Economic drivers of ecosystem and species decline are broad and operate at multiple scales. They may include new illegal markets for threatened marine species, the influence of perverse subsidies (such as in the fishing industry), the persistent presence of regional trade networks, and the transboundary nature of organised crime networks related to the illegal trade of marine species and products.

Indirect drivers include those related to governance, management and compliance issues, such as poor or inconsistent governance of maritime industries and activities including fisheries, the energy sector, marine biosecurity, as well as land-based activities such as mining, agriculture, land-use planning or forestry. Regulatory gaps may be compounded by ineffective law enforcement, monitoring or compliance.

A range of regional socio-economic and cultural drivers impact biodiversity also, including cultural practices, norms and factors such as low levels of awareness about the regional or global conservation status of species, ecosystems, or the lack of livelihood opportunities in coastal communities. The cumulative impact of these indirect and direct drivers should also be considered; alone, a single driver may not represent an existential threat to an ecosystem, ecological community or species, but when considered alongside other drivers, it may. Climate change, for example, is likely to exacerbate most impacts to ecosystems and populations in the ATS, especially where their current status may already be undermined by other factors.

ATS's high vulnerability to climate change may be attributed to low profile coasts, shallow continental shelves and macro-tidal conditions. Climate change is at times both a direct and indirect driver of ecosystem and species decline; accordingly, a sub-group related to its particular impacts on ecosystems emerged from the mapping exercise. Anthropogenic climate change may be considered a direct driver (such as in the case of changes in hydrological cycles) and in some cases an indirect driver, where altered storm frequency may result in altered patterns of abrasion and accretion on small island ecosystems. These ecological impacts, in turn, may have secondary impacts, such as a reduction in beach area due to sea level rise contributing to reduced nesting success for sea turtles. There may also be cascading effects of climate change; thermal stress resulting in bleaching of corals may also indirectly lead to reduced fish productivity on reefs, for example.

The social and economic impacts of climate change are already a major concern for ATS communities. Impacts to the region's ecosystems threaten lives and livelihoods across all littoral countries, but where social vulnerabilities exist, they may be exacerbated. In particular, where gender, poverty, and social exclusion are already being felt due to social or economic determinants, those vulnerable groups may experience disproportionate negative consequences from the impacts of climate change. For example, any pre-existing gender inequalities are expected to worsen, both in terms of the way impacts are felt, and the burden for adapting to them. Such inequities in the system should be considered in the development of responses to the priority transboundary issues.

Impacts on Ecosystem Services

This grouping of issues is where concerns related to the ongoing provision of ecosystem services to the communities of ATS littoral countries may be considered. While we have not used an ecosystem services framework across the entire CCA, by doing so for analysis of Issue #2, it is evident where provisioning, cultural, regulating and supporting ecosystem services may be impacted or compromised. A summary of this is provided in Table 17.

Table 17 – Impacts on ecosystem service types

Ecosystem service type	Impact
Provisioning	Declines in mariculture productivity
	Reduced seafood supply / reduced affordability
	Reduced income from marine and coastal tourism
	Declines in populations of useful species (e.g., commercially important fish stocks)
	Declines in fish catch
	Adverse impacts on fisheries productivity
Cultural	Loss of reef fisheries livelihoods
	Loss of fisheries incomes and employment
	Declines in local and regional populations of ETP species (incl. culturally important species)
Regulating	Reduced carbon sequestration in coastal ‘blue carbon’ ecosystems
	Destabilization of the coastal zone
	Reduced coastal protection/resilience of coastal communities from natural disasters
Supporting	Altered marine and coastal food webs
	Loss of reef building corals
	Loss of critical habitats for ETP species

In relation to climate change, seagrasses and mangroves also provide important regulatory ecosystem services with relation to carbon capture and sequestration; as such, their degradation may also further contribute to climate change by reducing the capacity of these regulatory services.

Root causes

The root causes of Issue #2 may be local, regional or global in nature, and include climate change impacts on ecosystems; increased sea surface temperatures, regional population growth, poverty and food insecurity in the region, and growing global demand for seafood products.

4.5.5 Linkages with other transboundary issue

This group of issues represents a core group of concerns related to overall ecological sustainability of the ATS; whereas issues #1 (pollution) and #3 (fisheries) are considered issues in their own right, they are also drivers of #2 by contributing to declines or adverse changes to ecosystems and species at the regional level.

4.5.6 Supporting data

Fundamental concern: climate impacts on ecosystems and critical habitats

The effects of climate change on coastal ecosystems are already being felt by communities in the ATS, and significant upheaval is expected in coming decades. Sea level rise and coastal inundation in Timor-Leste have resulted in the destruction of infrastructure and homes, the degradation of clean water and associated human wellbeing impacts (Fonseca et al., 2022). Results from an IOM assessment highlight alarming rise of sea levels in Timor-Leste is driving communities from the coastal areas, and away from established fisheries livelihoods; that analysis highlighted 306km of affected coastline likely to be affected (ROCA, 2021). Small, low-lying islands are particularly vulnerable. In the Torres Strait, impacts have been felt for more than a decade; erosion and inundation threaten communities, cultural heritage, infrastructure and water supply, while impacts on marine ecosystems and fisheries have flow-on effects to communities (TSRA, 2008). Further, in March 2019 northern Australia was impacted by two category four cyclones, a phenomenon only recorded twice previously (ROCA, 2021). Indonesia’s unique tectonic settings will create spatial variations in the way sea level rise will impact the country, with land subsidence in combination with sea level rise escalating coastal flood risk (Triana and Wahyudi, 2020). Outside of the ATS, but with significant implications for Indonesia, Jakarta is expected to be impacted severely by rising sea levels and subsidence; construction of protective infrastructure is underway, while the country is in the process of establishing the administrative capital, Nusantara, in East Kalimantan.

With coastal wetlands and estuaries expected to warm and become more eutrophic, and with sea level rise likely to impact coastal processes, it is expected that less suitable area in the coastal zone will be available for mangroves (as they ‘retreat’ landward), and remaining habitats are likely to be more vulnerable to intense storm events, decreased rainfall and reduced environmental flows.

Table 18 – Relative vulnerability of mangroves in ATS region and drivers of vulnerability (Johnson et al., 2021)

ATS Sub-region	Drivers of vulnerability	Expected impact
Western Papua New Guinea	Poor current condition; low species diversity; lack of management	Decline in condition and area
Timor-Leste	Rainfall declines; sea-level rise; low connectivity; limited formal management	Decline in condition and area
Indonesia/Arafura	Sea-level rise; poor current condition	Decline in condition and area
NW Australia and Gulf of Carpentaria	Sea-level rise	Stable

Seagrasses

The results of ATSEA-2 vulnerability assessment (Johnson et al., 2021) shown in Table 19 indicate that seagrasses in the Gulf of Carpentaria, and the Indonesia/Arafura sub-regions are most vulnerable to future climate change, and specifically to increase in Sea Surface Temperature (SST), rainfall changes that are likely to exacerbate land-based impacts such as sedimentation and nutrient run-off, and sea level rise.

Table 19 – Relative vulnerability of seagrass meadows in ATS region and drivers of vulnerability (Johnson, 2021)

ATS Sub-region	Drivers of vulnerability	Expected impact
Gulf of Carpentaria	SST+; historic SST+ exposure; rainfall changes; low species diversity	Decline in condition and area
Indonesia/Arafura	Rainfall increase/coastal runoff; sea-level rise; low connectivity; non-climate pressures	Decline in condition and area
Timor-Leste	SST+; sea-level rise; limited formal management	Decline in area
Western Papua New Guinea	Historic SST+ exposure; rainfall increase/coastal runoff; low diversity; no management	Decline in condition and area
NW Australia	SST+; historic SST+ exposure	Stable

Coral reefs

Table 20 outlines the key drivers of vulnerability of coral reefs across four ATS sub-regions. Poor current condition, sea surface temperature increases, low species diversity, poor management and pollution will all contribute to coral decline in a time of climate change. The expected impact for all sub-regions is declining condition, diversity and coverage, with the exception of NW Australia which is affected by less drivers.

Table 20 – Relative vulnerability of shallow coral reefs in the ATS region and drivers of vulnerability

ATS Sub-region	Drivers of vulnerability	Expected impact
Timor-Leste	Projected SST+; poor current condition; limited formal management	Declining condition, diversity and area
Indonesia/Arafura	Poor current condition; non-climate pressures, particularly pollution	Declining condition, diversity and area
Western Papua New Guinea	Low diversity; lack of management	Declining condition, diversity and area
NW Australia	Projected SST+	Stable to declining

Source: Johnson et al., 2021

Declines in populations of ETP Species

Global trends indicate widespread declines in biodiversity, with over one million plant and animal species now considered endangered (IPBES, 2019). The ATS has been described as a stronghold for marine species on account of its remoteness and relative lack of human disturbance (Alongi, 2011). The region is important for a range of migratory, rare, threatened and endangered species, many of which are listed as protected under national and international laws and conventions. Migratory species probably favour the ATS on account of several oceanic trenches, nutrient upwellings and varied environmental conditions.

Charismatic megafauna includes cetaceans, dugong, elasmobranch species including manta ray, whale shark and sawfishes, reptiles including sea turtles (including the leatherback), estuarine crocodile and sea snakes.

The ATS is home to six species of sea turtles, green turtle (*Chelonia mydas*); hawksbill (*Eretmochelys imbricata*), loggerhead (*Caretta caretta*), leatherback (*Dermochelys coriacea*), olive ridley (*Lepidochelys olivacea*), and flatback turtle (*Natator depressus*); all species are listed as Vulnerable, Endangered or Critically Endangered, and subject to national and international protections. Downward trends in populations have been observed in the leatherback, flatback populations appear to be stable, and deficiencies in data do not allow for observation of population trends for the other five species (Pilcher, 2021).

The ATS is a significant region for marine mammals, with 30 cetaceans and one Sirenia dugong recorded here; despite their relative high profile, marine mammal populations in the ATS are generally not well understood and population estimates, habitat range and level of vulnerability is not known for many of these species. On account of this high mammal diversity, several sites in the ATS are designated Important Marine Mammal Areas (IMMA) including Lesser Sunda Ecoregion, Sahul, the Gulf of Carpentaria and Torres Strait. Broadly, the Nusa Tenggara Timur has the highest incidence of marine cetacean, possibly on account of deep troughs that act as migratory pathways.

The ATS contains important habitats for elasmobranchs, with endangered, threatened and charismatic species including mantas (*Manta spp.*), whale shark (*Rhincodon typus*), up to five species of sawfishes (*Pristis and Anoxypristis spp.*), and river sharks (*Glyphis spp.*). At least 60 species of shark are reported as having been landed in Indonesian fisheries (Tambunan et al., 2003), with 37 reported as being landed as bycatch in the Indonesian demersal fishery (YKAN, 2020). Indonesia is considered the largest shark fishery in the world, with 66% of species landed of conservation concern (Jaiteh et al., 2014). Silky shark (*Carcharhinus falciformis*) is the most common shark landed in Indonesian waters (Simoen et al., 2018). Requiem sharks are encountered in ATS fisheries and have traditionally been associated with bycatch in Arafura demersal longline fisheries (Tambunan et al., 2003) and some species have shown declines since the 1990s, including Silvertip shark (*Carcharhinus albimarginatus*) which was once illegally targeted for fins in the MoU Box (FRDC, 2019). Bycaught shark may be finned and dried at sea, with fins sold by fishing crews to separate markets. Fisheries bycatch has been recognised as a threat to certain groups of ETP species and is addressed in Section 4.6 (Unsustainable Fisheries).

National protections on manta rays were introduced in Indonesia in 2014, prior to their listing on CITES in 2015, and various NGO-led efforts to transition manta fishers to sustainable fisheries took place since that time, including in East Nusa Tenggara province.

4.5.7 Knowledge gaps

- Generally, there are many knowledge gaps around ETP, migratory and charismatic megafauna species; knowledge of population dynamics, habitats, migratory behaviour, and foraging behaviour would greatly assist management
- The potential impacts of climate change for deep-water (mesophotic) reefs are not well understood but are likely to be driven by changes in ocean chemistry (e.g., acidification), temperature stratification, and changes to currents and ocean circulation (Johnson et al., 2021).

4.5.8 Key references and relevant ATSEA-2 regional assessments

- Assessing the Vulnerability of the Arafura and Timor Seas to Climate Change (Johnson et al., 2021)
- Analysis of Threatened, Charismatic and Migratory Species Distribution Around the ATS (Fajariyanto et al., 2020)
- The Atlas of Arafura and Timor Seas (2021 version) (ATSEA, 2022)
- Status of Habitats and Ecosystems in SE Aru (Handayani et al., 2021)
- Status of Sea Turtles in the Arafura and Timor Seas (Pilcher, 2021)
- Roadmap for the Establishment of New Marine Protected Areas in the Arafura and Timor Seas (Fajariyanto et al., 2021)

4.5.9 Recommendations to guide SAP update

Johnson et al. (2021) provided the following recommendations relevant to climate impacts on ecosystems and critical habitats

- Establish local MPAs to protect mangrove forests as part of a connected coastal mosaic of habitats.
- Implement management to promote recovery and improve condition of mangrove forests (e.g., replanting) and reduce non-climate pressures on mangroves (e.g., clearing and development).
- Reduce land-based inputs to nearshore seagrass habitats through integrated catchment management of deforestation, agriculture and coastal development in Indonesia/Arafura and western Papua New Guinea.
- Establish local MPAs to protect seagrass habitats in western Papua New Guinea.
- Implement management of non-climate pressures on seagrass meadows (e.g., intensive seaweed farming, overfishing, coastal mining and sand extraction) in Indonesia/Arafura.

The following priorities and possible strategies for consideration in SAP updating were proposed by the RWG:

- Inclusion of the proposed MPA Network Roadmap in the updated SAP.

- The MPA Network activities to include improved conservation of species along with activities that address illegal trade etc.
- Establish local MPAs to protect mangrove forests as part of a connected coastal mosaic of habitats.
- Regular monitoring of MPA management effectiveness, and strengthening of MPA management (e.g., periodic review of management plans, and financing, improved monitoring and reporting of progress)
- Development or implementation/strengthening of alternative livelihoods (to reduce pressure on ecosystems or species subject to unsustainable exploitation)
- Development of species-specific management plan/support strengthening of implementation and monitoring of existing species-specific management plans for ETPs (i.e., dugongs, turtles, crocodiles)

4.6 Transboundary issue 3 – Unsustainable capture fisheries

Within the ATS, capture fisheries is a significant economic sector for Indonesia and Australia, and vital to coastal livelihoods for all four ATS littoral countries. Since the 2011 TDA was conducted, fisheries production in the Indonesian provinces grew by about 70% (Yonvitner et al., 2022), while production in Australian waters has remained at similar levels. Due to challenges in monitoring small-scale catches, it is not clear how production has changed in Papua New Guinea or Timor-Leste. Across the region, new fisheries have developed, and new approaches to fisheries management introduced. There is some evidence that certain stocks are overfished and the region faces several specific but related challenges in relation to their ecological sustainability, or their ability to sustain fishing pressure and deliver benefits to the ATS region over time. These challenges are broadly in line with issues facing fisheries globally; nonetheless they present serious challenges to ATS communities.

4.6.1 Description of the issue and its transboundary importance

This priority transboundary issue is concerned with overall sustainability of capture fisheries activities in the ATS region, both from the perspective of the sustainability of the target species as part of the fisheries activities themselves (i.e., ‘can fishing be sustained?’), and in terms of the impacts of fisheries activities on ATS ecosystems and non-target species. The capture fisheries sector is broad and diverse and includes industrial scale and small-scale capture fisheries within EEZs of each country, and including transboundary areas where fish stocks and habitats may be shared, or demonstrate high ecological connectivity.

Within this broad issue, the following fundamental concerns were identified:

- #3.1 Unsustainable harvest levels (overfishing)
- #3.2 Illegal, unreported and unregulated (IUU) fishing
- #3.3 Fisheries bycatch
- #3.4 Fisheries impacts on habitats

This issue may be considered transboundary for three reasons; i/ ecological parameters such as distribution of fish stocks or habitats may span jurisdictional boundaries; ii/ human activities (including fishing activity, but also research, management surveillance, etc.) may also at times

span these national boundaries (or be required to, such as in the case of a regional response) and iii/ fish demand and supply chains may also be transboundary.

Fundamental concern #3.1: Unsustainable harvest levels (overfishing)

It is estimated that globally, around one third of fisheries are fished beyond biologically sustainable levels, with this trend of overfishing increasing. Overfishing is a major concern in the ATS and was recognised as a priority concern in the 2011 TDA. Across the ATS, the overall sustainability picture is uneven; some stocks are well managed according to robust data-driven frameworks, others are undoubtedly currently fished at unsustainable levels. Other stocks are recovering from historic patterns of overfishing, while the condition of many stocks (especially those important to small-scale fishers) is not well understood. While there have been significant advances in fisheries data over the intervening period, fisheries management challenges remain hampered by a lack of knowledge. Transboundary connectivity between important stocks and habitats is not well recognised or agreed at regional level, it is highly likely that small-scale catch is under-reported (or unreported), and it is not possible to define an overall estimate of landings from the ATS system.

Fisheries management frameworks in Australia and Indonesia are well established and, in most cases, now incorporate harvest control rules based on reference points for key species. Australia's management system is considered the strongest in the ATS, with fishing effort sustained generally below ecological limits. In Indonesia's FMA⁷¹⁸, reef fish and squid are currently assessed as overfished by MMAF, while there are concerns around overfishing in the demersal fishery also (YKAN, 2020). In the ATS waters of Papua New Guinea and Timor-Leste, fisheries management is focused on the small-scale sector, reflecting the importance of coastal fisheries to the livelihoods of coastal communities. A lack of fisheries data hampers the management of these fisheries, representing a risk to local food security and livelihoods.

Fundamental concern #3.2: Illegal, Unreported and Unregulated (IUU) Fishing

The primary transboundary instrument for addressing IUU fishing in the ATS is the Asia Pacific Fishery Commission (AFPIC) Regional Plan of Action to Promote Responsible Fishing Practices including Combating IUU Fishing (RPOA-IUU). RPOA-IUU is a ministerial initiative of eleven countries, including the four ATS littoral countries, which organise under a Sub-regional working group with a specific mandate for the Arafura – Timor Seas. Through annual RPOA-IUU processes, key IUU fishing issues for the ATS have been identified, including incursions by foreign vessels (including Vietnam), illegal transboundary fishing within the ATS littoral countries of multiple scales, and specific issues relating to particular products including fish maw, beche-de-mer, shark fin and lobster. Closely related to issues of IUU fishing operations are illegal, transboundary value chains and trade routes established within and beyond the ATS region.

Fundamental concern #3.3 Fisheries bycatch

Fisheries bycatch is a multi-faceted problem resulting from poor fishing selectivity. It may include the accidental or incidental capture of non-target species including ETP species (unable to be legally retained), as well as valuable species able to be retained. In some cases, it may be an unwanted catch of target species, including under-sized or disallowed catch due to output control. In some cases, bycatch of non-target species may be retained, where it is referred to as 'by-product' or 'secondary catch', or it may be returned to sea alive or dead, referred to as 'discards'. Much attention is placed on bycatch issues related to ETP species. In its assessment of pressures in the North Marine Parks Network, Australia's Marine Parks authority notes that specific bycatch risks include reef and shoal habitats, pinnacles of the Bonaparte Basin, with particular regard to species of shark, sawfish, dolphin, marine turtle, sea snake and dugong (Marine Parks Australia, 2018). There are documented concerns about elasmobranch bycatch mortality in Indonesia's (WPP718) snapper longline fisheries, and of turtle and elasmobranchs in prawn trawl fisheries, of which only the Northern Prawn Fishery (NFP) now remains in the ATS; the NFP operates according to its own fisheries bycatch plan (AFMA, 2020), and was recertified by the Marine Stewardship Council as recently as 2018.

Where bycatch is considered a driver of the declines in ETP species, it is addressed in Issue #2 (fundamental concern #2.2 Declining populations of endangered, threatened, and protected (ETP) species).

Fundamental concern #3.4: Fisheries impacts on habitats

This issue includes the incidental impacts that legal and illegal fishing operations may have on marine ecosystems, including the key habitats of fisheries target species. Blast fishing and poison fishing (including the use of cyanide), and potassium gleaning are all causes of habitat degradation in the ATS, with hotspots including the waters of East Nusa Tenggara and Maluku provinces (Hakim et al., 2020). Further, the gleaning of intertidal and nearshore shallow reefs (often for invertebrates) can also degrade reef habitats. Impacts of ghost fishing by Abandoned, Lost and Discarded Fishing Gears (ALDFG) are addressed as a pollution issue (Issue #1, fundamental concern #1.3). Concerns over the impact of trawl fisheries led to the permanent closure of Indonesia's Arafura trawl fishery in 2021.

4.6.2 Progress in Addressing the problem since 2011

Since 2011, numerous improvements have been made to improve the sustainability of fisheries in waters of the ATS; these improvements include the management of transboundary areas, and shared or connected ecological values, and of marine resources within territorial waters. It is not possible to list all developments here, but the following presents an overview of major advances in the region.

Improvements to fisheries sustainability, 2011-2022:

In the intervening period of 2011-2022, Indonesia has introduced significant reforms to its fishery sector. Since 2014, it has begun to manage its fisheries according to EAFM principles as set out in Decree No. 18/2014 of the Directorate of Capture Fisheries. EAFM is implemented through an

area-based system that divides the country into 11 ‘Fisheries Management Areas’, or FMAs, each with its own Fisheries Management Institution (LPP). Indicators for fishery performance include fish size, species composition, fish biomass, impacts on ETP species, and CPUE. Further, indicators of water quality, status of key habitats (e.g., coral reefs), climate impacts are used to understand status of fisheries habitats. At 480,830km², FMA718 (Figure 22) encompasses the Indonesian section of the Arafura Sea; as the largest fishery management unit of the ATS region, these developments will have significant bearing on the overall sustainability of ATS fisheries. In 2020, Indonesia also introduced harvest strategies for some species (including blue swimming crab, red snapper and grouper) that introduce minimum sizes, and stricter regulation of gear selectivity and permitting requirements.

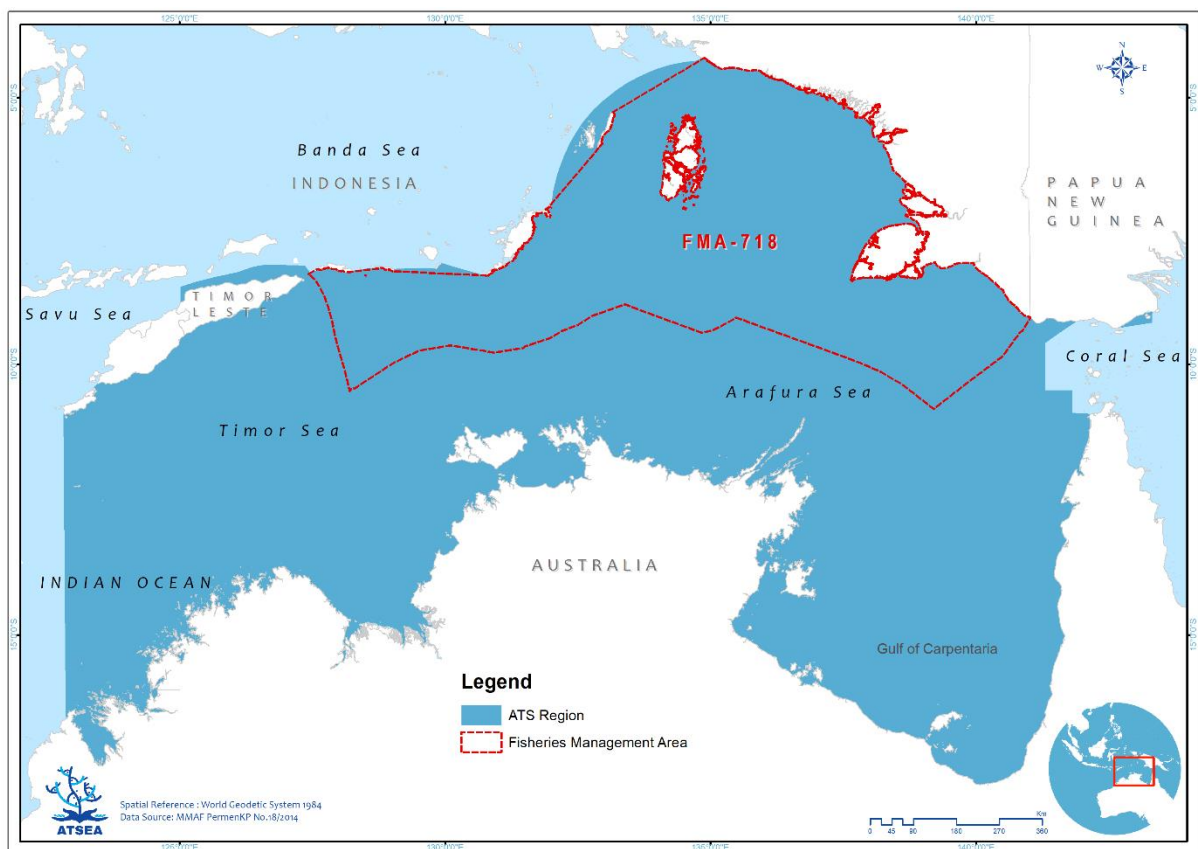


Figure 22 – Indonesia's Fisheries Management Area 718 (WPP718)

Indonesia has also invested significantly in community-based patrol systems which support marine protected areas and fisheries values; nationally, there are now 2,945 registered groups, and most of these have emerged since 2011 (Gokken, 2022).

Indonesia is also instituting a new policy of quota-based fisheries management to address problems of overfishing and resource allocation. Based on Government Regulation No. 11/2023 the quota-based system is a priority program intended to increase sustainability of target stocks through the introduction of quotas. FMA718 is designated an industrial fishing zone, with new quota-based management soon to be introduced for some species.

Since 2011, Papua New Guinea has developed fisheries management plans (FMPs) for several key capture fisheries in the ATS, including a Barramundi Fishery Management Plan, National Mud Crab Fishery Management Plan (2019), National Beche-de-Mer Fisheries Management Plan (2016),

and a draft National Plan of Action for Sharks. Through ATSEA-2, the National Fisheries Authority (NFA) is also piloting an area-based artisanal fisheries management planning approach to improve management of small-scale fisheries. Papua New Guinea and Australia also collaboratively manage the Torres Strait Protected Zone (TSPZ) lobster and finfish fisheries through joint management arrangements.

Timor-Leste has introduced a data collection system for small-scale fishers using vessel monitoring system; PeskaAAS dataset is providing a clearer picture of catch and effort distribution among coastal fisheries. And several locally-managed marine areas (LMMAs) have introduced local-level fisheries management regulations, alongside no-take sanctuary areas intended to recover depleted stocks. More broadly, Timor-Leste adopted in April 2023 a National Oceans Policy which would elevate the importance of sustainable development of fisheries resources.

Fisheries Improvement Projects (FIPs)

Through FIPs, the fishing industry itself has engaged in voluntary measures to improve the performance of their fishing operations in the ATS.

- The Indonesian Deepwater Groundfish FIP is a national-level FIP led by the Nature Conservancy, focused on 4 fishing methods (drop-line and long-line, trap and gill-net) used by more than 10,000 vessels operating across the country; this is particularly relevant to deepwater snapper fisheries in the ATS.
- The Indonesia Snapper Grouper FIP is led by the industry body Indonesian Demersal Association (ADI), and brings together three regional snapper-grouper FIPs, including Aru in the ATS region. This FIP encompasses dropline, longline, trap and gillnet fisheries for six snapper species and 10 grouper species caught in Indonesian FMAs.
- In Australia, the Northern Prawn Fishery (NPF) first received MSC Certification in 2012 - one of the first prawn (shrimp) trawl fisheries to achieve the MSC certification - and was re-certified in 2018. The NPF operates within the Australian Fishing Zone, with 52 licensed vessels in 2021 landing 8,581 t with combined value of AU\$1117 million. The fishery has adopted a Maximum Economic Yield (MEY) target for Tiger Prawn in 2005 and for white Banana Prawn in 2014 (AFMA, 2020); aligning harvesting with MEY optimises both economic returns and sustainability of stocks. The MSC standard assesses fishery performance and incorporates indicators of stock sustainability alongside environmental impacts and management systems. Bycatch in the fishery is managed via a Bycatch Management Plan, which stipulates the use of Bycatch Reduction Devices (BRD).

IUU Fishing

Sustainable Development Goal (SDG) 14.4 set a target to end IUU fishing by 2020, and good progress was made in the intervening years since the 2011 TDA first identified IUU as a challenge in the ATS. Indonesia first identified IUU Fishing as a priority since it established the Ministry of Marine Affairs and Fisheries (MMAF) in 2001, but significant progress was made after 2014 when it authorised its Navy to sink illegal vessels; in the four years following it had destroyed more than 363 vessels (Farhan et al., 2018).

In terms of regional cooperation, the RPOA-IUU (Sub Regional Arafura – Timor Seas) drives transboundary action on IUU in the ATS. The Asia Pacific Fishery Commission (AFPIC) Regional Plan of Action to Promote Responsible Fishing Practices including Combating IUU Fishing (RPOA-IUU) is a ministerial initiative of eleven countries, including the four ATS littoral countries, which organise under a Sub-regional working group with a specific mandate for the Arafura – Timor Seas. Since 2009, an annual meeting between the four countries has been convened, and an annual work plan agreed. The most recent meeting was held in 2021.

The past decade has also seen significant bilateral cooperation on IUU. In October 2022, governments of Australia and Indonesia signed a joint commitment to ‘eradicate illegal fishing in the Timor and Arafura Seas’. Signed at the 22nd Indonesia-Australia Fisheries Surveillance Forum (IASFS) in Darwin, Australia, the agreement outlines cooperation in eradicating illegal fishing in the shared transboundary area, which includes creation of working groups focused on public information campaigns (in East Nusa Tenggara), surveillance and law enforcement, and alternative livelihoods. More broadly, the IASFS establishes long-term measures for cooperation on surveillance and responses, sharing of intelligence, coordination on operations, and technical assistance for anti-IUU programs; the Forum has its origins in the 1992 Fisheries Cooperation Agreement between the two countries, and supports the ongoing ‘AUSIDO CORPAT’ bilateral framework for transboundary sea patrols involving Australian and Indonesian Armed Forces.

Progress on Indonesia and Papua New Guinea bilateral arrangements was advanced through a 2015 Joint Communiqué (JC) issued by the two governments recognising the need to strengthen cooperation on IUU Fishing. The JC highlighted the need to prevent, deter and eliminate IUU Fishing based on existing national, regional and international tools and measures. It notes the need for the use of precautionary principles to achieve sustainable fisheries management and notes the potential for further voluntary joint initiatives in the future.

Similar to the Indonesia-Papua New Guinea Joint Communiqué, Indonesia and Timor-Leste released a JC in January 2016 acknowledging the issue of IUU Fishing and outlining measures to combat it. This JC built on an initial bilateral MoU signed by the two countries in 2015.

And in 2022, the Timor-Leste Government accepted an offer from the Australian Government to provide two ‘Guardian’ patrol vessels to assist in the surveillance of Timor-Leste waters and AUS-TL transboundary areas. The 40m vessels have a range of 3000nm and are expected to be delivered in 2023.

At national levels, Australia is considered to have the strongest anti-IUU approach in the ATS, with up-to-date National Plans of Action for IUU, Sharks and Seabirds, considerable monitoring control and surveillance (MCS) resources, and ratification of FAO Port State Measures Agreement. Indonesia’s fisheries sector is considered generally steadier and more sustainable after being forced to improve management after receiving an EU ‘yellow card’, while Papua New Guinea and Timor-Leste have begun to embed core values of RPOA-IUU in national plans and policies (Afriansyah et al., 2021). Within its sovereign waters, Timor-Leste has also committed to tackling IUU through the Development of National Fisheries Strategic Plan and revision of Fisheries Code, the adoption of vessel monitoring systems on 600 vessels, new data enumeration programs in most municipalities and the adoption of Global Fishing Watch to monitor IUU.

Other initiatives include the following:

- ASEAN Guidelines for Preventing the Entry of Fish and Fishery Products from IUU Fishing into the Supply Chain (2015)
- ACIAR Project (Australia): Developing alternative small scale fishery models for women in the Fly River, Western Province, Papua New Guinea.
- PARKS AUSTRALIA Project: Trawl gear configuration effects on sawfish catches - mitigating commercial fishing interactions with sawfish in the North and North-west Marine Parks Networks: Northern Prawn Fishery industry members using in-net cameras to record sawfish-net interactions, in order to refine/modify trawl nets or/and fishing methods, with a view to reducing bycatch impacts on threatened species of sawfish in the North and North-west Marine Parks Networks.

4.6.3 Emerging problems

Transboundary Fish maw fishery (Papua New Guinea and Indonesia)

Fish maw is the market name for the dried swim bladder of several finfish species occurring in the ATS, including Barramundi *Lates calcarifer*, Black jewfish *Protonibea diacanthus*, Largefin croaker *Johnius macropterus* and catfish (*Arius* spp.). Fish maw is considered a delicacy in Chinese markets and is believed to contain a high collagen content. In the past decade, a new fish maw fishery has emerged on the southern coast of Papua. Gillnetting and longlining for key fish maw species occurs in coastal waters and estuaries across the southern coast, at least as far west as Kaimana, Indonesia, and east to the Torres Strait (author, personal obs., R. Mana, pers. comm, Busilacchi et al., 2021). Catching methods vary across the fishery. Gillnets may be up to 50m in length, with 2m drop and mesh size of 7.5inches (Sajriawati, 2021). Bottom longlines are commonly used also particularly for croaker (YKAN, 2020). Due to the relatively low value of some target species, often only the maw is retained, while the (edible) flesh may be discarded. This discarding may be exacerbated due to the difficulties in obtaining ice in remote areas of Papua, and exorbitant costs transporting fish to destination markets; conversely, dried maw may be retained and sold at a later date to visiting buyers.

Fish maw enters export markets via aggregators and buyers based in Merauke, with value chains ending in Hong Kong, Singapore and Kuala Lumpur; value chains to these destinations exist both in Indonesia and Papua New Guinea (Busilacchi et al., 2021). One study notes the rapid increase in production over a four-year period; from 3,192 Kg in 2015 to 145,562 Kg in 2018 (Zulham, 2019).

Primary research in Papua New Guinea's South Fly district undertaken by ATSEA-2 in 2022 highlights the characteristics of the South Fly maw fishery (Table 21). Species harvested include jewfish, barramundi, catfish, gulama (croaker), shark and salmon (presumably threadfin). Women represent up to half of maw fishers in some villages, and a high proportion of carcasses are retained for local consumption. Most fish maw is sold to buyers in the village, with some sold to buyers in Merauke and Daru. Prices received for fish were between USD 70 and USD 425 per kilogram for dried, A-grade maw.

Table 21 – Results of September 2022 fish maw investigations, South Fly district villages (ATSEA-2)

Village	Species harvested	Fish maw fishers in village	% of female maw fishers	Percentage carcass consumed, discarded, sold	Market
Bula	Croaker, Jewfish, Barramundi, Catfish	123	35%	65, 34, 1	Village, Merauke, Daru
Mari	Croaker, Jewfish, barramundi, catfish	128	22%	90, 10, 0	Village, Daru, Merauke
Tureture	Jewfish, barramundi, shark, catfish	50	0	70, 5, 25	Village, Daru
Sigabaduru	Jewfish, barramundi, catfish	178	11%	50, 13, 37	Village (some buyers come from Merauke), Daru, Port Moresby
Parama	Jewfish, Barramundi, Gulama (croaker), Salmon, Catfish	165	35%	43, 2 55	Village, Daru, Port Moresby
Old Mawata	Jewfish, barramundi, salmon, catfish, sharks	50	0	80, 0, 20	Village, Daru
Mabudawan	Croaker, Jewfish, barramundi. catfish	475	40%	73, 11, 16	Village, Daru, Merauke
Sui	Barramundi, jewfish, gulama (croaker), salmon, catfish	148	15%	62, 0, 38	Village, Daru, Port Moresby
Sigabaduru	Jewfish, barramundi, catfish	178	11%	50, 13, 37	Village, Daru, Port Moresby
Kadawa	Jew fish, barramundi, catfish, shark	372	2%	34, 0, 66	Village, Daru, Merauke, Port Moresby
Buzi/Ber	Gulama (Croaker), jewfish, barramundi, salmon, catfish	50	50%	50, 20, 30	Village
Katatai	Gulama (Croaker), jewfish, barramundi, salmon, catfish	120	14%	17, 1, 82	Village, Kadawa Village, Daru, Merauke, Port Moresby

Stock assessments of *P. diacanthus* undertaken in northern Australia (within the ATS) have shown fine-scale location fidelity with fish lifetimes, suggesting limited exchange between populations; this indicates that the species is likely to be vulnerable to localised overfishing and local extirpation, but that management of populations may be achievable through fine-scale areal catch limits (Talillebois et al., 2017). A fisheries profile of the Merauke barramundi fisheries (PT. Multi Area Desentralisasi Pembangunan, 2021a) also indicates that since the early 2000s, barramundi has been targeted by former shark fishers for swim bladders. The fisheries profile reported percentages of barramundi product from the region as follows: 56% as swim bladder, 43% as fresh/frozen product, and 1% as local saltfish product. Barramundi exhibits protandrous

hermaphroditism; they first become sexually mature as males at about three years of age, before becoming females after six years of age (requiring access to saltwater). This unique life history makes them particularly vulnerable to local overfishing.

This fishery is problematic for several reasons; the extent and status of target stocks are not well understood, and total catch is currently unclear. It is unclear to what extent the fishing effort may be sustained and it is likely that illegal transshipment occurring across the Indonesia-Papua New Guinea border. Further, the practice of discarding is wasteful and detrimental to public perceptions of commercial fisheries more broadly. Zulham (2019) notes the opportunity to divert some discarded fish to be developed as pet food. Barramundi is typically a high value fish (both for consumption and sports-fishing), and depletion of local stocks by overfishing would represent a significant opportunity cost for those affected areas and communities. Expansion of cold chain would allow some high value species to be retained for human consumption.

Both Indonesia and Papua New Guinea recognise the need to regulate the fishery; through the RWG process, MMAF has expressed a desire to bring the fishery under sustainable management in order to sustain the economic benefits, and in September 2022, NFA indicated its desire to develop a National Management Plan for Fish Maw Harvesting, including management of fish carcass as part of their ATSEA-2 efforts.

Indonesia’s Country Synthesis Report includes anecdotal reports of declines in Squid fisheries in Rote, with displaced fishers shifting their fishing activities to the MoU Box within Australia’s EEZ; based on MoU box regulations prohibiting the use of powered vessels, this would technically be illegal (Yonvitner et al., 2022).

4.6.4 Causal Chain Analysis, including causes and impacts

Table 22 highlights the root causes, indirect drivers, direct drivers, and impacts of this issue and the subordinate fundamental concerns including bycatch, fisheries impacts on fisheries habitats, overfishing and IUU fishing.

Table 22 – Causal Chain Analysis (CCA) for Priority Issue #3, unsustainable capture fisheries

Priority Transboundary Issue:		Unsustainable capture fisheries		
>	>	>	>	>
ROOT CAUSES	INDIRECT DRIVERS	DIRECT DRIVERS	ECOLOGICAL IMPACTS	SOCIO-ECONOMIC IMPACTS
Lack of knowledge or education on marine resources Poverty and food insecurity in ATS region	Lack of data on stocks Low knowledge on fisheries management among fishers	Destructive gears (dynamite, potassium, cyanide, electro-fishing) Gears with low selectivity (inappropriate mesh, hook size) or poor targeting Reef gleaning	Habitat degradation Decline / depletion of commercially important stocks Unintended catch of juvenile target species Bycatch (unintended catch) of non-target species (discards or by-product)	Reduced food security in ATS Reduced protein supply Increased cost for consumers Reduced fish quality

Global market demand for certain sizes "golden size"	SECTORS: Government, Fisheries, Communities	SECTORS: Government, Fisheries, Communities	Bycatch (unintended catch) of ETP species	
Global demand for seafood	Unsustainable quotas, fleet overcapacity, open access arrangements Transboundary / regional demand for unsustainable products Lack of transboundary compliance framework	Overfishing within territories by commercial fleets due to inappropriate TAC/quota (catch levels exceeding MSY) Unreported catch by small-scale fishers ('unknown take') Unsustainable harvests of croaker and jewfish in 'fish maw' fishery	Impacts on biodiversity, marine food webs, ecological imbalance Phenomenon of 'fishing down' or exploiting new stocks Loss or depletion of non-target species including ETP species, charismatic megafauna, Fish spoilage, waste driving fishing mortality	Reduced food security for artisanal fishers Reduced income and employment from fisheries Safety-at-sea issues for fishers Increased cost for fishing companies (e.g., having to travel further to fish) Human rights violations for fisheries workers Lost market value
Global market for new marine products (including ETPs)	Poorly developed supply chains (e.g., no ice chain) limit market access Influence of perverse subsidies SECTORS: Government, Fisheries, Communities	SECTORS: Government, Fisheries, Communities		
Population growth in the ATS region	Lack of budget / uneven capacity for fisheries law enforcement	Organised IUU (illegal) fishing in transboundary areas by foreign vessels	Decline / depletion of commercially important stocks	Increased costs for management Cost of surveillance
Climate change	Organised illegal trade / crime networks High incentive / low risk for illegal fishing SECTORS: Government, Fisheries, Communities	Illegal take of protected species SECTORS: Government, Fisheries, Communities	Decline / depletion of populations of ETP species, charismatic megafauna, migratory species	Conflict and/or diplomatic issues between countries
	Lack of monitoring, supervision Some maritime boundaries unresolved, or unclear to fishers (e.g., TL-ID) Cultural norms and factors, Women excluded in decision-making SECTORS: Government, Fisheries, Communities	Unregulated community fishing effort in transboundary areas (e.g., ID-TL boundary waters) Insecure access for SSF / traditional fishers Lack of fisheries opportunities for women Lack of livelihood opportunities in coastal communities SECTORS: Government, Fisheries, Communities	Contributes to overfishing	Conflict between fishing sectors (e.g., industrial v. SSF) Increased burden of food insecurity borne by women

The direct drivers of these issues included the use of unsustainable fishing practices (including the use of destructive or unselective gears), unsustainable harvest (including issues of legal and illegal overfishing, catch exceeding known maximum sustainable yield (MSY), inappropriate total allowable catch (TAC) allocation, and unregulated or unreported fishing contributing to overall fisheries mortality), fisheries-related bycatch (of target, non-target and ETP species) and inequitable access to fisheries resources (including gender inequity, conflict between fishing sectors/scales). The High Level Panel for A Sustainable Ocean Economy (Ocean Panel) notes three drivers that contribute to IUU fishing: economic incentives which make IUU activities low-risk and high return; weak governance that fails to enact regulations, and barriers to enforcement caused by lack of political will, lack of capacity or corruption. Busilacchi et al. (2021) notes several context-dependent drivers of transboundary illegal trade of marine products between Papua New Guinea and Indonesia, including: strong influence of cross-border familial and kinship ties, traditional bartering systems, a lack of information, obligatory dependencies created by middlemen, lack of government enforcement capacity and authorities' tolerance of illegal trade.

Indirect drivers of unsustainable fisheries identified for ATS included; a lack of data required for management purposes, a lack of budget or capacity in the region for fisheries management, lack of harvest control rules, open access arrangements or inappropriate catch allocations, fleet overcapacity, a lack of clarity on some maritime boundaries (such as that between Indonesia and Timor-Leste), poor alignment of traditional approaches to resource access and modern fisheries and maritime law, a lack of alternative livelihood options for coastal communities, and market forces acting against sustainability imperatives.

The direct ecological impacts of unsustainable fishing include the decline / depletion of commercially important stocks or those important for food security or cultural reasons, the phenomenon of 'fishing down' or exploiting new stocks as established fisheries enter decline, the degradation of fisheries habitats (e.g., by use of destructive gears), the impacts on biodiversity, marine food webs, ecological imbalance, and the decline or loss of (non-target) species, including a range of ETP species such as sea turtles, dugong, cetaceans, elasmobranchs and seabirds. All these impacts may, in turn, have cascading ecological impacts, especially when considered alongside other threats.

The main socio-economic impacts shown in Table 12 relate to or arise from unsustainable capture fisheries in the ATS. These may stem from a scarcity of fisheries resources, or at times, the misallocation of them. Impacts may be felt disproportionately or unequally among different stakeholders and sectors and of the community, and may include the issues related to food security, employment, fisheries workers' rights and conditions, and lost economic value and opportunity. Impacts may be gendered also; any increased burden of food insecurity may be borne by women, for example.

4.6.5 Linkages with other transboundary issues

Fisheries bycatch was considered by the Regional Working Group as a driver of Issue #2, in relation to certain groups of ETP species including sea turtles, dugong, cetaceans, elasmobranchs and seabirds.

4.6.6 Supporting data

Sustainability of ATS fisheries stocks

Estimates of total catch landings across the ATS vary; the 2011 ATS TDA reported total landings of 2.2m t in 2004, with a value of USD 1.2bn (ATSEA, 2012). As shown in Table 16, Australia’s total catch of snapper in the ATS in 2019 was 6,187-7,051 t (Knuckey et al., 2021). The total catch from Australia’s Northern Prawn Fishery (NPF) in 2020 was 5,146 t, which included 3,661t of Banana Prawns, 1,026 t of Tiger Prawn, 444 t of Endeavour prawns and 16 t of King prawns (Cahill, 2022).

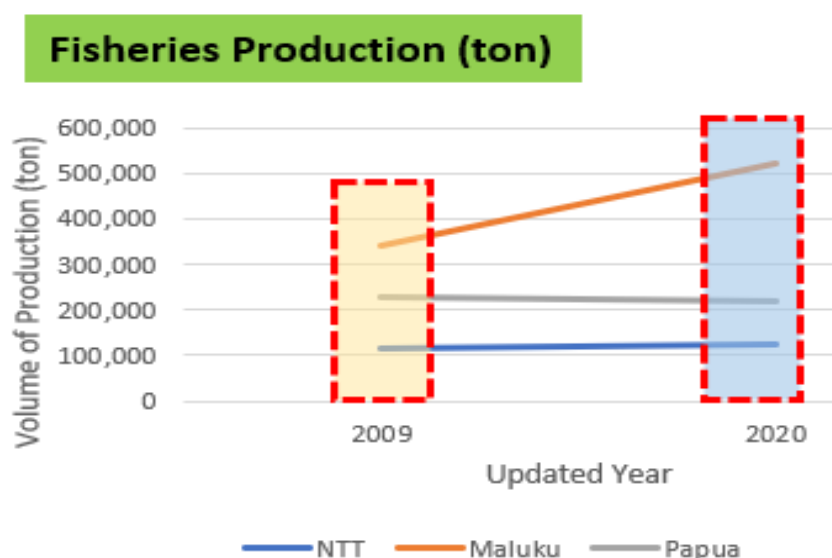


Figure 23 – Fisheries production in Indonesian ATS provinces, 2009-2020 (Yonvitner et al., 2022)

Indonesia’s total (national) annual catch is estimated at 8 million tonnes (Minderoo, 2021), which means the ATS provides roughly a quarter of the nation’s (reported) catch. Figure 23 shows production from ATS provinces from 2009 to 2020; the most recent data is derived from provincial records. This suggests a total catch from Indonesian ATS waters of around 600,000 t per year, with landings from NTT and Papua relatively static, and a significant increase in Maluku waters.

Fisheries Management Area 718 (WPP718) is the most productive of Indonesia’s 11 fisheries management areas. As shown in Table 23, in 2018, actual (recorded) landings totalled 257,376 t with an estimated harvest potential of 2,637,565 t (MMAF, 2022). As shown in Table 23, the most recent stock assessments for WPP718 show estimated fisheries ‘potential’, total allowable catch (TAC), and level of exploitation; of 9 stocks assessed, 7 are considered fully exploited and 2 overexploited (reef fish, and squid). Total catch for WPP718 across all stocks in 2022 was 242,094 t (MMAF, 2022).

Table 23 – WPP718 estimate of fisheries resource potential and total allowable catch (2022)

WPP718 – Estimate of fish resource potential, total allowable catch and level of exploitation of fisheries resource (2022)										
Fishery resource	Small pelagic fish	Large pelagic fish excl. tuna & skipjack	Demersal fish	Reef fish	Penaeid shrimp	Lobster	Crab	BSC	Squid	Total (MT)
Production (2018)*	58,380	23,524	110,276	36,399	3,465	1	5,049	3,142	17,140	257,376
Estimate of fisheries potential (2022)**	836,973	818,871	876,722	29,485	62,842	1,187	1,498	775	9,212	2,637,565
TAC (2022)	669,579	655,096	701,378	23,588	50,274	950	1,198	620	7,370	2,110,053
Level of exploitation (E) (2022)	0.51	0.99	0.67	1.07	0.86	0.97	0.85	0.77	1.28	

Source:

* <https://statistik.kkp.go.id/>

** KepMen KP19/2022 (MMAF, 2022)

WPP718 contains the largest snapper and grouper fishery in Indonesia, comprised of one-fisher small (1-5GT) boats through to large 100GT boats crewed by 20. Snapper fisheries in Indonesia's WPP718 (Arafura Sea) saw a significant increase in total fleet capacity between 2019 and 2021, when it increased from 9,795 GT to 15,008 GT (combined vessel weight), probably due to displacement of other WPP fleets to 718. This increase in effort in WPP718 saw correlating reductions in fish health indicators over the same period (Green et. al., 2022). One key indicator for health status is Spawning Potential Ratio (SPR), and a stable SPR of 30-40% is considered an indicator of fair stock health status. SPR in 2021 for key species was as follows, indicating that all species are currently overfished:

- *Pristipomoides multidens* –17%
- *Lutjanus malabaricus* –14%
- *Epinephelus areolatus* –18%

10% is sometimes regarded as a 'crash level', a critical threshold at which recruitment declines. 20% is referred to as the 'replacement level', at which stocks are expected to be just high enough to replace stock removed through fisheries mortality. 40% is widely considered to be the point of maximum sustainable yield (MSY), while 50% is considered the level of maximum economic yield (MEY), where higher catch rates and larger body size can maximise profits and reduce operational cost. This would be significant progress; to date, most WPPs lack concrete plans or reference points from which they can effectively regulate effort based on resource status (such as through the issuing of licensing); the creation of harvest control rules (HCRs) to achieve this represents the most significant next step for Indonesia in achieving sustainable harvests.

Indonesia does have a Management Plan for Snapper and Grouper. Based on Minister of Marine Affairs and Fisheries Regulation No. 123/2021, the plan aims to ensure sustainability of snapper and grouper fisheries by providing guidance to central and local government fisheries managers for the management of snapper and grouper resources in Fisheries Management Areas (WPPs).

WPP718, in the ATS region, has the largest annual share of snapper production in Indonesia, at 25% of national production. The plan estimates a fisheries potential for reef fishes of 29,485 t, and stipulates a total allowable catch (TAC) of 23,588 t, 80% of estimated potential. It notes that the species at highest risk of overharvesting are Malabar snapper, *Lutjanus malabaricus*, and Anggoli grouper *Pristipomoides multidentis*.

A pre-assessment of the groundfish fishery determined that 37 shark species were taken as bycatch in the fishery, most of which are Carcharhinids; data at the time showed that these represented 0.25% of total catch (YKAN, 2020).

Sources: Indonesia Snapper Consortium 2021 State of the Fishery (Green et. al., 2022), YKAN (2020)

Australia’s snapper fisheries are generally considered to be sustainably managed. Western Australia (WA) has fisheries management plans for several fisheries operating in the Arafura Sea. These fisheries include the Pilbara Fish Trawl Managed Fishery (PFTMF), Pilbara Trap Managed Fishery (PTMF), and Pilbara Line Fishery (PLF), the Kimberly Demersal Scalefish Managed Fishery, and the Pilbara Demersal Scalefish fishery. All employ risk-based EBFM frameworks, with harvest control rules based on reference points for indicator species.

The Northern Territory (NT) manages the NT Demersal Fishery (NTDF), a multi-species, multi-gear fishery with 17 license holders targeting snapper and emperor species, using traps, trawls, line and nets. The fishery is managed by individual transferrable quota system (ITQ) against total allowable catches (TAC) for key species including red snappers *Lutjanus malabaricus* and *L. erythropterus*. The NT Timor Reef Fishery operates further offshore, using baited traps, handlines, droplines and demersal longlines, targeting snapper species. Queensland has managed the Gulf of Carpentaria Developmental Fin Fish Trawl Fishery (GOCDFTF) since 1998, and introduced stricter management measures in 2014 to address overfishing of some species. Today the fishery management plan sets out spatial management arrangements (open fishing areas), TAC for all target species, and input controls including minimum mesh sizes (Knuckey et al., 2021). Landings for all fisheries are included in Table 24.

Table 24 – Summary of 2019 snapper landings in Australian waters of the ATS (Knuckey et al., 2021)

AUSTRALIA				
	Species	Gears	Landings	Vessels
WA PFTMF*	<i>L. sebae</i> <i>P. multidentis</i>	Trawl	940 -1416 (total)	11
WA PTMF*	<i>L. sebae</i> <i>P. multidentis</i>	Trap	241-537 (total)	6
WA PFL*	<i>L. sebae</i> <i>P. multidentis</i>	Line	36-127 (total)	9
WA NDSMF*	<i>L. sebae</i> <i>P. multidentis</i>	Trap	101 152	11
NT Demersal**	<i>L. malabaricus</i> <i>L. erythropterus</i> <i>P. multidentis</i>	Trawl Trap	2,406 339	5-10
NT Timor Reef**	<i>L. malabaricus</i> <i>L. erythropterus</i> <i>P. multidentis</i>	Trap Dropline	334 251	3-6
Qld GoC***	<i>L. erythropterus</i>	Trawl	100	3

	<i>L. malabaricus</i>		67	
	<i>L. sebae</i>		2	
Qld LFR ***	<i>L. erythropterus</i> <i>L. malabaricus</i> <i>L. sebae</i> <i>P. multidentis</i>	Hook and Line	1,218 (333 including snapper)	
TOTAL			6,187-7,051 MT	

Sources (in Knuckey et. al., 2021)

*Newman et al. 2008 2002 data by species.

**NT (2019a) 2017 data by species catches and TACCs (combined *L. malabaricus* and *L. erythropterus*; *P.multidentis*)

**NT (2019a) 2017 data by species catches and TACCs (combined *L. malabaricus* and *L. erythropterus*; *P.multidentis*)

***DAF Qld (2016) 2015 data by species

***DAF Qld (2020). 2018/19 data

Overfishing was recognised as an issue in the Arafura Sea in the 2011 TDA (ATSEA, 2012), and in 2022 it was again raised as a concern by the Regional Working Group in the preparation of this TDA. However, with hundreds of species exploited by both large- and small-scale fishers using multiple gears across all four countries, quantifying overfishing at regional level is complex. Specifically, there are reported declines across several ATS transboundary fisheries including sharks in the MoU box (Marshall et al., 2016), lobster in Parama, South Fly in Papua New Guinea (Faiparik, 2022 cited by Mana and Mungkaje, 2022), beche-de-mer in Western Province, Papua New Guinea (Mana and Mungkaje, 2022), snapper in Indonesia’s WPP718 (Mous, 2020), and barramundi in the South Fly district (Mungkaje et al., 2007).

Mungkaje et al. (2007) documented precipitous declines in barramundi landings in the South Fly over two decades; from landings of 200-300 tonnes in the 1960s, it dropped to 4 tonnes in 1985 (with current harvest levels unknown). Although there are barramundi fisheries management plans in place, landing data is required. Based on allozyme and mtDNA, there are believed to be 18 discrete barramundi stocks along the northern Australian coast, and only one uniform stock along the New Guinea south coast (Blaber et al., 2009). Where stocks, critical habitats such as the *Avicennia* mangroves dominant on New Guinea’s south coast (Mungkaje et al., 2007) or fisheries operations and/or supply chains traverse national boundaries, these issues of sustainability can be considered transboundary, and therefore relevant to the overarching joint commitments of the ATSEA community.



Figure 24 – Fishing pressure in ATS (ATSEA-2)

Figure 24 highlights fishing pressure in Indonesia and Australia derived from VIIRS night light detections data, a method that tends to highlight larger, multi-day fishing vessels. The image highlights several sites of fishing pressure, including Aru, Kolepom, the MoU box, in the Aru area, and what are assumed to be shrimp trawl grounds in the north of the Australian sector. The image should be considered indicative only; it does not discriminate between fishing and non-fishing vessels, nor can it detect fishing operations underway.

The Causal Chain Analysis identifies strong external forces that drive overfishing; namely market forces from beyond the ATS region, market preferences for certain size “golden size” fish, and the fishery has shown itself to be mobile and adaptive, with fishers moving across Fisheries Management Areas from time to time, as licensing or stock conditions dictate. As an example of this connectivity, Figure 25 demonstrates the extent to which Aru’s fisheries are influenced by these external forces, both legal and illegal (e.g., transshipment).

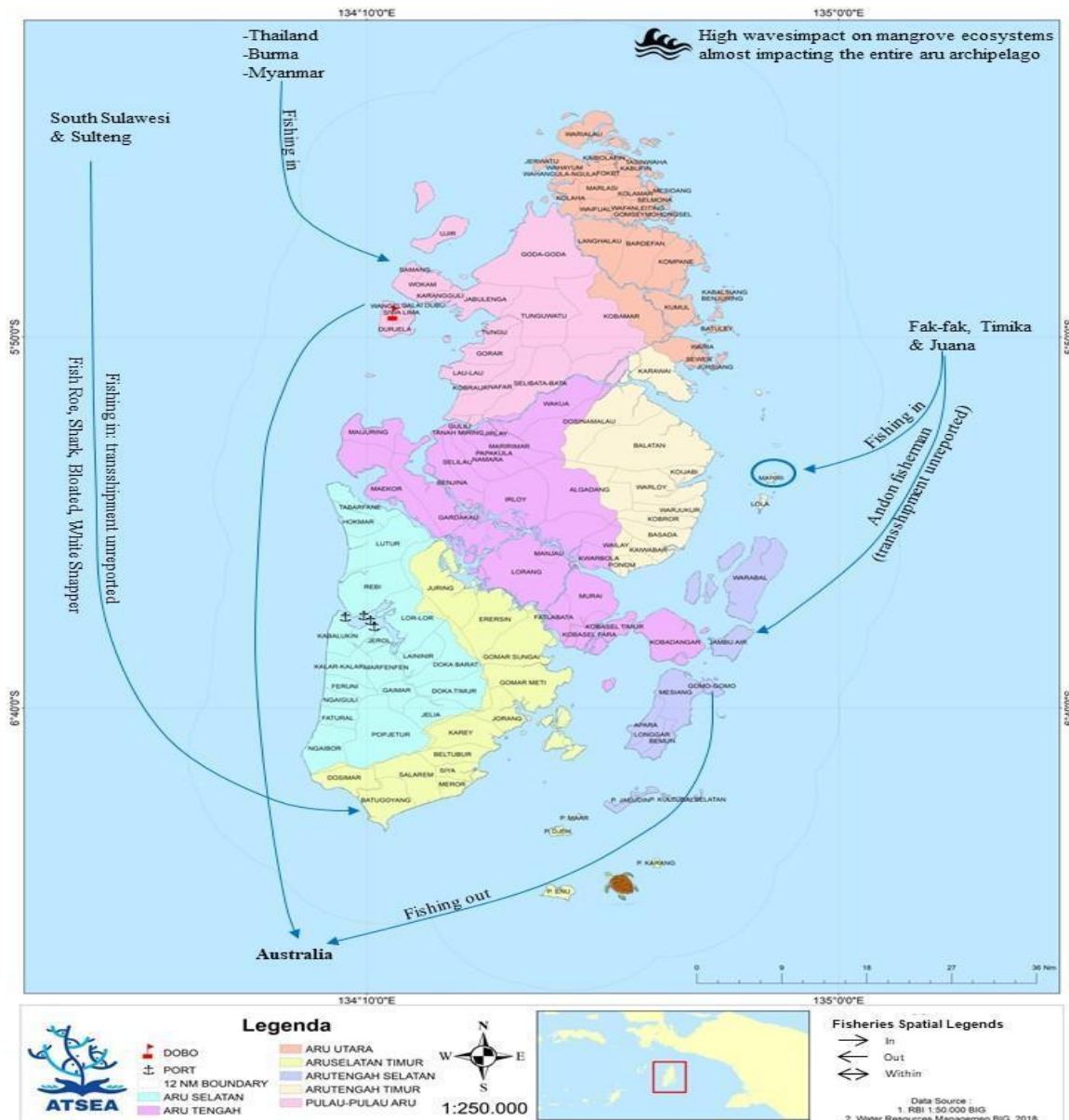


Figure 25 – Connectivity of Aru fisheries with regional supply chains (Yonvitner et al., 2022)

IUU Fishing

Table 25 highlights the key IUU fishing issues in the ATS region, as identified by ATS governments in 2019. Generally, issues include persistent incursions into sovereign waters by industrial-scale vessels (including vessels from Vietnam) and transboundary fishing by small-scale vessels (often nationals of ATS countries), illegal and unlicensed fishing practices by domestic fleets, the use of destructive and illegal gears including FADs, the illegal use of Indonesian flags by foreign vessels, and issues pertaining to particular species or products including fish maw, sea cucumber, rock lobster and ETP species.

Table 25 – National IUU fishing issues raised by RPOA-IUU Sub Regional Arafura and Timor Seas, 2019

	IUU fishing issues raised (2019)
Australia	<ul style="list-style-type: none"> ● Persisting, though declining, incursions by Indonesian and Papua New Guinean fishing vessels into Australian waters ● Increasing FADs on the boundary of Australia’s northern waters particularly within the MOU box area (noting FADs are a navigation and environmental hazard, and cost of retrieval/disposal) ● Issues related to incursions by Vietnamese fishing boats ● Management of Papua New Guinean Banana boats found to be illegally fishing in Australia ● The ‘Papuan Dog-leg’ area suspected of increasing illegal activity including emerging trade risks
Indonesia	<ul style="list-style-type: none"> ● Continuing pressure of Vietnamese fishing boats in northern waters ● Unauthorised Foreign Fish Aggregating Devices (FADs/Rumpon) ● Fishing Vessels without license ● Fishing Vessels not complying with the applicable rules and regulations (No Legal Letter/SLO, Sailing Permit/ SPB) ● IUU Fishing Vessel crews and the associated costs ● Fishing using prohibited fishing gears, and operated in unauthorised fishing ground ● Foreign Fishing vessels disguising and operating under Indonesian flag and name with prohibited gear; and ● FADs within Indonesian waters and the discontinuation of FAD permit administering.
Papua New Guinea	<ul style="list-style-type: none"> ● Illegal fishing for Tropical Rock Lobster (TRL) and Bêche-de-Mer (BDM/Trepang) in the Australian/ Papua New Guinean jurisdiction by nationals ● Border crossing of Foreign Fishing Vessels between Indonesia and Papua New Guinea ● Growing lucrative black market trade of Fish Maw (Swim Bladder) ● Continued illegal fishing by Indonesian fishing vessels ● BDM trading in the north/south Papua New Guinea/Indonesian border
Timor-Leste	<ul style="list-style-type: none"> ● The need to develop small scale fishing industry in Timor-Leste waters ● Use of Pelagic Data Systems technology to monitor small scale fishing activity ● The need for an MCS framework (including Port State Measures training, VMS, Catch Documentation Schemes) and review of fisheries legislation / licensing ● The need to deliver public information campaign in conjunction with Indonesia on cross-border trade

Source: Adapted from RPOA-IUU Sub Regional Arafura and Timor Sea, Summary Report of 9th Meeting, 9-11 April 2019

FAO (Wilcox et al., 2021) identifies four IUU fishing hotspots in the Arafura Timor Seas (Figure 26), first identified in 2015 and validated in 2021. These include Timor-Leste’s EEZ (including that portion of the Timor Sea to the south, bordering Indonesia), the Indonesian EEZ of the Arafura Sea, the Papua New Guinean “Dog Leg” (Papua New Guinea EEZ) and the Ashmore Reef, Scott Reef and Cartier Island, all within Australia’s EEZ.

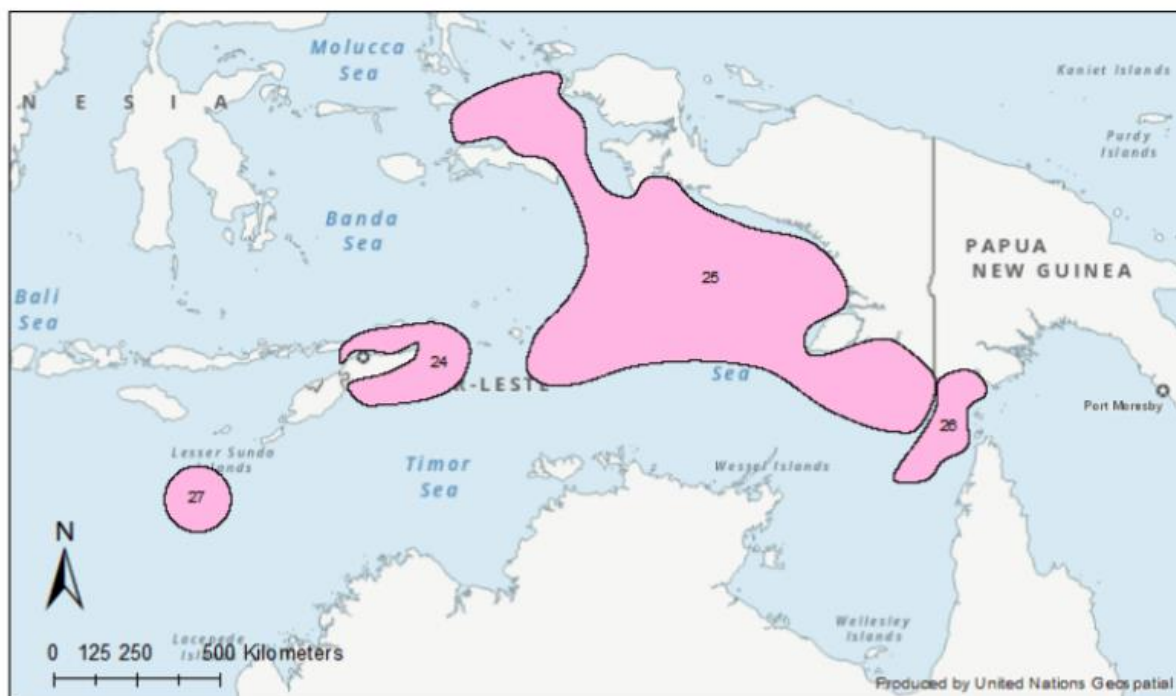


Figure 26 – Hotspots in the Arafura Sea region as indicated in the 2015 FAO study on illegal fishing in the APFIC region (Wilcox et al., 2021)

Estimates of economic loss from IUU vary across the four countries and are limited due to lack of data and varying methodologies. ATSEA-2 data shown in Table 26 suggests that total annual losses across the ATS in the late 2010s were approximately USD 80 million annually. Independently, Timor-Leste’s Directorate of Fisheries, Aquaculture and Marine Resources Management has estimated its economic losses from IUU in its waters USD 84 million annually (Fonseca et al., 2022). Counter-IUU efforts in Indonesia led to a 90 percent reduction in foreign fishing boats which was attributed to a 25-35 percent reduction in total fishing effort (CEA, 2019).

Table 26 – Estimates of IUU losses by ATS countries, 2015-2019 (adapted from Afriansyah et al., 2021)

COUNTRY	YEAR	APPREHENDED VESSELS/YEAR	VALUE LOSS (USD)	VALUE LOSS (TONNES)
Australia	2016-2019	18	1,144,800	572
Indonesia	2015-2019	1	70,258,776	35,130
Papua New Guinea	2016, 2018-2019	139	8,840,400	4,420
Timor-Leste	2017	1	63,000	32
TOTAL		159	80,306,976	40,154

A major barrier to IUU fishing mitigation remains a lack of data; this hinders policymakers from enacting effective regulations and policies; while Table 18 shows the results of a recent ATSEA-2 assessment, it is expected that actual IUU activity is significantly higher (Afriansyah et al., 2021). New technologies have developed considerably in the past decade, including vessel monitoring systems (VMS), remote sensing applications such as Global Fishing Watch, and automatic identification system (AIS) on larger vessels; however capacity to use these tools effectively, and the cost in doing so may currently prevent their even use across the ATS. Detecting entry by illegal vessels, and then deploying enforcement capabilities remains challenging and expensive, particularly for Papua New Guinea and Timor-Leste.

In 2017, MAF issued a 12-month permit to 15 Chinese-registered industrial fishing vessels to operate in the Timor Sea, but the permits were revoked after an NGO reported evidence of illegal fishing, including harvesting of CITES-listed species and suspected transshipment, illegal in Timor-Leste. While the vessels were legally permitted to fish within Timor-Leste's waters, their fisheries operations were exposed as illegal; this example highlights the complexity of challenges for fisheries managers, particularly in those countries with modest budgets.

Parallel to issues of IUU fishing are the illegal value chains that link the operations of fishers to markets within and beyond the ATS. They may be illegal for several reasons, including illegal transshipment or movement of product across international borders, trade in protected species (e.g., CITES-listed species), non-compliance with export requirements, or sourcing product fished illegally. Illegal value chains may operate adjacent to legal value chains. Busilacchi et al. (2021) reported that legal value chains for three key Papua New Guinea marine products; beche-de-mer, shark fin and fish maw operated through Papua New Guinea, while illegal chains operated through Merauke, Indonesia, aided by unlicensed Indonesian middlemen crossing the border to trade with Papua New Guinea coastal communities. Survey participants reported that they continued to trade fish illegally because they needed to improve their living standards, and that illegal markets were the only markets available to them. The price for shark fin received by Papua New Guinea fishers was up to 80 times less than the endpoint sellers in Hong Kong, Singapore and Kuala Lumpur.

Fisheries bycatch in the ATS

In the EAFM assessment of the Aru Snapper fishery in WPP718, bycatch of sharks and rays was identified as a key management challenge. Longline bycatch species also included sharks, cobia, trevallies which were often sun-dried and sold separately to the 'target' catch of snappers, croakers, groupers. Bycaught sharks are often finned, with only fins retained and sold by crew.

Bycatch is often associated with trawl fisheries, as the mobile gears can interact with larger areas of the marine environment than set gears. The NPF operates according to comprehensive bycatch reduction strategy. The 2020-2024 strategy is focused on addressing bycatch of 'priority species', including ETP species such as sawfishes and marine reptiles including sea turtles and sea snakes. The Tiger Prawn fishery often results in larger quantities of finfish bycatch. A crew-based observer system is in place to assist with monitoring and data collection. Priority species outlined in the strategy include sea snakes and sawfish (noting previous successes in mitigating sea turtle bycatch).

Since the early 2000s, the NPF has piloted and mandated numerous forms of bycatch exclusion devices including Turtle Excluder Devices (TEDs) including chute forms to exclude larger animals including turtles and elasmobranchs, and square mesh panels, which can help to reduce small finfish catch. Generally, trawl shot time has also been reduced, so that animals caught in nets have better prospects of being returned to the water alive. Since the introduction of TEDs and BRDs it is estimated turtle catch in the NPF has been reduced from around 5,000-6,000/year (with mortality rates of between 10-22%) to less than 30; a reduction to less than 0.5% of pre-TED mortality rates, to the point where it is now considered a negligible source of turtle mortality (CSIRO, 2021). Similarly, the industry body reports a 73% reduction in capture of sawfish species since the introduction of BRDs (Burke et al., 2012)

Other bycatch issues in the region include the incidental capture of elasmobranchs in the Papua New Guinea-Indonesia transboundary fish maw fishery. Surveys conducted in Papua New Guinea between 2017 and 2020 observed 38 species captured as bycatch, predominantly in monofilament gill nets targeting teleost species for swim bladder. In the southern study site in the Western Provinces, *Glyphis* spp. river sharks comprised 29.4% of observations in the south, while *Pristidae* sawfishes made up 20.3% of captures. With the species in decline, or at risk of decline, the fishery represents the primary threat to their populations (Grant et al., 2021)

Fisheries impacts on habitats

Demersal fisheries such as trawl fisheries are most commonly associated with adverse impacts on marine environments. Pelagic fisheries interact less, if at all with benthic habitats, but demersal trawls make contact with the seabed and can damage benthic communities, depending on the size and weight of gears used. With the permanent closure of Indonesia's trawl fisheries in 2021, Australia is now the only ATS country with an active trawl industry in the ATS region; the MSC-certified Northern Prawn Fishery (NPF) operates within the Australian Fishing Zone. Figure 16 illustrates the spatial extent of the fishery, extending from Cape York and the Torres Strait in the east, westward across the Australian shelf. Fisheries assessments undertaken in 2010 noted that impacts to benthic habitats were likely to be low based on fleet size at the time (52 vessels, down from more than 300 at the fishery's peak in the 1980s), and since that time the fishery has benefited from the use of continuous VMS tracking and the use of Fishery Closure Areas to protect juvenile prawn nursery (seagrass) areas to further limit impacts. It was the first prawn trawl to be certified against the MSC standard.

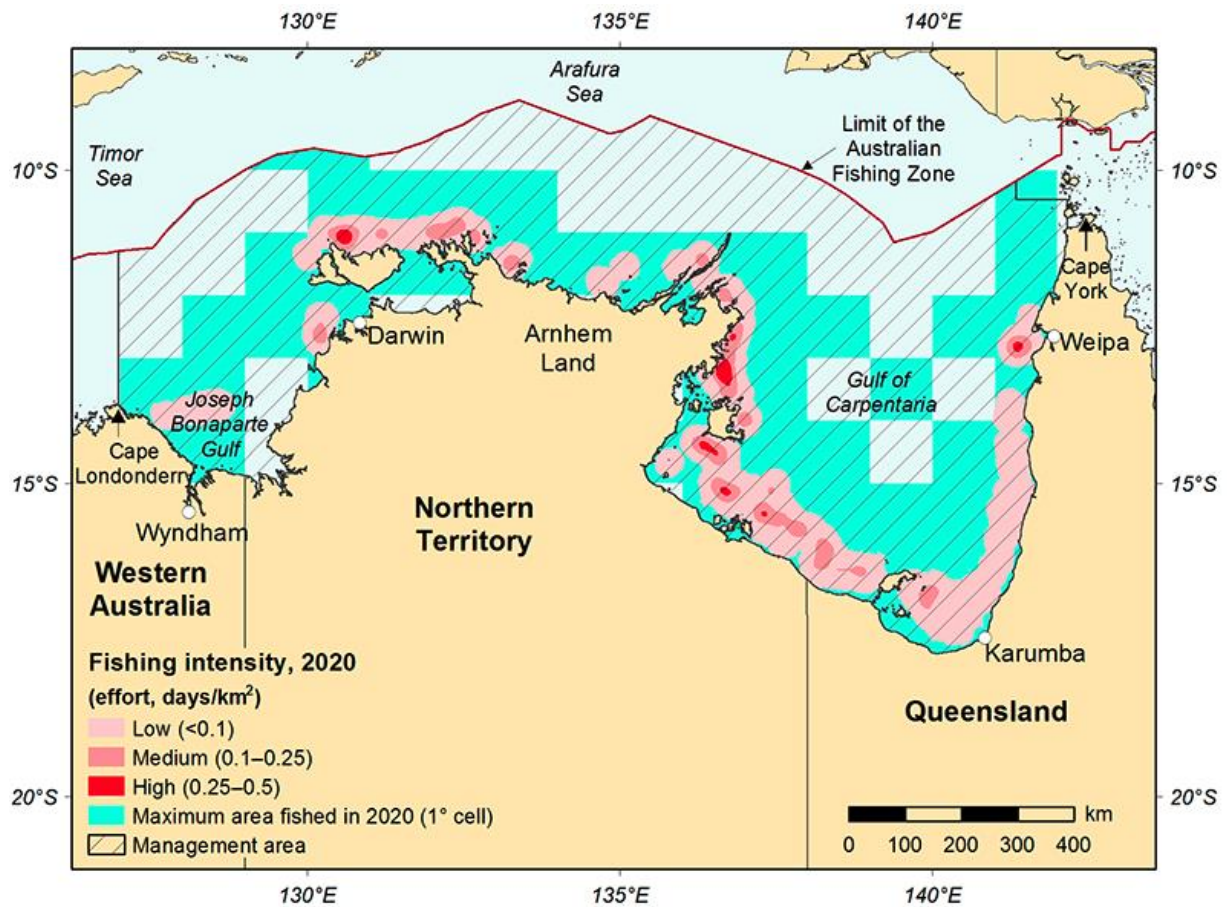


Figure 27 – Fishing intensity in the Northern Prawn Fishery, 2020 (ABARES, 2021)

Impacts of climate change on capture fisheries

Climate change was identified as a root cause of this issue; in the same way that climate impacts are likely to undermine the health of ecosystems (as outlined in Issue #2), those impacts are likely to impact certain fisheries values also. The extent to which this occurs – the vulnerability of key species to the impacts of climate change – is dependent on several factors, including their preferred habitat, life cycle characteristics (such as larval duration or age at maturation) and current status of populations.

The ATSEA-2 Regional Climate Change Vulnerability Assessment (Johnson et al., 2021) examined vulnerability of a range of commercially, locally and culturally important species for the sub-regions of Indonesia/Arafura, western Papua New Guinea, Timor-Leste, Gulf of Carpentaria and north-western Australia. As shown in Table 27, species that favour shallow water habitats, such as coral reef and mangrove-associated species including red mangrove snapper and black teatfish exhibited higher vulnerability. Green turtle reproduction includes a nesting stage on beaches, which are likely to be impacted by increased air temperature and increased abrasion. Table 19 also shows the species assessed as ‘highest priority for management’, based on their perceived local level of importance and assessed vulnerability.

Table 27 – Relative vulnerability of selected important species in ATS sub-regions (adapted from Johnson et al., 2021)

ATS Sub-region	Most vulnerable species	Least vulnerable species	Highest priority for management
Indonesia/Arafura	Black teatfish Barramundi Green turtle Hawksbill turtle Mangrove red snapper	Mackerel scads Black-lined emperor Crimson snapper Indian Ocean squid Ruby snapper	Black teatfish Wedgefish Hawksbill turtle Mangrove Red snapper Red emperor
Western Papua New Guinea	Mud crab Dugong Green turtle	Whitetip reef shark Black teatfish	Green turtle Dugong
Timor-Leste	Green turtle Flowery cod Mangrove red snapper Octopus Dugong	Forktail rabbitfish Bluefin trevally Narrow-banded Spanish mackerel Fusiliers Midnight snapper	Green turtle Dugong Flowery cod Octopus Yellowfin tuna
Gulf of Carpentaria	King threadfin Green turtle Dugong Barramundi Golden snapper	Blacktip sharks White banana prawn Scalloped hammerhead Spanish mackerel Crimson snapper	Barramundi Mud crab Green turtle Spanish mackerel
North-western Australia	Golden snapper Green turtle Dugong King threadfin Mud crab	Crimson snapper Saddle tail snapper Blacktip shark Goldband snapper White banana prawn	Black jewfish Mud crab Spanish mackerel Barramundi

4.6.7 Knowledge gaps

- Overall fish catch for ATS (ecosystem-wide) and value
- Estimates of artisanal catch
- Species, status of species targeted and landings and spatial extent of the fish maw fishery
- Patrol records (IUU fishing)
- Number of patrol groups active across ATS (including Pokmaswas, Tara Bandu groups, etc.)

4.6.8 Key references and relevant ATSEA-2 regional assessments

- Review of National Policies and Regulations of RPOA-IUU Participating Countries (Afriansyah et al., 2021)
- EAFM Plan for Timor-Leste South Coast Red Snapper Fishery (Knuckey et al., 2021)
- Fishery Baselines – an EAFM Approach to Management of Red Snapper in the ATS (Knuckey et al., 2021)

- Scaling up RBM (Rights-based Management) in the ATS (Fox et al., 2021)
- Papua New Guinea Legal Framework in Marine and Fisheries (Mitchell et al., 2021)
- Profile of Barramundi Fisheries in Merauke (PT. Multi Area Desentralisasi Pembangunan, 2021a)
- Profile of Shrimp Fisheries in Aru (PT. Multi Area Desentralisasi Pembangunan, 2021b)
- A Study of Illegal, Unreported and Unregulated (IUU) Fishing in the Arafura Sea, Indonesia (Wagey et al., 2009)

4.6.9 Recommendations to guide SAP update

- Ongoing work is required to monitor the development of PNG-ID transboundary ‘fish maw’ fishery, including the key target species, genetic and stock and habitat connectivity, locations of fishing grounds and fish landing sites, fishery participants, transboundary business arrangements, and mapping of supply chains. This work should build on recent baseline data collection undertaken by ATSEA-2 on harvest, target species and supply chains, to be incorporated in a management plan for the fishery.
- A call be made to both countries (Papua New Guinea and Indonesia-Papua Province) to make effective and stronger their current catch statistics acquisition and management practices for the transboundary barramundi fishery
- A joint bilateral committee be formed to explore the need for further research as well as developing the protocols for the possibility of joint management of this stock, as is done by Papua New Guinea and Australia regarding the Lobster Fishery.

4.7 Cross-cutting issues

As agreed by the RWG, two cross-cutting issues were proposed for inclusion in the TDA adjacent to the three agreed priority transboundary issues. While different types of issues, both warrant special attention throughout the development of the next iteration of the SAP. The first, climate change is recognised as a common root cause and driver across all transboundary issues (to varying extents), and therefore warrants particular attention in SAP formulation. Inclusion of the second, Gender Equity and Social Inclusion (GESI) is concerned with ensuring that inherent structural inequalities are adequately considered in responses to the three transboundary issues identified.

4.7.1 Climate change

Johnson et al. (2021) provides a detailed analysis of the vulnerabilities and likely impacts of climate change in the ATS region across a number of domains, including ecosystems, species and derived uses. Further, Fundamental concern #2.1 of this document is primarily concerned with specific impacts of climate change on ATS ecosystems, (ecological) communities and critical habitats.

Table 28 – Climate change considerations across priority transboundary issues

ATS Transboundary Issue	Fundamental concerns ('sub-issues')	Climate change considerations
Issue #1: Pollution of marine and coastal environment	1.1 Oil spill	Climate change may affect oceanographic conditions that manifest oil spill impacts on coastal ecosystems and values
	1.2 Harmful marine debris including plastic pollution	Climate change may affect oceanographic conditions that manifest marine debris impacts on coastal ecosystems and values
	1.3 Abandoned, lost and discarded fishing gear (ALDFG)	Climate change may affect oceanographic conditions that manifest ALDFG impacts on coastal ecosystems and values
	1.4 Land-based pollution and sedimentation	Climate change has implications for land-based pollution through altered or increased runoff patterns and alterations to sensitive coastal ecosystems, and possible changes in form/bioavailability of various pollutants (heavy metals, POPs, etc.) due to changes in seawater temperature, acidity/pH
Issue #2: Ecosystem, habitat and biodiversity decline	2.1 Climate impacts on ecosystems, ecological communities and critical habitats	Outlined in full in Fundamental Concern #2.1
	2.2 Declining populations of endangered, threatened, and protected (ETP) species	Numerous potential implications including altered range, altered marine food web, reduced foraging or reproductive habitat (e.g., turtle nesting beaches), altered physiology or behaviour (e.g., sex ratio of turtle hatchlings)
	2.3 Deterioration of critical habitats, ecosystems and communities resulting from anthropogenic causes	Not relevant (climate impacts to ecosystems and habitats covered in fundamental concern #2.1)
Issue #3: Unsustainable capture fisheries	3.1 Unsustainable harvest levels (overfishing)	Climate change impacts may affect regional distribution of fish stocks, altering fishing behaviour of regional fleets, and act as a primary or secondary driver of stock declines in

		combination with fishing pressure.
	3.2 Illegal, unreported and unregulated (IUU) fishing	Climate change impacts may affect regional distribution of fish stocks, altering fishing behaviour of regional fleets
	3.3 Fisheries bycatch	Climate change may exacerbate declines caused by other factors
	3.4 Fisheries impacts on habitats	Climate change may exacerbate declines caused by other factors

4.7.2 Gender equity and social inclusion

As outlined in Section 3.3.4, structural gender and social inequalities in place in some ATS communities may mean that transboundary environmental issues affect women in different ways to men, and in some cases, more severely. Further, in some instances, women may carry the burden of remediation more than men. Table 29 highlights specific gender and social inclusion considerations as they relate to transboundary issues and fundamental concerns.

Table 29 – GESI considerations across priority transboundary issues

ATS Transboundary Issue	Fundamental concerns ('sub-issues')	GESI considerations
Issue #1: Pollution of marine and coastal environment	1.1 Oil spills	Women and households in Rote, Timor-Leste may be vulnerable to impacts of oil spills. Questionable whether economic benefits of the industry are shared equally.
	1.2 Harmful marine debris including plastic pollution	Women may shoulder additional burden of environmental remediation at local level due to marine debris issues
	1.3 Abandoned, lost and discarded fishing gear (ALDFG)	
	1.4 Land-based pollution and sedimentation	These issues may impact food security in coastal areas; women are more likely to carry the burden of food insecurity due to heavily gendered caring roles.
Issue #2: Ecosystem, habitat and biodiversity decline	2.1 Climate impacts on ecosystems, ecological communities and critical habitats	Due to inherent inequality, women are likely to experience impacts of climate change disproportionately; unless inequalities may be addressed systematically, their involvement in mitigation and adaptation may increase burden borne by women.

	2.2 Declining populations of endangered, threatened, and protected (ETP) species	Some ETP species are known to be important to indigenous communities for traditional or cultural reasons.
	2.3 Deterioration of critical habitats, ecosystems and communities resulting from anthropogenic causes	Damage to nearshore fisheries resources such as intertidal reefs, coral reefs and mangroves may impact food security; women are more likely to carry the burden of food insecurity due to heavily gendered caring roles
Issue #3: Unsustainable capture fisheries	3.1 Unsustainable harvest levels (overfishing)	<p>Fisheries tend to be male-dominated (harvest sector). Some progress observed in South Fly as education standards improve.</p> <p>The post-harvest sector provides more opportunities for women; as a result, limited employment opportunities for women in seafood industries may be adversely impacted due to overfishing.</p>
	3.2 Illegal, unreported and unregulated (IUU) fishing	Small-scale, artisanal fisheries including subsistence fisheries important for local-level food security may at times fit into IUU category, particularly unreported or unregulated.
	3.3 Fisheries bycatch	
	3.4 Fisheries impacts on habitats	Damage to nearshore fisheries resources such as intertidal reefs, coral reefs and mangroves may impact food security; women are more likely to shoulder the household burden of reduced fisheries productivity

Root Causes of Transboundary Issues



Chapter 5

In its causal chain analyses of the three priority transboundary issues, the RWG identified a total of twelve root causes. Of these, five are global in nature, and seven regional (Table 30).

Global root causes include global demand for seafood, global demand for shipping, climate change, global market demand for certain sizes ("golden size"), and global market for new marine products (including ETPs). Regional root causes include population growth in the region, tourism growth in the region, lack of knowledge or education of marine resources, inadequate regulatory mechanisms, land use change / intensification in ATS region, poverty and food insecurity in ATS region, and natural disasters.

Of all root causes noted, only one; natural disasters, was not anthropogenic in nature. The implication of this is that while some root causes identified may be beyond the specific scope of the ATSEA-2 project, many may be addressed by ATS littoral nations in broader regional and national policy discourse.

Table 30 – Commonalities among root causes

ROOT CAUSE	SCALE	PRIORITY TRANSBOUNDARY ISSUE		
		Issue#1 – Pollution of marine and coastal environments	Issue #2 – Decline of ecosystems, habitats and biodiversity	Issue #3 – Unsustainable fisheries
Global demand for seafood	Global	✓	✓	✓
Population growth in the ATS region	Regional	✓	✓	✓
Tourism growth in the ATS region	Regional	✓	✓	✓
Lack of knowledge or education of marine resources	Regional	✓		
Inadequate regulatory mechanisms	Regional	✓		
Global demand for shipping	Global	✓	✓	
Climate change	Global	✓	✓	✓
Natural disasters	Regional	✓		

Land use change / intensification in ATS region	Regional		✓	
Poverty and food insecurity in ATS region	Regional		✓	✓
Global market demand for certain sizes ("golden size")	Global			✓
Global market for new marine products (including ETPs)	Global		✓	✓

Globally, IPBES notes five key drivers of biodiversity loss, as follows (in order of largest impact):

- Changes in land and sea use;
- Direct exploitation of organisms;
- Climate change;
- Pollution; and
- Invasion of alien species.

It goes on to note that the underlying causes (root causes) of these five drivers include societal values and behaviours that include production and consumption patterns, human population dynamics and trends, trade, technological innovation, and ‘local through global’ governance (IPBES, 2019). In considering the root causes of transboundary issues identified as specific to the ATS, these global underlying factors (many of which are broader in scope) may also be considered when developing the SAP.

Governance and Institutions



Chapter 6

The following section summarises key aspects of legal, governance and institutional frameworks in the ATS region as they relate to the key Transboundary Issues outlined in Chapter 4. It should therefore not be considered an exhaustive analysis; rather, it is intended to support SAP processes by focusing on the legal and institutional frameworks that relate to key issues.

6.1 Stakeholder analysis

Appendix 8 summarises the broad range of stakeholders relevant to the three identified priority transboundary issues. A rapid analysis by the RWG identified almost 50 government agencies, more than 25 not-for-profit organisations, more than a dozen research organisations and several private sector bodies with direct interests in the management of ATS and its resources, and particularly the transboundary issues identified within the TDA.

6.2 ATS Governance and implications for TDA

Existing governance of the ATS region and its environmental assets is a mosaic of both binding and voluntary frameworks and measures operating at the regional level, and the national and sub-national regulatory environments and sectoral arrangements within the four littoral countries and sub-national jurisdictions.

The complete legal, policy and regulatory environments for marine ATS littoral countries are outlined in ATSEA-2 Country Synthesis Reports for Indonesia (Yonvitner et al., 2022), Papua New Guinea (Mana and Mungkaje, 2022) and Timor-Leste (Fonseca et al., 2022) and are not further elaborated here; the following section highlights existing governance arrangements of key sectors at regional and national levels, as they relate to the 2022 priority transboundary issues outlined in Section 4.

The need for a regional governance response to manage transboundary threats and issues has been identified in a regional governance assessment completed for ATSEA-2 in 2021 (Pet-Soede, 2021), and proposed arrangements are outlined in Section 6.2.3.

6.2.1 Governance and management of territorial waters and resources

Australia

In Australia, matters of national environmental significance are managed in accordance with the Environmental Protection and Biodiversity Conservation (EPBC) Act. These include federally listed threatened species and ecological communities, migratory species, wetlands of international significance, and all Commonwealth marine areas (including protected areas). Within the ATS region of Australia's EEZ, there is a network of eight Australian Marine Parks, covering a total 157,480km². The 'North Marine Parks Network' is managed for multiple uses by the North Marine Parks Advisory Committee according to a consolidated management plan (Australia Marine Parks, 2018). The Australian Maritime Safety Authority is responsible for the implementation of marine pollution control in accordance with MARPOL provisions, as well as oil spill preparedness and response.

In accordance with the Fisheries Administration Act 1991 and the associated Fisheries Management Act 1991, Australia's federal system sees fisheries management responsibilities divided between the Commonwealth (the 'federation') and its states and territories. Fisheries in 'coastal waters' out to 3 nautical miles are managed by the states and territories, and beyond this coastal limit, by a federal agency, the Australian Fisheries Management Agency (AFMA). AFMA may also delegate management of offshore fisheries beyond the coastal limit to the states and territories under joint management agreements; this is the case in Queensland, the Northern Territory and Western Australia (which all have coastal waters within the ATS).

Indonesia

Fisheries management in Indonesia is multi-tiered, with small-scale fisheries now defined as those fishing from boats of <10GT (whereas once the definition was <5GT). Provincial governments manage fisheries within 12 nautical miles from shore, and within this, small-scale fishers are granted exclusive access to waters less than 4 nautical miles from shore, essentially under an open-access arrangement. Large-scale, or industrial-scale fisheries operate beyond this 12 nautical mile limit and are licensed by national government. Three fishing 'zones' (Jalur) and five vessel sizes are defined by Indonesian law, as follows:

Fishing gear regulation as outlined in Ministerial Regulation PerMen KP No.18/2021 (MMAF, 2021)

- Jalur I (0-4 nautical mile): ≤5 GT
- Jalur II (4-12 nautical mile): 5-30 GT
- Jalur III (>12 nautical mile): >30 GT

Fishing vessel criteria:

- Boat without engine
- Boat with engine ≤5 GT
- Boat with engine >5 - 10 GT
- Boat with engine >10 - 30 GT
- Boat with engine >30 GT

Indonesia's 1945 constitution and Fisheries Law No. 31/2004 essentially mandate a position of open-access regarding the use of fisheries resources; that fish resources are to be utilised optimally for 'greatest prosperity of the Indonesian people', through an 'even distribution in the utilization thereof' by giving priority to the expansion of work opportunities and improvement of fishers' living standards.

Today, the Arafura Sea is managed as Fisheries Management Area 718 (WPP718) according to an area-based EAFM framework. The first iteration of the WPP718 management plan was endorsed by MMAF in June 2014, the first of its kind in Indonesia. PERMEN 29/2012 mandated the creation of fisheries management plans, after which other management plans relevant to the ATS include a West Nusa Tenggara Sharks and Rays Action Plan, in support of the National Plan of Action for the Conservation and Management of Sharks.

Relevant national laws and regulations related to fisheries management include the following:

- Law 31/2004 and Law 45/2009 on Fisheries, together known as the Fisheries Law
- Ministerial Regulation 1/2009 on Fisheries Management Zones (WPP-RIs)
- Ministerial Regulation 29/2012 on Fisheries Management Planning

- Law 23/2014 on Regional Government, which grants the national government responsibility for managing archipelagic and EEZ waters while allocating authority to manage coastal waters from 0 to 12 nautical miles offshore to provincial governments
- Presidential Regulation No. 115/2015 on a Task Force for the Eradication of Illegal Fishing
- Ministerial Regulation 56/2014 on Moratorium on Fisheries Business Licensing in the Fisheries Management Region of the Republic of Indonesia
- Ministerial Regulation 57/2014 banning at-sea transshipment
- Ministerial Regulation 10/2015 regarding the exploitation of fish resources by fishing vessels manufactured overseas with sizes of 150-400 GT

Source: ATS Financial Landscape and Guidance Report (Greenberg et al., 2021)

Further information on Indonesia’s national legislation and policies related to marine and coastal management and transboundary issues identified within this report is contained in the ATSEA-2 Country Synthesis Report (Yonvitner et al., 2022)

Timor-Leste

Timor-Leste’s fisheries law reflects the importance of fisheries resources to local communities. While commercial fishing is technically subject to licensing arrangements overseen by the General Directorate of Fisheries and Aquaculture, Ministry of Agriculture and Fisheries, the Fisheries Decree Law 2004 highlights the importance of small-scale fisheries to the community and subsistence fishing is exempt from licensing.

There is an unusually strong legal basis for applying local customs in Timor-Leste; the Environmental Framework Law (Article 8) states that tara bandu may be ‘established through local common law to conserve the environment and promote the sustainable use of natural resources’, while the Constitution affirms that “The State shall recognize and value the norms and customs of East Timor that are not contrary to the Constitution and to any legislation dealing specifically with customary law”.

A nascent network of locally managed marine protected areas (MPAs) is administered by the National Directorate of Fisheries and Aquaculture (NDFA) under the MAF, currently focused on Nino Konis Santana National Park (NKSNP) and MPAs on Atauro Island and in Batugade Subdistrict. The ATSEA-2 Design of the Arafura Timor Sea MPA Network identified 935.231 km² of existing MPAs (including NKSNP, Atauro) and 83.27 km² of proposed MPAs in Liquica, as well as Areas of Interest (AOIs) totalling 9,564.38 km² at multiple new and extension sites (Greenberg et al., 2022).

In April 2023, Timor-Leste adopted a National Oceans Policy intended to; provide a whole-of-government approach to addressing national marine issues, enhance direction of future ocean use and management, assist external support bodies to understand national ocean priorities, and guide the country in the development of detailed implementation plans to achieve its vision of a healthy and secure ocean that sustains livelihoods and prosperity of the people of Timor-Leste in a fair and equitable manner.

Relevant Regulations and Policies include the following:

- Government Decree Law no. 6/2004 on General Bases of the Legal Regime for the Management and Regulation of Fisheries and Aquaculture
- Government Decree Law No. 5 on General Regulation on Fishing (2004)
- Decree Law no. 21/2008 on the Implementation of Satellite System for Monitoring Fishing Vehicles
- Decree Law No. 12/2004 Crimes Related to Fishing
- Decree Law no. 13/2005 on Petroleum Activities
- Decree Law no. 6/2020 on Establishing the Legal Regime for the Protection and Conservation of Biodiversity
- Decree Law no. 6/2012 Environmental Framework Law
- Decree Law no. 5/2011 Environmental Licensing
- Decree Law no. 5/2016 Creating the National System of Protected Areas
- Ministry of Agriculture and Fisheries Strategic Plan 2014-2020
- Timor-Leste National Aquaculture Strategy 2012-2030
- National Biodiversity Strategy Action Plan of Timor-Leste 2011-2020
- Timor-Leste Strategic Development Plan 2011-2030
- National Adaptation Programme of Action (NAPA)
- National Adaptation Plan
- National Climate Change Policy

Papua New Guinea

Papua New Guinea's development is guided by its Vision 2050 Kaiku, which sets out 7 strategic pillars for the sustainable and equitable development of the country; these pillars reflect economic, social, institutional, sustainability, cultural, international relations and strategic priorities. These directions are further elaborated in the National Development Strategic Plan (DSP), a twenty-year plan which sets out development targets for the country by 2030.

Papua New Guinea has a National Oceans Policy, which aligns to Vision 2050 and the UN-SDGs, reflects international best practice for oceans management, and incorporates traditional knowledge and customs relating to ocean and coastal resources management. It provides a national framework for ocean governance and includes strategic direction for Integrated Ocean Management (IOM) and Integrated Coastal Zone Management (ICZM).

The management of fisheries by Papua New Guinea's National Fisheries Authority (NFA) is mandated by the Fisheries Management Act 1998 (as amended) and guided by its Fisheries Strategic Plan (FSP) 2021-2030, which is built around 11 Key Results Areas related to trade and revenues, food security, sustainable management of the resource, research and development and international cooperation. Papua New Guinea's fisheries sector is dominated by the tuna fishery landing around half a million tonnes annually. The FSP does recognise the need for better management and reporting of the coastal fishery, noting its importance to communities for food security and livelihoods. Under ATSEA-2, a new EAFM fisheries management plan is being developed for the South Fly; the Fore-coast Artisanal Fisheries Management Plan (community EAFM plans document) will strengthen fisheries management at site, and serve as a model for management of Papua New Guinea coastal artisanal fisheries more broadly.

Protected areas are managed according to the Papua New Guinea Policy on Protected Areas (2014) administered by the Conservation and Environment Protection Authority (CEPA). In the marine realm, National Marine Sanctuaries (NMS) are typically zoned PAs (IUCN Category IV) while Regional Protected Areas may take the form of Community Conservation Areas (CCAs) or Locally Managed Marine Areas (LMMAs), which allow for traditional subsistence fishing and resource collection (IUCN Category V). Both may incorporate customary law, including the customary tenure systems still practiced throughout the country; in Papua New Guinea more broadly, these practices are recognised by the Underlying Law Act (2000).

6.2.2 Bilateral and multilateral management arrangements

The [ATSEA-2 Review of National Policies and Regulations of RPOA-IUU Participating Countries](#) provides detailed information on the suite of policies employed by ATS littoral nations in tackling IUU. This is a dynamic and changeable set of issues and responses and the Arafura and Timor Sub Region Working Group of RPOA-IUU should be considered as the primary cooperative mechanism and source of information on the issue.

In addition to post-2011 developments in transboundary collaboration IUU outlined above, bilateral arrangements for fisheries management exist also. These long-standing arrangements may present useful models for other transboundary management systems in the ATS.

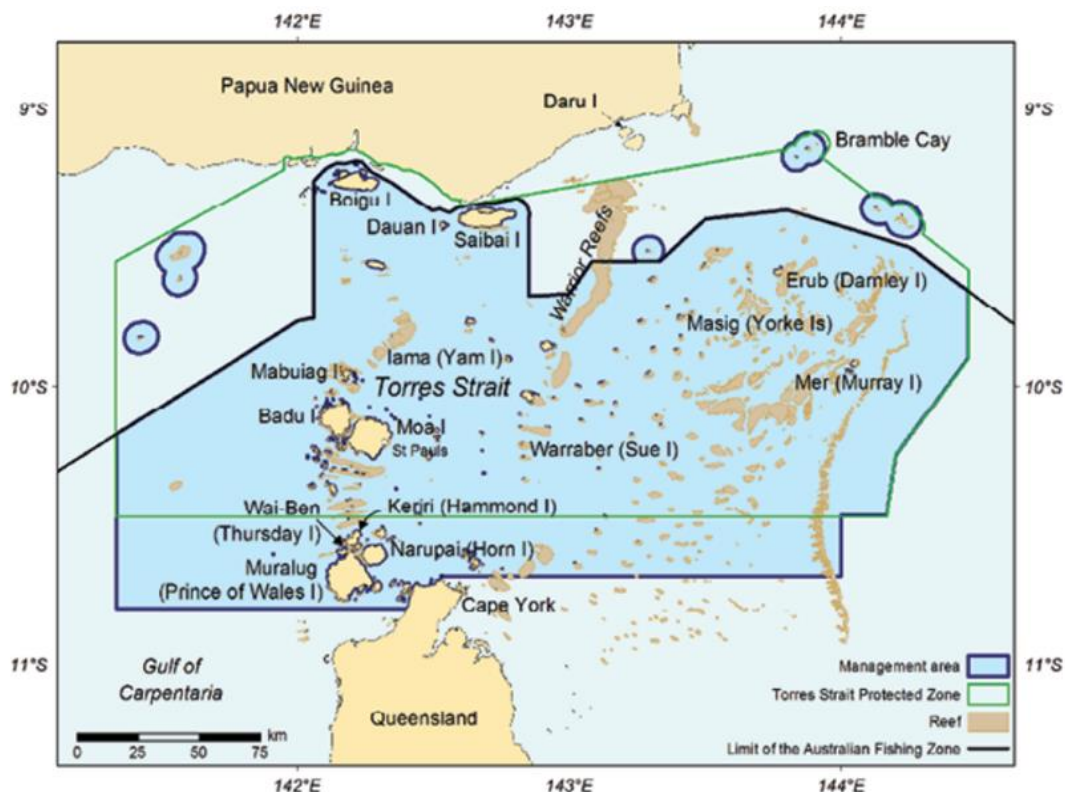


Figure 28 – Torres Strait Protected Zone and ‘Management area’ for Tropical Rock Lobster fisheries (Australia Government, 2022)

In the Torres Strait, between Australia and Papua New Guinea, Fisheries management is governed by the provisions of the Torres Strait Treaty. Certain fisheries (including rock lobster) are managed under a Protected Zone Joint Authority (PZJA), which is responsible for the management of commercial and traditional fishing in the Australian area of the Torres Strait Protected Zone (TSPZ) and designated adjacent waters (Figure 28). Commercial fishing is one of the most significant economic activities in the TSPZ and provides important incomes and financial independence for traditional communities.

Also, in the ATS, a 50,000km² area of water between Indonesia and Australia known as the ‘MoU Box’ is managed according to a joint Fisheries Cooperation Agreement between the two countries. The Australia-Indonesia Memorandum of Understanding regarding the Operations of Indonesian Traditional Fishermen in Areas of the Australian Fishing Zone and Continental Shelf (1974) agreement sets out joint management arrangements including a 200-mile provisional fisheries surveillance and enforcement line (PFSEL), and access rights for Indonesian traditional fishers permitted to fish in Australian waters using traditional fishing methods only, in unpowered vessels. MoU Box spatial management arrangements are shown in the map in Appendix 6.

Regional Fisheries Management Organisations (RFMOs)

Two Regional Fisheries Management Organisations (RFMOs) also operate within parts of the ATS. The Western and Central Pacific Fisheries Commission (WCPFC) also known as the ‘Tuna Commission’) includes Australia and Papua New Guinea as Contracting Parties, as custodian states and fishing nations. The WCPFC includes some 70% of global tuna production, although focuses mainly on promoting cooperative management of stocks of highly migratory tuna species across high seas and is therefore of limited relevance to ATS. Similarly, the Indian Ocean Tuna Commission (IOTC) is an RFMO with 31 Contracting Parties, including Australia and Indonesia; the IOTC’s mandate is the sustainable management of migratory stocks of tuna and tuna-like species in the Indian Ocean.

RPOA-IUU (Sub Regional Arafura – Timor Seas)

The Southeast Asian Regional Plan of Action to Promote Responsible Fishing Practices including Combating IUU Fishing (RPOA-IUU) is a ministerial initiative of eleven countries: Australia, Brunei Darussalam, Cambodia, East Timor, Indonesia, Malaysia, Papua New Guinea, Philippines, Singapore, Thailand and Vietnam. The aim of the RPOA-IUU is to promote responsible fishing practices and combat IUU fishing in the Southeast Asian region. The initiative is the regional extension of a global Plan of Action (IPOA-IUU) adopted by Food and Agriculture Organisation (FAO) members in 2001.

At the level of ATS, a Sub Regional working group including the four ATS littoral countries has also been established. Support to the RPOA-IUU has been a priority strategy of ATSEA, since IUU was identified as a priority transboundary concern in the 2011 ATS TDA. Australia currently plays a lead role in the coordination of Monitoring, Control and Surveillance (MCS) activities in line with the RPOA.

The Coral Triangle Initiative for Coral Reefs, Fisheries and Food Security (CTI-CFF)

The CTI-CFF is a partnership between Indonesia, Malaysia, Papua New Guinea, the Philippines, Solomon Islands and Timor-Leste. The CTI-CFF is focused on improving marine conservation and management through sustainable livelihoods, food security and economic development. It has working groups on Seascapes, Marine Protected Areas, EAFM, Climate Change Adaptation, and Threatened Species, and is coordinated by a Regional Secretariat that reports to a regional Council of Ministers via a Committee of Senior Officials. Australia is an Official Development Partner of the CTI-CFF.

The Archipelagic & Island States Forum (AIS Forum)

Indonesia, Papua New Guinea and Timor-Leste are all member states in the AIS Forum; a global platform that brings together 47 such states to collectively address challenges of resource usage for sustainable economic growth, climate change resiliency, ocean pollution, emergency management and the enhancement of sustainable fisheries. Through the joint Manado Declaration, member states have agreed to focus on four collaborative areas; climate change mitigation and adaptation, blue economy, marine plastic debris, and good maritime governance. It advances these focal areas through programs of research and development, entrepreneurship, innovative financing and regional awareness raising.

6.2.3 International ocean-related commitments and instruments

Appendix 9 pertains to ocean-related international instruments, commitments, and related agreements to which ATS countries are signatories, and status of any ongoing accession or ratification processes by countries.

6.2.4 Development of a Regional Governance Mechanism (RGM) for the ATS

The inaugural ATSEA program established a joint commitment by Australia, Indonesia, Papua New Guinea and Timor-Leste for the improved management and governance of the Arafura and Timor Seas (ATS) ecosystems to serve their overarching objectives of sustainable development in the region. While this joint commitment stands, the dimensions of many of the transboundary challenges faced by the littoral countries have changed over time, as highlighted in this, the second TDA for the region.

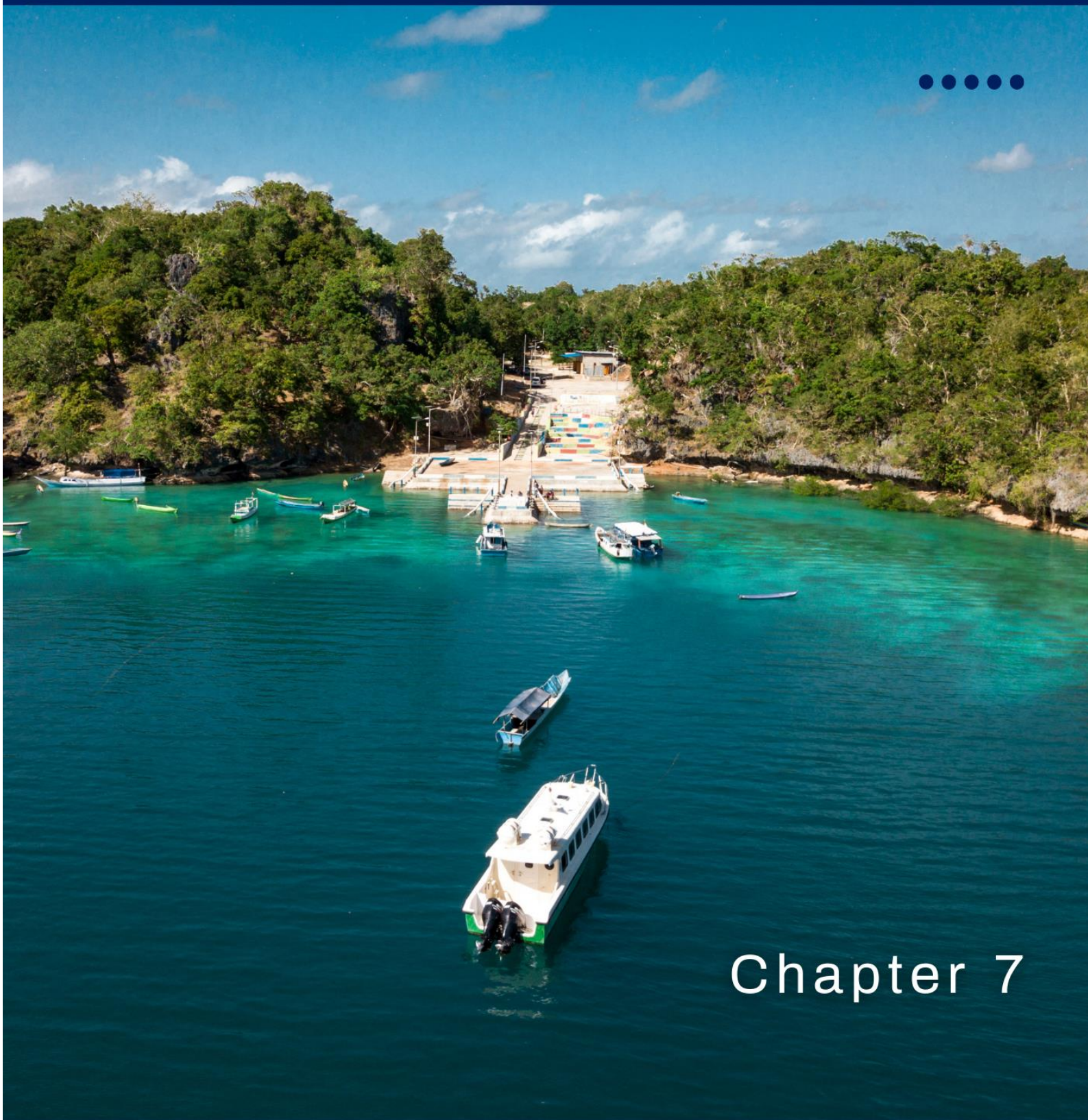
Under ATSEA-2 a regional assessment of governance options was undertaken to determine the most appropriate options for enabling cooperation and strengthening governance of shared and transboundary environmental values and assets. The assessment has undergone a series of national and regional consultations, which led to the two options or models that were further presented and discussed through national workshops in 2022, as well as Pre-RSC Consultative Meeting (Oct. 2022) and the 4th Regional Steering Committee (RSC) Meeting (Nov. 2022).

Under ATSEA-2, a comprehensive governance framework has been proposed, which incorporates the following key elements:

- ATS Council of Ministers (COM) which will provide the highest levels of guidance and decision-making on behalf of the four parties
- A Regional Coordination Committee (RCC) comprised of representatives from the four countries who will lead the implementation of the governance mechanism, initiate and monitor effective actions under agreed workplans to deliver the Strategic Action Programme (SAP)
- A Regional Secretariat (RS), which guided by the RCC provides secretariat functions to the RCC, oversees monitoring and evaluation of workplans and of programme impacts to guide adaptive management and resource allocation, and reports on progress to RCC
- Regional Stakeholder Working Groups (RSWG) which will foster the inclusive engagement of regional stakeholders based on thematic needs
- At national level, these structures would be supported by National Coordination Committees (NCCs), National Secretariats (NSs) and National Stakeholder Working Groups (NSWGs) for the four littoral countries.
- Strategic Development Partners will be engaged to support and fund targeted projects contributing to SAP implementation.

Surveys conducted among partner countries indicates that the eventual governance framework should support both legally binding actions and voluntary actions; work to finalise the governance structure is ongoing.

Summary and Recommendations



Chapter 7

7.1 Summary of findings

This TDA highlights the broad range of transboundary and shared environmental challenges facing the ATS region. It also reveals an enormous amount of progress in addressing these issues since 2011, including the introduction of EAFM and FIPs, development of important community patrol systems, progression of regional, coordinated approaches to IUU, and a much more sophisticated understanding of many of the issues first analysed more than a decade ago.

However, despite the many intensive and coordinated efforts of ATS littoral countries, and of regional and national-level stakeholders since 2011, this TDA highlights numerous alarming trends, that if left unabated, will compound existing threats and continue to undermine ecosystem health and human wellbeing. These include projected increases in plastic production, the accumulation of ghost nets, numerous climate related factors including SST, SLR and acidification, overfishing, and unprecedented global declines in biodiversity and ecosystem services. The impacts of climate change are already being felt and are beginning to undermine ecosystem health and human wellbeing.

More broadly, the TDA highlights progress on aspects of ocean governance including expansion of marine protected area coverage, uptake of marine spatial planning, adoption of the ‘blue economy’ frame and valuation of ecosystem services, and enhanced monitoring and ability to produce spatial information on values, uses and threats. Social and economic progress in ATS jurisdictions, although varied, indicates positive trends for all countries.

The TDA also highlights critical information gaps; the lack of a consolidated regional approach to understanding capture fisheries production, gaps in our knowledge of the needs of ETP species, and the extent to which habitats and species span jurisdictional boundaries.

Further, this TDA identifies new and emerging issues that were not present at the time of the 2011 TDA, including:

- the transboundary Indonesia-Papua New Guinea ‘maw fish’ fishery,
- greater potential for seabed mining, and
- the possibility of expanded petroleum resource extraction in Timor-Leste as a result of maritime jurisdiction resolution with Australia.

This TDA also presents a much clearer picture of likely climate change impacts, which must be considered a priority, cross-cutting issue as the ATS moves forward.

7.2. Linking the TDA to SAP: subsequent steps prior to SAP formulation

Prior to commencement of the preparation of the next iteration of the ten-year Strategic Action Programme (SAP) for ATS, several integration steps were conducted in order to link the findings of this TDA analysis with SAP strategic thinking and planning. These steps include further prioritisation and selection of issues to be addressed by the SAP, the identification of leverage points, and further discussions regarding ATSEA’s niche and value-add in terms of responding to transboundary environmental issues. Pursuant to this, a Regional Transboundary Diagnostic

Analysis (TDA) and Strategic Action Programme (SAP) Updating Workshop was conducted from February 21-24, 2023 at Prama Sanur Beach Bali, Indonesia.

Key results from this workshop included the following:

- The identification of ‘leverage points’ pertinent to the key issues and fundamental concerns outlined in this TDA
- Further prioritisation of transboundary issues for inclusion in next iteration of SAP, on the basis of an assessment of the scope, severity and reversibility (feasibility)
- Initial consensus on four key issues for the updated SAP: marine plastic pollution (including ALDFG); oil spill; declines in regional populations of ETP species; and IUU fishing
- A greater shared understanding of ATSEA’s niche and ‘value-add’. As the only entity and partnership focused on management of ATS as a semi-enclosed sea (based on the UNCLOS definition), ATSEA has a unique ability to capture political engagement at a high level, introduce and apply best practice management approaches at the ecosystem level (e.g., regional rollout of EAFM), leverage blue economy country- and regional-level initiatives, as well as an ability to couple ‘on-the-ground’ local level initiatives with policy development across all four countries.

The outputs from the February 21-24 Bali meeting will serve as an initial reference for the renewal of the SAP for ATS, noting that any initial prioritisation or selection of issues may be subject to further changes. (Link to meeting proceedings: [ATSEA-2 Regional TDA-SAP Updating Workshop Report \(21-24Feb2023\)](#))

7.3 Summary of technical recommendations

Table 31 collates all RWG recommendations contained throughout this TDA, as proposed for each technical issue. Inclusion of recommendations in the table below does not necessarily reflect the views of ATSEA-2, and should not be considered a mandate, or prerequisite for inclusion in the revised SAP. However, the recommendations are summarised here in order to assist RWG in SAP strategic thinking and development and should be referred to throughout that planning process.

Table 31 – Summary of recommendations

ATS Transboundary Issue	Fundamental concerns ('sub-issues')	Recommendations for SAP
Issue #1: Pollution of marine and coastal environment	1.1 Oil spills	<ul style="list-style-type: none"> ● Immediate oil spill preparedness and response actions are needed for Rote and Timor Islands (Shin, 2021) ● Ratify 'OPRC 1990' for countries which have not done so (e.g., IDN, TL, PNG) ● Develop a regional platform for oil spill response ● Build national capacity to respond to oil spills and marine debris
	1.2 Harmful marine debris including plastic pollution	<ul style="list-style-type: none"> ● Applicable technologies for 3Rs from land and sea-based sources ● Consider bans on single use plastics within the ATS countries ● Establish a regional monitoring program on marine debris, which would also provide a legal and technical basis for future collaboration
	1.3 Abandoned, lost and discarded fishing gear (ALDFG)	<ul style="list-style-type: none"> ● Formulation of Minimum Standards of Guidelines for ATS countries for adoption by those developing/reviewing laws, regulations or licensing conditions
	1.4 Land-based pollution and sedimentation	<ul style="list-style-type: none"> ● Amend laws allowing discharge of mine tailings into river systems (Papua New Guinea)
Issue #2: Ecosystem, habitat and biodiversity decline	2.1 Climate impacts on ecosystems, ecological communities and critical habitats	Johnson et al. (2021) provided the following recommendations: <ul style="list-style-type: none"> ● Establish local MPAs to protect mangrove forests as part of a connected coastal mosaic of habitats. ● Implement management to promote recovery and improve condition of mangrove forests (e.g., replanting) and reduce non-climate pressures on mangroves (e.g., clearing and development). ● Reduce land-based inputs to nearshore seagrass habitats through integrated catchment management of deforestation, agriculture and coastal development in Indonesia/Arafura and western Papua New Guinea. ● Establish local MPAs to protect seagrass habitats in western Papua New Guinea.

		<ul style="list-style-type: none"> ● Implement management of non-climate pressures on seagrass meadows (e.g., intensive seaweed farming, overfishing, coastal mining and sand extraction) in Indonesia/Arafura.
	2.2 Declining populations of endangered, threatened, and protected (ETP) species	<ul style="list-style-type: none"> ● Development or implementation/strengthening of alternative livelihoods (to reduce pressure on ecosystems or species subject to unsustainable exploitation) ● Development of species-specific management plan/support strengthening of implementation and monitoring of existing species-specific management plans for ETPs (i.e., dugongs, turtles, crocodiles)
	2.3 Deterioration of critical habitats	<ul style="list-style-type: none"> ● Inclusion of the proposed MPA Network Roadmap in the updated SAP. The MPA Network activities to include improved conservation of species along with activities that address illegal trade etc. ● Regular monitoring of MPA management effectiveness, and strengthening of MPA management (e.g., periodic review of management plans, and financing, improved monitoring and reporting of progress) ● Establish local MPAs to protect mangrove forests as part of a connected coastal mosaic of habitats.
Issue #3: Unsustainable capture fisheries	3.1 Unsustainable harvest levels (overfishing)	<ul style="list-style-type: none"> ● Further work is required to establish baseline data for the PNG-ID transboundary ‘fish maw’ fishery, including the key target species, fishing grounds, landings, fishery participants and mapping of the supply chains.
	3.2 Illegal, unreported and unregulated (IUU) fishing	<ul style="list-style-type: none"> ● Explore options for regulating cross-border trade between Indonesia (South Papua) and Papua New Guinea (Western) and implement a feasible option to regulate instead of blocking.
	3.3 Fisheries bycatch	No recommendations proposed by RWG
	3.4 Fisheries impacts on fisheries habitats	No recommendations proposed by RWG

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APPENDICES

Appendix 1 – Regional Working Group (RWG) and National Working Group (NWG) activities in support of TDA update

Appendix 2 – RWG, NWG members and TDA participants

Appendix 3 – Detailed description of TDA revision process

Appendix 4 – Initial RWG issues mapping exercise, Sep 1, 2022

Appendix 5 – ATS littoral countries sub-national jurisdictions and populations

Appendix 6 – Management arrangements in the Australian EEZ including the ‘MoU’ Box

Appendix 7 – Climate change vulnerability assessment maps, seagrasses and coral reef

Appendix 8 – Rapid stakeholder analysis

Appendix 9 – International conventions and agreements relevant to key transboundary issues

Appendix 1 – Regional Working Group (RWG) and National Working Group (NWG) activities in support of TDA update

Table 32 – RWG and NWG activities in support of TDA update

Date	TDA Step	Participants	Outputs
10 February 2022	TDA Inception Workshop (remote)	TDA Specialist, National TDA Consultants, National Project Directors/Focal Points (NPDs/NFP) of the 4 countries, RPMU and NCUs	Introduction to TDA/SAP methodologies, drafting of workplan, roles and responsibilities of RWG and NWGs, draft outlines of the country synthesis report (CSR) and the updated TDA,
March-May 2022	Meetings on assessment of available data/information, key data gaps for the preparation of Country Synthesis reports, and preparation of proposals for the additional primary data gathering	TDA Specialist, National TDA Consultants, NCUs and RPMU	Consolidation of available data, confirmation of gaps, approved primary data gathering proposals to support CSR preparation
May – June 2022	NWG meetings in Indonesia (19 May 2022), Papua New Guinea (24 June 2022), and Timor-Leste (17 May and 16 June 2022)	NWG, NPDs, NCU, RPMU and National TDA Consultants	NWG feedback/inputs on available data and sources, and confirmation of important data gaps.
19 July, 2022	Country Synthesis Report workshop (remote)	TDA consultants, RPMU, NCUs	Review draft CSRs, provide feedback
1 August 2022	Kick-off Meeting for TDA-SAP Regional Working Group (RWG)	TDA consultants, NPDs/NFP, NWGs/RWG, RPMU, NCUs	Confirmed RWG members; additional members identified Agreed TOR of RWG
9 August 2022	TDA Updating Workshop in Bali (w/ virtual participation by Papua New Guinea and Australia)	TDA consultants, NPDs, NWGs/RWG, RPMU, NCUs	Reviewed Country Synthesis Reports Agreed ToR for RWG Developed timeline for updated TDA
1 Sep 2022	RWG workshop - initial investigation of priority transboundary issues (remote)	TDA consultants, NPDs, NWGs/RWG, RPMU, NCUs	Draft list of priority trans boundary issues
8 Sep 2022	RWG CCA workshop #1 – Issue #1, Pollution of marine and coastal environment (remote)	TDA consultants, NPDs, NWGs/RWG, RPMU, NCUs	Draft Causal Chain Analysis (CCA) for Issue #1
15 Sep 2022	RWG CCA workshop #2– Issue #2, Ecosystem, habitat and biodiversity decline (remote)	TDA consultants, NPDs, NWGs/RWG, RPMU, NCUs	Draft Causal Chain Analysis (CCA) for Issue #2
22 Sep 2022	RWG CCA workshop #3 - Issue #3, Unsustainable fisheries (remote)	TDA consultants, NPDs, NWGs/RWG, RPMU, NCUs	Draft Causal Chain Analysis (CCA) for Issue #3

29 Sep 2022	RWG CCA workshop #4– CCA review and refinement (remote)	TDA consultants, NPDs, NWGs/RWG, RPMU, NCUs	Refined draft Causal Chain Analyses for Issues #1,2 and 3, for inclusion in TDA
W1-2 October 2022	Draft CCA Report provided to RWG & NWG for feedback	NPDs/NFP, NWG, RPMU, NCUs	Feedback provided and incorporated in CCA final report.
3 Nov 2022	CCA Report tabled at RSC for endorsement of priority transboundary issues and timeline/roadmap for the completion of updated TDA	RSC, RPMU, NCUs	Endorsement of priority issues by Indonesia, Papua New Guinea and Timor-Leste
W4 Nov 2022	Draft TDA Report prepared and distributed to NWGs/RWG	Regional Consultant, RPMU	
29-30 Nov 2022	National TDA Validation Workshops held with Indonesia, Papua New Guinea and Timor-Leste	NPDs, NWGs, Regional TDA Consultant, RPMU, NCUs	Validation of issues as ‘transboundary’, identification of gaps, identification of additional references and resources
W1-2 Dec 2022	Feedback/inputs on draft TDA provided	NPDs, NWGs, RPMU, NCUs	Additional data/information provided for TDA revision
W3 Dec 2022	Revision of TDA draft by TDA Consultant	Regional TDA Consultant	
W3 Jan 2023	Second Draft TDA Report distributed to RWG	RPMU	
21-24 Feb 2023	ATSEA-2 Regional Workshop on TDA and SAP Updating	TDA consultants, NPDs/NFP, NWGs/RWG, RPMU, NCUs	Feedback on Second Draft TDA and agreed timeline for completion Transition to SAP updating: identification of leverage points, prioritisation of issues for the SAP, review of SAP vision, goals, objectives; agreement on timeline for SAP preparation
W4 Feb-W2 Mar 2023	Revision of TDA draft by TDA Consultant, and dissemination to RWG	Regional TDA Consultant, RPMU	
W3 March 2023	Review of Third Draft TDA	RWG members	Draft Updated TDA approved by RWG and endorsed for RSC review and approval

Appendix 2 – RWG, NWG members and TDA participants

Table 33 – RWG, NWG members

TDA-SAP REGIONAL WORKING GROUP (RWG) MEMBERS			
INDONESIA	Mr. Aris Budiarto	Coordinator of Inland Fisheries Resources	DG of Capture Fisheries Ministry of Marine Affairs and Fisheries (MMAF)
	Dr. Zainal Arifin	Biodiversity Specialist	National Research and Innovation Agency (BRIN)
	Dr. Dedi Adhuri	Senior Researcher	Centre for Community and Cultural Research (PMB), National Research and Innovation Agency (BRIN)
	Dr. Fery Sutyanwan	Coordinator for Management Group for Inland Marine, Territorial and Archipelagic Waters	Ministry of Marine Affairs and Fisheries (MMAF)
TIMOR-LESTE	Dr. Mario Cabral	Lecturer, Governance Specialist	National University of Timor-Leste
	Mr. Celestino Da Cunha Barreto	National Director for Marine Spatial Planning, Capture Fisheries and Aquatic Resources Management	Ministry of Agriculture and Fisheries (MAF)
	Ms. Alda Sousa Lemos da Rosa	Gender Focal Point	Ministry of Agriculture and Fisheries
	Ms. Bernadete Fonseca	Climate Change, EAFM and Gender Specialist	
PAPUA NEW GUINEA	Mr. Rickson Lis	Manager-Sedentary	National Fisheries Authority
	Dr. Ralph Mana	Associate Professor, Biological Sciences	University of Papua New Guinea
	Mr. Vagi Rei	Manager for Marine Ecosystem	Conservation and Environmental Protection Authority
NATIONAL WORKING GROUP (NWG) MEMBERS			
INDONESIA	Mr. Kamaluddin Kasim	Fisheries Management and Governance	Center for Fisheries Research
	Ms. Ariani Andayani,	Aquaculture	Center for Fisheries Research
	Dr. Novi Susetyo Adi	Blue Carbon/Mangrove	Center for Marine Research /
	Mr. Eko Susilo	Oceanography	Institute for Marine Research and Observation /
	Mr. Aris Budiarto	Fisheries Management	Directorate for Fish Resource Management /

	Dr. Ir. Zainal Arifin, M.Sc	Biodiversity	National Research and Innovation Agency (BRIN)
	Dr. Dedi Supriadi Adhuri	Socio-Economics	National Research and Innovation Agency (BRIN)
	Dr. Ir. Fredinan Yulianda	Dean of Faculty of Fisheries and Marine Science	IPB University
	Mr. Jotham Ninef	Academic	Nusa Cendana University, Kupang
	Ms. Norce Mote	Academic	Musamus University, Merauke
	Dr. James Abrahamsz	Academic	Pattimura University, Maluku
	Dr. Muhammad Helmi	Academic	Diponegoro University, Semarang
	Ir. Iman Djuniawal	Local govt	Regional Maritime Affairs and Fisheries Office
	Mr. Absalom Solossa	Local govt	Regional Maritime Affairs and Fisheries Office, Papua Province
	Ms. Sherley S. Wila Huky	Local govt	Regional Research and Development Agency. NTT Province
	Dr. Erawan Asikin	Local govt	Regional Marine and Fisheries Affairs Office, Maluku Province
Papua New Guinea	Mr. Rickson Lis	Coastal fisheries expertise	National Fisheries Authority (NFA)
	Mr. Jeff Kinch	Fisheries management and training	National Fisheries Authority (NFA)
	Ms. Nancy Taka	Legal counsel	National Fisheries Authority (NFA)
	Mr. Vagi Rei	Marine ecosystem expertise	National Fisheries Authority (NFA)
	Dr. Augustine Mungjake	Marine and fisheries research	University of PNG (UPNG)
	Dr. Ralph Mana	Marine and fisheries research	University of PNG (UPNG)
	Ms. Dainah Gligiba	Western province fisheries and culture	South Fly District Fisheries
	Mr. Odori Kolony	Western province fisheries and culture	Western Province Fisheries
	Mr. Havini Vira	Aquaculture and inland fisheries	OK Tedi Development Foundation
	Ms. Selma Pamolak	Aquaculture	PNG Sustainable Development Program
	Mr. Jonathon Booth	Marine and fisheries research and conservation	Wildlife Conservation Society
Timor-Leste	Mr. Acacio Guterres	Director General	PARM (MAF)
	Mr. Horacio Guterres	National Director	MAF

	Mr. Celestino da Cunha Barreto	National Director	MAF
	Mr. Pedro Rodrigues	Chief of Department	MAF
	Dr. Mario Cabral	Lecturer	University of TL
	Prof. Roumaldo Ximenes	Dean, Agriculture Faculty	UNITAL
	Mr. Marito Filipe	Senior Technical, Fisheries and Marine Science	MAF
	Mr. Constancio dos Santos	Chief of Department	MAF
	Mr. Nelson Madeira	National Director of Pollution Control	SEA Environment
	Mr. Antonio De Limas		FONGTIL (NGO)
TDA CONSULTANTS			
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	Dr. Arsyad Al Amin	National Consultant - Indonesia Climate Change Specialist	Center for Coastal and Marine Resources Studies, IPB University
	Dr. Eva Anggraini	National Consultant - Indonesia Social Institutional Specialist	Center for Coastal and Marine Resources Studies, IPB University
	Ms. Mega Natasha Indah	National Consultant - Indonesia Assistant in Climate Change	Center for Coastal and Marine Resources Studies, IPB University
	Mr. Akhmad Solihin	National Consultant - Indonesia Assistant in Socio Economic	Center for Coastal and Marine Resources Studies, IPB University
	Ms. Artika Nanda Magfiroh	National Consultant - Indonesia Assistant in Ecology	Center for Coastal and Marine Resources Studies, IPB University
	Ms. Retia Reviany	National Consultant - Indonesia Assistant in Marine Pollution	Center for Coastal and Marine Resources Studies, IPB University
	Dr. Sigid Hariyadi	National Consultant – Indonesia Marine Pollution Specialist	Center for Coastal and Marine Resources Studies, IPB University

	Dr. Luky Adrianto	National Consultant – Indonesia EAFM Specialist	Center for Coastal and Marine Resources Studies, IPB University
PAPUA NEW GUINEA	Dr. Ralph Mana	National Consultant – Papua New Guinea RWG Member	University of Papua New Guinea
	Dr. Augustine Mungkaje	National Consultant – Papua New Guinea	University of Papua New Guinea
TIMOR-LESTE	Dr. Abilio Da Fonseca	National Consultant – Timor-Leste	National University of Timor-Leste
	Dr. Mario Cabral	National Consultant – Timor-Leste	National University of Timor-Leste
	Mr. Walter Oliveira Soares	National Consultant – Timor-Leste	National University of Timor-Leste
ATSEA-2 NATIONAL PROJECT DIRECTORS/FOCAL POINT			
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INDONESIA	Mrs. Yayan Hikmayani	Director	Center for Fisheries Research Ministry of Marine Affairs and Fisheries
	Ms. Niken Winarsih	Sub-coordinator for MFR/National Development Planner	Center for Fisheries Research Ministry of Marine Affairs and Fisheries
PAPUA NEW GUINEA	Mr. Noan Pakop	Deputy Managing Director	National Fisheries Authority
TIMOR-LESTE	Mr. Acacio Guterres	Director General for Fisheries	Ministry of Agriculture and Fisheries
ATSEA-2 PROJECT TEAMS			
NCU INDONESIA	Mr. Dwi Ariyoga Gautama	National Project Coordinator	UNDP Indonesia
	Mr. David Kuntel	M&E Specialist	UNDP Indonesia
	Ms. Laeli Sukmahayani	GESI Specialist	UNDP Indonesia
NCU PAPUA NEW GUINEA	Mr. Kenneth Yhuanje	National Project Coordinator	ATSEA-2 NCU - PNG
NCU TIMOR LESTE	Mr. Almerindo Oliveira da Silva	National Project Coordinator	UNDP Timor Leste

RPMU			
ATSEA-2 RPMU	Dr. Handoko Adi Susanto	Regional Project Manager	
	Ms. Cristine Ingrid S. Narcise	Policy and Results-based Management Specialist	ATSEA-2 RPMU
	Ms. Kathrine Rose G. Aguilin	Project M & E Specialist	ATSEA-2 RPMU
	Ms. Casandra Tania	Regional Biodiversity Specialist	ATSEA-2 RPMU
	Ms. Deti Triani	Marine Technical Assistant	ATSEA-2 RPMU

Appendix 3 – Detailed description of TDA revision process

Regional Thematic Assessments

An important consideration for the updating of the TDA is the use of updated information on the status of biophysical, socioeconomic and governance conditions in the ATS region, and the involvement of a broad range of key stakeholders representing various disciplines and key sectors from the ATS countries in order to provide necessary expertise, ensure adequate representation of various sectors in the consensus building process, and promote ownership in the updating of the TDA and its results which will serve as inputs in the formulation of the updated SAP.

Key governance and issue-specific assessments at the regional and national levels were undertaken by the project to support the updating of the TDA. In view of the limitations posed by the COVID-19 pandemic in terms of validating and gathering key information on-the-ground, preparation of Country Synthesis Reports that will consolidate available secondary data/information at the national/sub-national levels as well as undertake additional primary data gathering for key data gaps was also undertaken.

Preparation for TDA revision

To facilitate the consolidation of data/information at the regional and national levels and the preparation of the updated TDA, the ATSEA-2 Regional Project Management Unit (RPMU):

- 1) Engaged an international consultant/TDA Specialist to lead the assessment and consultation process and preparation and drafting of the updated TDA;
- 2) Engaged research institutions/organizations in the countries as National TDA Consultants to support the preparation of Country Synthesis Reports that will serve as key references in the regional TDA updating, using available secondary data/information with additional primary data gathering to address key data gaps; and
- 3) In coordination with the ATSEA-2 National Coordination Units (NCUs) and National Focal Agencies in Indonesia, Papua New Guinea and Timor-Leste, established National Working Groups (NWGs) with representatives from various sectors and disciplines to facilitate national inputs and perspectives to the TDA and SAP updating.

The members of the National Consultant teams and NWG members for Indonesia, Papua New Guinea and Timor-Leste are presented in Appendix 2. Considering the national elections in May 2022 and subsequent government restructuring, Australia was at the time of writing, unable to establish its NWG.

Inception Workshop, 10 February 2022

A virtual Inception Workshop was conducted on 10 February 2022, participated by the TDA Specialist, National TDA Consultants, National Focal Points of the 4 countries, RPMU and NCUs, which discussed the TDA and SAP process, the TDA updating work plan and timeline, roles and responsibilities of key participants including the TDA Specialist, National TDA Consultants, the cross-sectoral and multi-disciplinary NWGs, and a Regional Working Group (RWG) that will provide the regional and transboundary perspective. The workshop also agreed on the outlines of the country synthesis report and the updated TDA.

Country Synthesis Reports

Guided by a list of core data sets for the country synthesis reports and a rapid assessment of available data/information and sources as prepared by the TDA Specialist, a series of meetings were organized by the RPMU with the TDA Specialist and National TDA Consultants in March-May 2022 to discuss the desktop reviews, assessment of available data/information, key data gaps for the preparation of Country Synthesis reports, and preparation of proposals for the additional primary data gathering. NWG meetings were conducted on 19 May 2022 for Indonesia, 24 June 2022 for Papua New Guinea, and 17 May and 16 June 2022 for Timor-Leste to gather feedback, input and advice from the NWG members for the preparation of the Country Synthesis Reports.

As the National TDA Consultants prepared the Country Synthesis Reports, a workshop was organized by the RPMU with the Regional and National TDA Consultants on 19 July 2022 to discuss their progress, provide further guidance, and prepare for a regional workshop in Bali, Indonesia, to present the draft country reports.

Regional Working Group

In line with the process and timeline agreed in the TDA Updating Workshop in Bali, the Regional Working Group for TDA/SAP (RWG) was established in accordance with its role in assisting with the updating of the Arafura and Timor Seas TDA and SAP in 2022/2023. RWG members were selected based on their core competencies; in assembling the group, it was intended that a wide range of expertise be incorporated, including fisheries management, biodiversity research and management, socioeconomics, gender, climate change, spatial planning, ocean governance, maritime law and pollution. The RWG includes representatives from the National Working Groups (NWGs) as nominated by the National Project Directors (NPDs), and additional members who were proposed in the initial workshops to cover the range of specializations needed for the TDA-SAP updating. RWG activities and members are listed in Appendices 1 and 2 respectively.

In parallel with RWG activities, the NWGs conducted national-level meetings to agree national-level priorities, supported by the National TDA Consultants.

TDA Updating Workshop, Bali (9 August 2022)

On 9 August 2022, the TDA Updating Workshop in Bali reviewed the initial draft Country Synthesis reports including key changes seen relative to the first TDA in 2011 and key transboundary issues emerging from the reports, discussed the TOR of the Regional Working Group and process for its establishment, and agreed on an updated timeline for the completion of the Country Synthesis Reports and the Updated TDA. The meeting in Bali was joined by the Regional and National TDA consultants, National Project Directors (NPDs), NWG representatives from Indonesia and Timor-Leste, as well as members of the ATSEA-2 RPMU and NCU Coordinators, while representatives from Papua New Guinea and Australia, as well as NCU Papua New Guinea joined via zoom.

Identification of priority transboundary issues

In line with the process and timeline agreed in the TDA Updating Workshop (Bali, 9 August 2022), the ATSEA-2 project hosted the first meeting (virtual) of the Regional Working Group (RWG) on 1 September 2022. In accordance with the GEF/IW TDA methodology, the RWG agreed to a proposed course of action which include the refinement/completion of i/ Country Synthesis Reports (Indonesia, Papua New Guinea, Timor-Leste), ii/ the Identification of Priority Transboundary Issues, and iii/ workshops to conduct participatory Causal Chain Analyses (CCA) for the agreed priority issues.

Identifying Priority Transboundary Issues

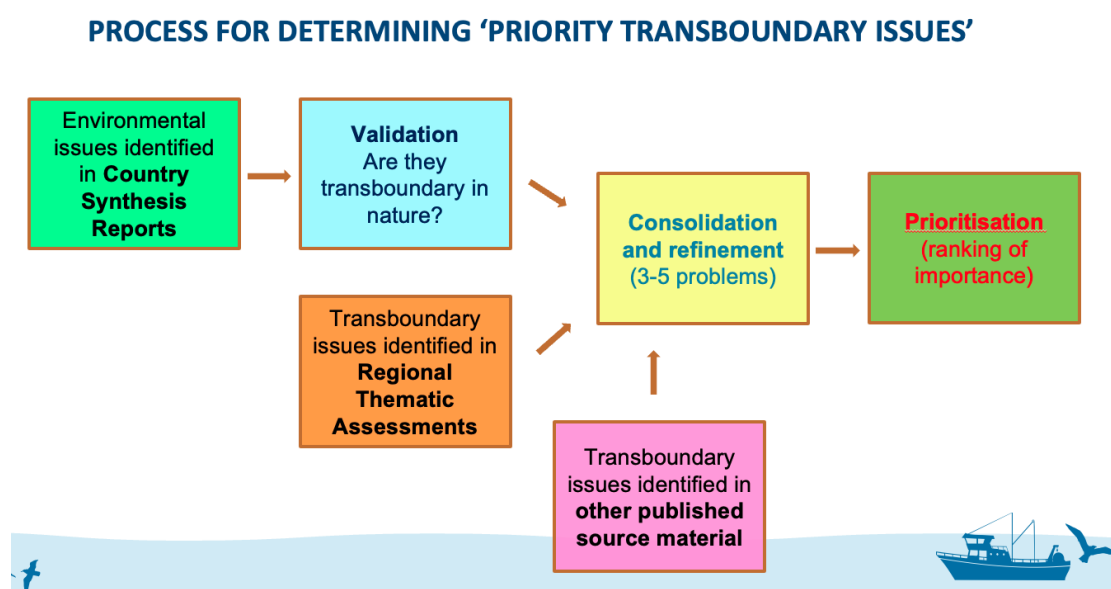


Figure 29 – Process for identifying priority transboundary issues

As noted in Figure 29 above, priority issues were identified from multiple sources, including the Country Synthesis Reports, Regional Thematic Assessments conducted by ATSEA-2, and from other relevant published source material.

Through draft Country Synthesis Reports, and through national and regional workshops, ATS country groups identified their initial priorities, noting that these included issues that were transboundary and national (or sub-national) in nature. Through a series of online workshops in September 2022, the RWG was then facilitated to propose priority issues via a shared digital whiteboard. Those issues were discussed by the group, and those that were considered ‘transboundary’ were grouped into themes for further sorting and refinement. Initial prioritization was done by using a colour code for low, medium and high priority, and it was also noted where an issue was contributed multiple times. Results of the initial mapping exercise are shown in Appendix 4.

Of the issues proposed by RWG members, three groupings emerged; fisheries-related issues were most prevalent (grouping #1, with ~45 responses), followed by issues related to declines in

biodiversity and ecosystems (grouping #3 with ~25 responses), and pollution-related issues (grouping #2 with <20 responses).

Further, clear linkages were observed between these; for instance, between pollution and fisheries (e.g., marine debris causing ghost-fishing), between pollution and deterioration of critical habitats (e.g., land-based sedimentation leading to mangrove decline), and between fishing and biodiversity decline (e.g., fisheries bycatch contributing to declining populations of ETP species). Other contributions (including governance and security concerns, and socio-economic impacts) did not clearly fit the definition of transboundary environmental issues, or were outside the scope of ATSEA-2, and the RWG agreed that they would be treated as ‘drivers’ (governance) and ‘impacts’ in the subsequent CCA process.

The group also discussed whether climate change in itself should be included as an issue (as per the 2011 ATS TDA) or whether it was technically a driver of issues. The impacts of climate change were thought to be relevant to all three issue groups: fisheries-related issues, pollution, and ecosystem and biodiversity decline. After examination of a range of example TDAs from IW/GEF programmes, and other international best practice, it was agreed that climate change would be treated as a driver of transboundary issues.

Analysis of causal chains

For each of the three issues identified, a participatory process of Causal Chain Analysis (CCA) was undertaken by the RWG. As shown in Figure 4, CCA supports the systematic analysis of the component parts of Transboundary Issues, in order to support the development of strategies that can systematically address the root causes of issues. The CCA process results in the development of conceptual models for priority issues, which include ‘causal chains’ linking root causes to the main drivers and impacts (or ‘cause-and-effect’).

Mitigation efforts are more likely to succeed if they target root causes and underlying or catalytic causes (‘indirect drivers’) rather than immediate causes (‘direct drivers’). Root causes may include those aspects of transboundary environmental issues that relate to human behaviour, governance systems, the allocation of resources, and the way that resources are considered by markets.

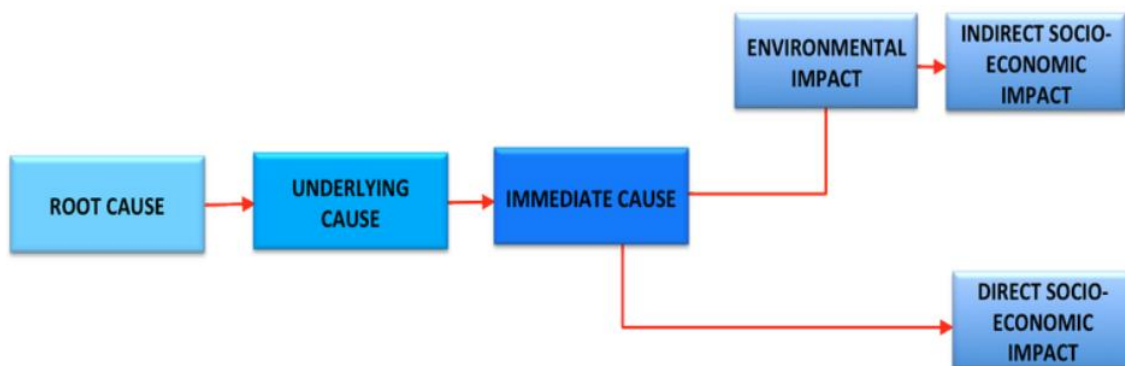


Figure 30 – Causal Chain Analysis (CCA) overview (GEF/IW)

The draft CCA analyses were edited for consistency in language, scale and accuracy and refined CCA diagrams shared back to the RWG for further comment and endorsement, ahead of being tabled at the November 2022 Regional Steering Committee (RSC) meeting for RSC endorsement. Summary tables of the three CCAs are included in this report in Table 7, Table 8 and Table 13.

A secondary, but important outcome of the CCA process was the discussion of transboundary issues by the regional team. These frequent exchanges facilitated open and transparent discussion, and the sharing of national perspectives on transboundary issues and priorities and were an important step in establishing the working relationships and partnerships needed to implement a regional programme of action such as the ATS SAP.

A series of national consultation workshops was held in Indonesia, Papua New Guinea and Timor-Leste between August and October 2022 to review and provide feedback on the above inputs.

Endorsement by Regional Steering Committee (RSC)

At the 4th Regional Steering Committee Meeting held in Port Moresby 2-3 November 2022, the Regional TDA Consultant presented progress on ATS TDA updating process to the RSC. Points highlighted included the consultative processes undertaken, the resulting three priority transboundary issues identified (i.e., marine pollution, declines in biodiversity, and unsustainable fisheries), and the outcomes of causal chain analysis (CCA) workshops, and a proposed roadmap towards the finalization of the updated TDA.

Indonesia, Papua New Guinea and Timor-Leste endorsed the three priority transboundary environmental issues to facilitate initiation of the drafting of the full updated TDA report, while Australia will require more time to undertake in-country consultations on the transboundary issues identified in the CCA report. The 4th RSC also endorsed proposed roadmap for completion, which would see a final TDA completed by the end of March 2023.

Draft Updated TDA and National TDA Validation Workshops (November 2022)

In line with the recommendations from the 4th RSC Meeting, an Exposure Draft of the revised TDA for ATS was prepared by the Regional TDA Consultant with inputs provided by the national TDA consultants, NWGs and RWG, ATSEA-2 National Project Directors/Focal Point, NCUs and the RPMU.

A series of three TDA Validation workshops was held with Indonesia, Papua New Guinea and Timor-Leste on November 29 and 30, 2022 in order to get feedback from ATS countries on the draft; specifically, to elicit feedback on document structure and balance, accuracy of information, and to validate information in the draft on the three key transboundary issues and eleven subordinate 'fundamental concerns'. The inputs gained from the three workshops will assist the TDA Consultant to refine the draft.

Of eleven sub-ordinate fundamental concerns, all three countries agreed that there was sufficient evidence to support a description of the following issues as trans-boundary in the TDA:

- 1.1 Oil Spills
- 1.2 Marine Debris and Plastic Pollution
- 2.1 Climate impacts on ecosystems, ecological communities and critical habitats
- 2.2 Declining populations of endangered, threatened, and protected (ETP) species
- 3.2 Illegal, unreported and unregulated (IUU) fishing

Additional information was requested on transboundary elements of fundamental concerns 1.3 Abandoned, lost and discarded fishing gear (ALDFG), and 3.1 Unsustainable Fisheries.

Further, all countries considered that there was insufficient evidence to support the inclusion of the following fundamental concerns as transboundary; 1.4 Land-based pollution and sedimentation, 2.3 Deterioration of critical ecosystems and habitats resulting from anthropogenic causes, 3.3 Fisheries bycatch and 3.4 Fisheries impacts on habitats. These issues were shown to be largely localised in nature, with impacts often experienced within sovereign boundaries, and limited evidence of impacts crossing international boundaries (as per the agreed definition of transboundary environmental issue).

Australia was unable to conduct a national validation workshop, but written feedback was received from the National Focal Point.

Considering the results of this validation exercise, a second draft of the TDA document was prepared by the Regional TDA Consultant and disseminated by the RPMU to the countries for review in January 2023.

Regional Transboundary Diagnostic Analysis (TDA) and Strategic Action Programme (SAP) Updating Workshop, Bali, Indonesia, February 21-24, 2023

A Regional TDA and SAP Updating Workshop was conducted from February 21-24, 2023 at Prama Sanur Beach Bali. The workshop was attended by the National Project Directors/National Focal Point, members of the NWGs and RWG for TDA-SAP updating, and regional and national TDA consultants from Indonesia, Papua New Guinea, Timor-Leste and Australia. The 4-day workshop was attended by 31 participants (including RPMU team), and facilitated by the Regional TDA-SAP consultant with support from the RPMU and NCU Coordinators. The workshop employed a combination of PPT presentations, group exercises, and discussions.

The first two days of the workshop focused on completion of this TDA and Country Synthesis Reports (CSRs), eliciting final feedback on the draft TDA report, and ‘bridging discussions’ regarding the linkages between TDA and SAP; these included further exercises to prioritise transboundary issues to be selected for transboundary action under the next SAP iteration, and the identification of ‘leverage points’ for selected issues. The second two days of the workshop focused on commencing **SAP Strategic Thinking** which serves as the first phase of SAP development.

Overall, the workshop generated the following key results and agreement:

- List of country feedback on the draft TDA
- Leverage points for the 11 fundamental concerns
- Consensus on four key issues for the updated SAP: Marine plastic pollution including ALDFG; Oil Spill; ETP species; and IUU fishing
- Proposed component goals and operational objectives for the four key issues
- Suggested revised vision statements for the SAP
- Consensus on the TDA, SAP and NAPs roadmap and completion timelines

Building on the results of the workshop, it was agreed that the Regional TDA consultant would finalize the TDA report in the first week of March 2023 for final review and endorsement by the RWG and RSC shortly thereafter.

Appendix 4 – Initial RWG issues mapping exercise, Sep 1, 2022

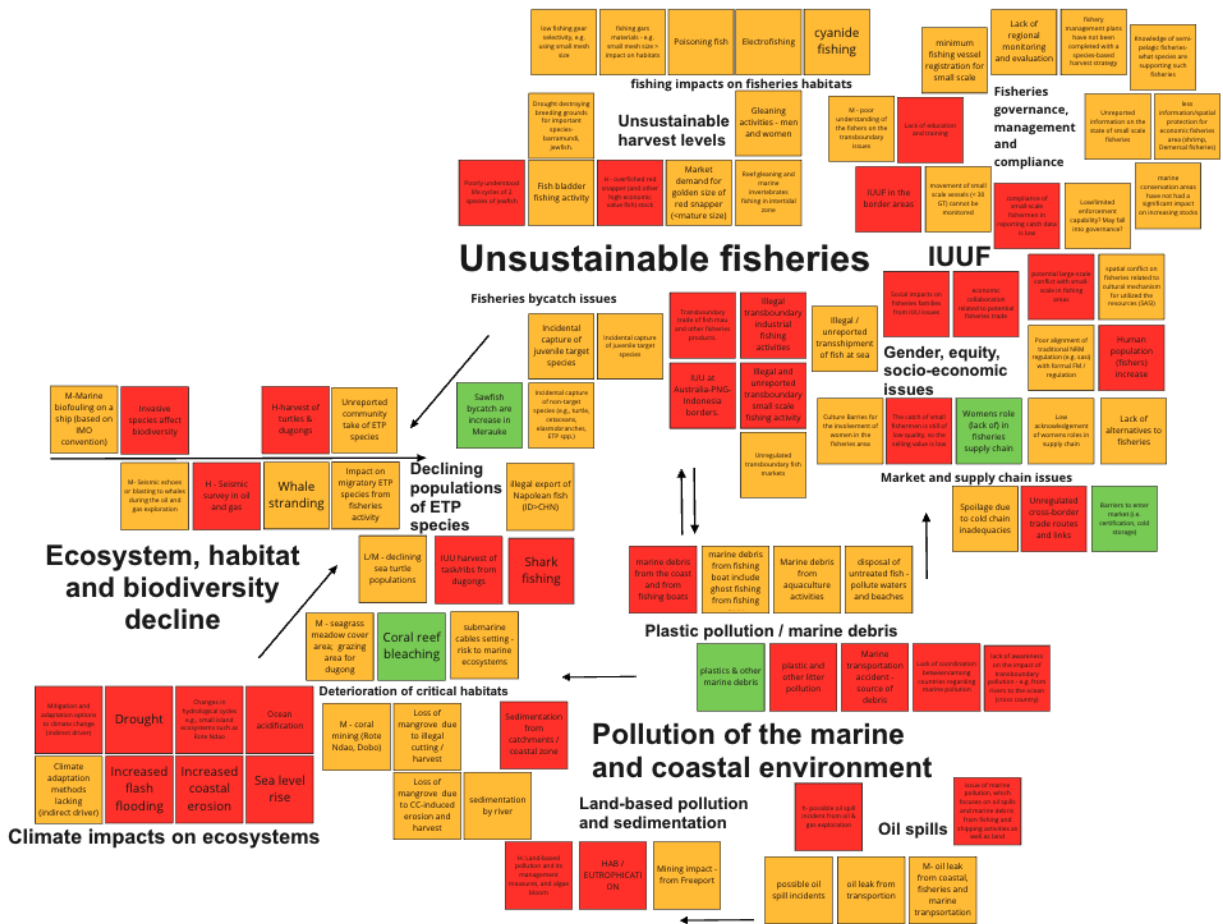


Figure 31 – Mapping of issues on Miro board (September 29, 2022, output). Colours indicate priority as suggested by participants (red – high, orange – medium, green – lower). Arrows indicate connectivity between issues

Appendix 5 – ATS littoral countries sub-national jurisdictions and populations

Table 34 – ATS littoral countries sub-national jurisdictions and populations

ATS Country	State/provinces	Sub-national jurisdiction	Population	Total
Australia				195,288
	Northern Territory (Total – 146,323)	Belyuen	165	
		East Arnhem	10,097	
		Darwin	85,397	
		Palmertson	39,587	
		Wagait	465	
		West Arnhem	7,186	
		West Daly	3,426	
	Queensland (Total – 14,289)	Aurukun	1,131	
		Burke	430	
		Carpentaria	2,159	
		Kowanyama	1,108	
		Mapoon	442	
		Mornington	1,061	
		Napranum	907	
		Northern Peninsula Area	2,886	
		Pompuraaw	632	
		Torres	3,533	
	Western Australia (Total – 34,676)	Broome	18,209	
		Derby-West Kimberly	8,414	
Wyndham-East Kimberly		8,053		
Indonesia				3,083,379
	East Nusa Tenggara Province	Rote Ndao Regency	148,811	
		Kupang City	465,637	
		Kupang Regency	379,464	
		South Central Timor Regency	459,600	
		North Central Timor Regency	266,293	
		Belu Regency	224,306	
		Malacca Regency	188,191	
	Maluku Province	Aru Islands Regency	102,916*	
		Tanimbar Islands Regency	123,572	
		Southeast Maluku	122,640	

		Southwest Maluku Regency	82,187*	
		Tual City	90,322*	
	South Papua Province	Asmat	110,105	
		Boven Digoel	64,285	
		Mappi	24,118	
		Merauke	230,932	
Papua New Guinea				29,000
	Western Province	South Fly district	29,000	
Timor-Leste				205,806
	Covalima municipality	Suai	26,565	
		Tilomar	9,967	
		Zumalai	16,159	
	Ainaro municipality	Ainaro	17,685	
	Manufahi municipality	Alas	9,547	
		Fatuberlio	8,498	
		Same	34,885	
	Manatuto municipality	Barique	6,166	
	Viqueque municipality	Uatu-Carbau	7,897	
		Viqueque	28,322	
	Lautem municipality	Iliomar	6,528	
		Lospalos	29,925	
		Tutuala	3,662	
ATS				3,513,473

Sources:

Australia - Australian Bureau of Statistics, 2021

Indonesia - Statistic Indonesia, 2022/2021* (bps.go.id)

PNG - Fore Coast LLG Center at Daru in 2022 (as part of primary data gathering exercise under ATSEA-2, Mana and Mungkaje, 2022)

Timor-Leste Directorate General of Statistic Timor-Leste. (2022). General Population and Housing Census. Dili: Ministry of Planning and Finance.

Appendix 6 – Management arrangements in the Australian EEZ including the ‘MoU’ Box

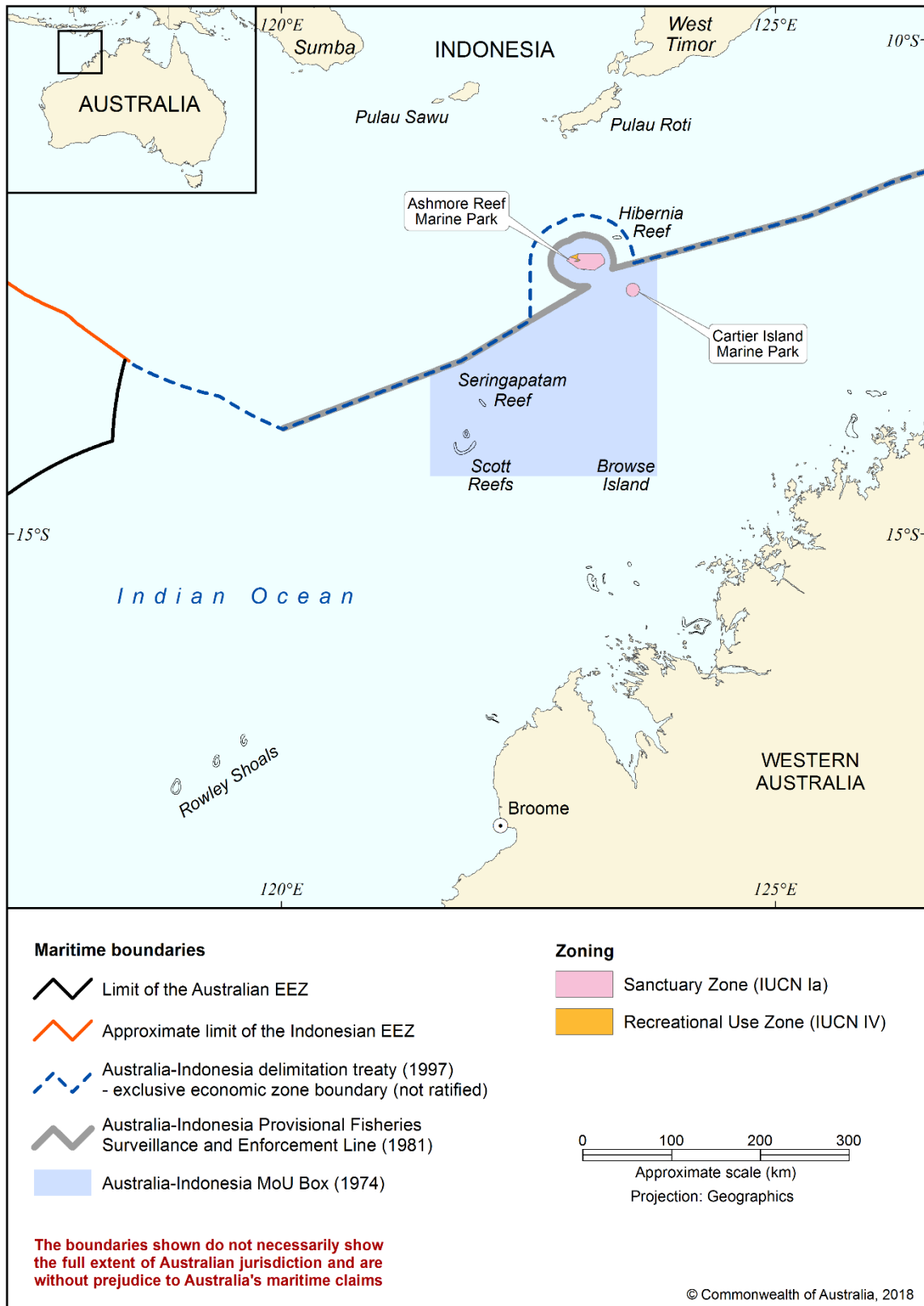


Figure 32 – Management arrangements in Australia’s EEZ (Source: AFMA, 2022)

Appendix 7 – Climate change vulnerability assessment maps, seagrasses and coral reefs

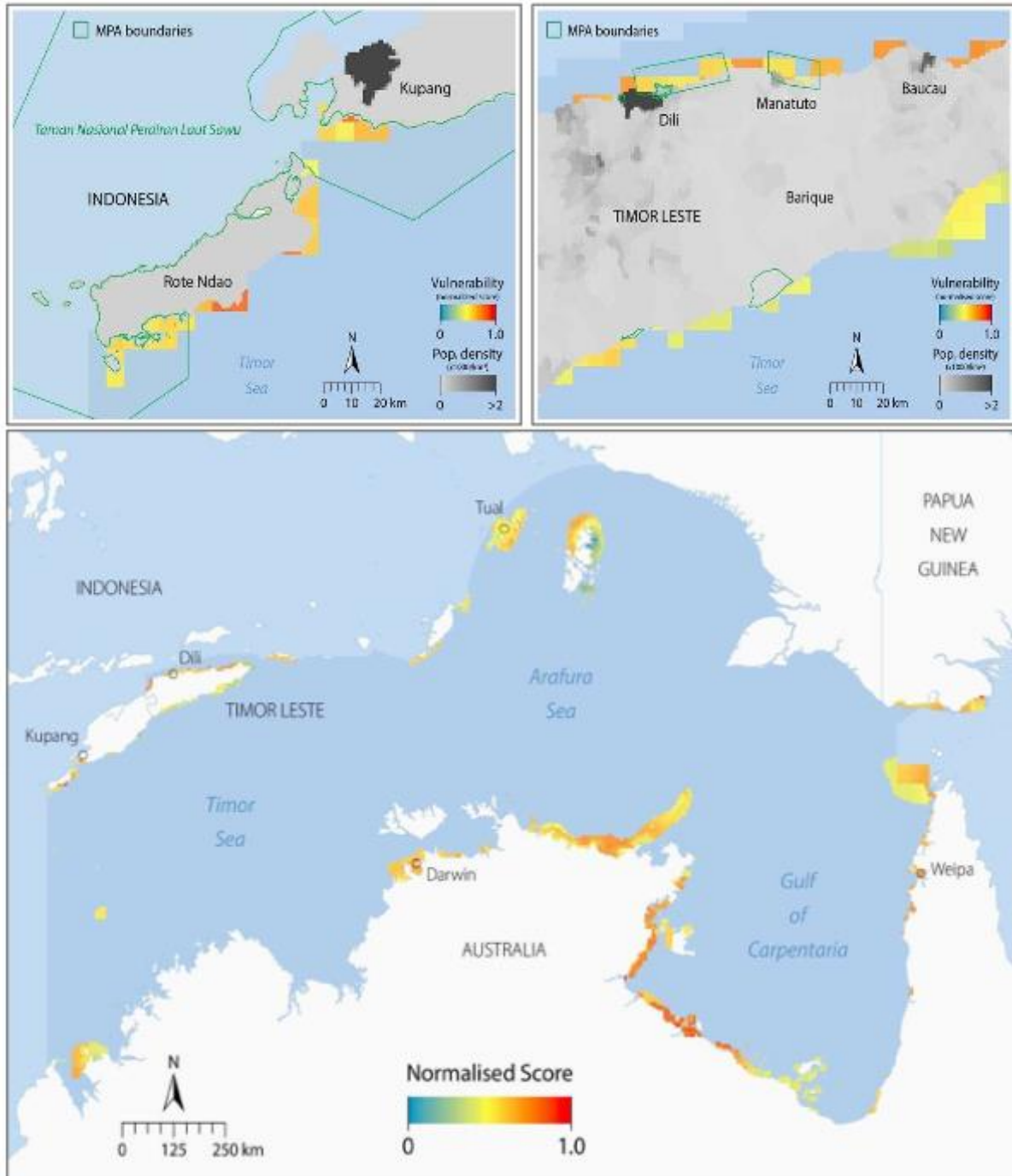


Figure 33 – Regional relative vulnerability of seagrass meadows in the ATS region (Johnson, 2021). Colour represents normalised scores; white; not vulnerable, dark red; high vulnerability.

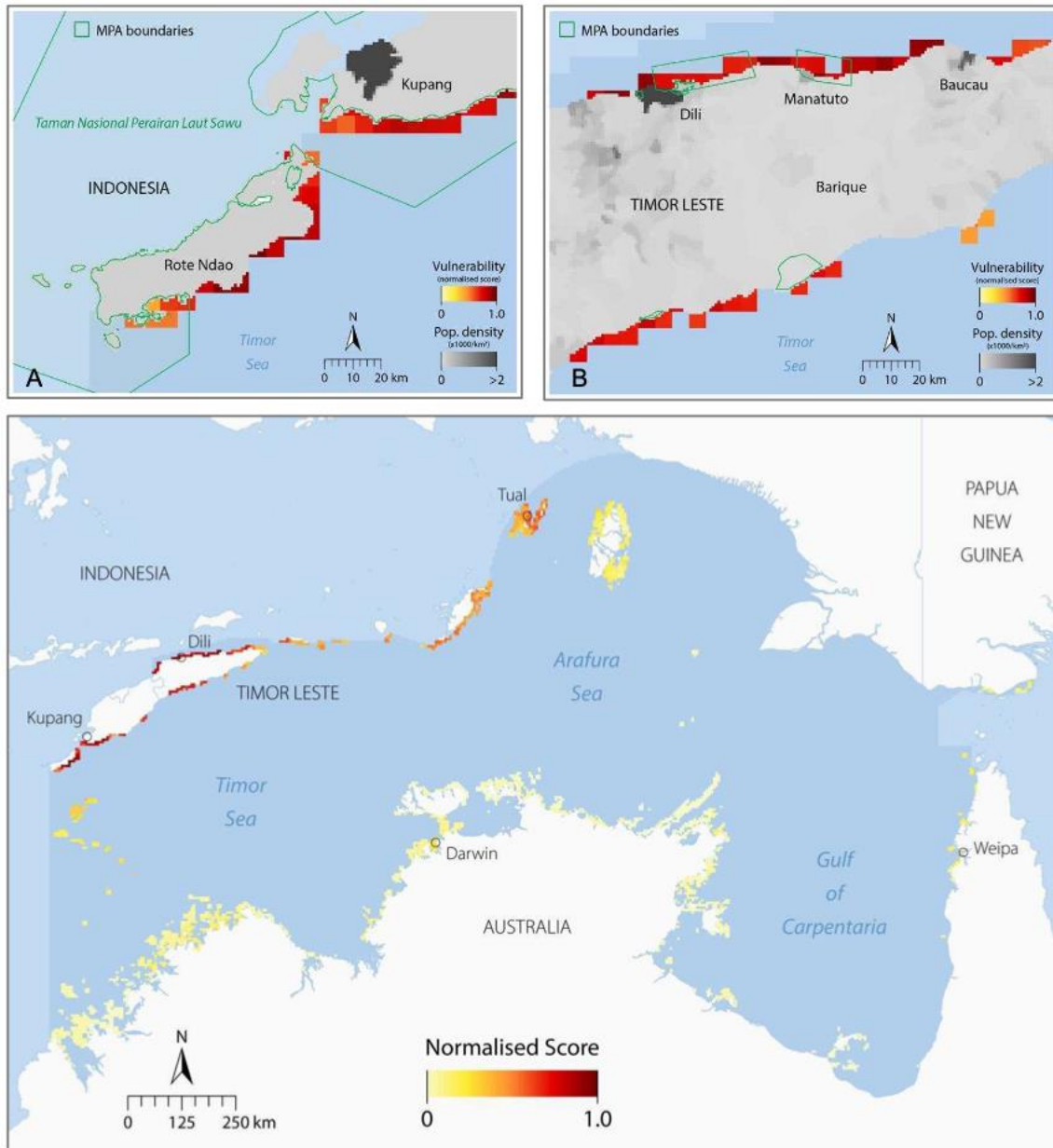


Figure 34 – Regional relative vulnerability of shallow coral reefs in the ATS region (Johnson, 2021). Colour represents normalised scores; white; not vulnerable, dark red; high vulnerability.

Appendix 8 – Rapid stakeholder analysis

Table 35 – Rapid stakeholder analysis

SECTOR	JURISDICTION	All issues (#1-3)	Issue #1: Pollution of marine and coastal environments	Issue #2: Declines in ecosystems, habitats and biodiversity	Issue #3: Unsustainable capture fisheries
Government, inter-governmental and public sector	Regional	UNDP	International Maritime Organisation (IMO)	International Union for the Conservation of Nature (IUCN)	ASEAN Fisheries Working Group
		Partnerships in Environmental Management for the Seas of East Asia (PEMSEA)			Fisheries and Agriculture Organization of the United Nations (FAO)
		Coral Triangle Initiative on Coral Reefs, Fisheries and Food Security (CTI-CFF)			SEAFDEC
		Global Environment Facility (GEF)			RPOA-IUU (Sub Regional Arafura Timor Seas)
		Asian Development Bank (ADB)			APEC Ocean and Fisheries Working Group
		World Bank (WB)			
		United Nations Environment Program (UNEP)			
		Australia	Department of Climate Change, Energy, the Environment and Water	Australian Maritime Safety Authority	Parks Australia
	States and territory governments (Queensland, Northern Territory, Western Australia)				Queensland Department of Agriculture and Fisheries
					Department of Fisheries, Western Australia
					Fisheries NT (Northern Territory)
	Indonesia	Ministry of Marine Affairs and Fisheries (MMAF)	Ministry of Transportation	Ministry of Environment and Forestry (MoEF)	Ministry of Cooperatives and Small and Medium Enterprises
		Coordinating Ministry for Maritime Affairs and Investment	The Indonesian Maritime Security Agency		National Border Management Agency
		Ministry of National Development Planning	Ministry of Energy and Mineral Resources		Ministry of Transportation
		Ministry of Foreign Affairs	Ministry of Environment and Forestry (MoEF)		Indonesian Navy

		National Research and Innovation Agency (Badan Riset dan Inovasi Nasional-BRIN)	National Board for Disaster Management		Indonesia National Police	
	Papua New Guinea		Conservation and Environment Protection Authority (CEPA)	Conservation and Environment Protection Authority (CEPA)	National Fisheries Authority (NFA)	
			National Maritime Safety Authority (NMSA)	Climate Change and Development Authority (CCDA)		
	Timor-Leste	Ministry of Agriculture and Fisheries (MAF)	Secretariat of State for the Environment	Secretariat of State for the Environment	National Directorate of Fisheries and Aquaculture	
			National Petroleum Authority			
Research and academia	Regional					
	Australia	Charles Darwin University			Commonwealth Scientific and Industry Research Organisation (CSIRO)	
		James Cook University (JCU)			Worldfish	
		Australian National University (ANU)				
		Australian Institute of Marine Sciences (AIMS)				
	Indonesia	Nusa Cendana University (Undana)	University of Indonesia	Kupang State Agricultural Polytechnic		
		Pattimura University (Unpatti)	Institute Technology of Bandung (ITB)	Nusa Lontar University		
		Institute Pertanian Bogor (IPB)		Musamus University, Merauke (Musamus)	Musamus University, Merauke (Musamus)	
	Papua New Guinea	University of PNG (UPNG) University of Natural Resource and Environment (UNRE)		University of PNG?	National Fisheries College (NFC)	
	Timor-Leste			National University of Timor-Leste (UNTL)		
	Not-for-profit sector (International and local NGOs)	Regional	Greenpeace			Sustainable Fisheries Partnerships (SF)
						Marine Stewardship Council (MSC)
		Australia	AMCS	Ghost Nets Australia		WWF
WWF						
Indonesia		WWF-ID	Yayasan Peduli Timor Barat (YPTB)	Yayasan Konservasi Cakrawala Indonesia (YKCI)	MDPI	

		Coral Triangle Center (CTC)	Greenpeace	Wildlife Conservation Society	Marine Stewardship Council (MSC)
		YKAN / The Nature Conservancy	Walhi	Sitakena Foundation	DFW Indonesia
				DFW Indonesia	Fisheries Resource Center of Indonesia
				Rekam jejak alam nusantara Rekam	International Pole and Line Foundation (IPNLF)
					Sustainable Fisheries Partnership (SFP)
					Rekam jejak alam nusantara Rekam
	Papua New Guinea	Wildlife Conservation Society			
		Eco Custodian Advocates (ECA)			
		WWF-PNG			
	Timor-Leste	Blue Ventures		Conservation International	WorldFish
		Mercy Corps			HABURAS
Industry and private sector actors	Regional				
	Australia				Seafood Industry Australia
					NT Seafood Council
					Northern Prawn Fishery Industry
	Indonesia		Pertamina		Himpunan Nelayan Seluruh Indonesia
			PT. Pelayaran Nasional Indonesia (Pelni)		Indonesian Demersal Association (ADI)
					Himpunan Penangkap Udang Indonesia (HPPI)
					Tuna longline association (ATLI)
	Papua New Guinea	OK Tedi Mining Limited (OTML)			
	Timor-Leste	Timor Gap			

Appendix 9 – International conventions and agreements relevant to key transboundary issues

(*Issue 1 – pollution, Issue 2 – ecosystems, communities or species decline, Issue 3 – unsustainable fisheries)

Table 36 – International conventions and agreements relevant to key transboundary issues

Convention or agreement	Relevant TB Issue*	Australia	Indonesia	PNG	Timor-Leste
The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal (Basel Convention 1989)	1	✓	✓	✓	
Stockholm convention	1	✓	✓	✓	
Kyoto Protocol	1, 2, 3	✓			✓
Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (London Convention 1972)	1	✓			
International Convention for the Prevention of Pollution from Ships (MARPOL 1973/78)	1	✓			Legislated commitment to ratify 10/22
UNCLOS	2	✓			✓
Convention on Migratory Species of Wild Animals (Bonn Convention)	2	✓			
Ramsar Convention (on wetlands)	2	✓			
Paris Agreement on Climate Change	1, 2, 3	✓	✓	✓	✓
International Convention on Oil Pollution Preparedness, Response and Co-operation (OPRC)	1	✓			
Convention on Biological Diversity (CBD)	2	✓			✓
Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)	2, 3	✓			
International Whaling Commission	2	✓			
UNCLOS Conservation and management of straddling fish stocks and highly migratory fish stocks	3	✓			

2009 Agreement on Port State Measures to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing	3	✓			✓
1995 United Nations Food and Agriculture Organization (FAO) Code of Conduct for Responsible Fisheries	3	✓			
1994 United Nations Framework Convention on Climate Change	1,2,3	✓	✓	✓	✓



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