CAUSAL CHAIN ANALYSIS REPORT FOR THE ARAFURA AND TIMOR SEAS

2022

This report was prepared by Matthew Fox for the Arafura and Timor Seas Ecosystem Action Phase II (ATSEA-2) Project.
October 2022

CAUSAL CHAIN ANALYSIS REPORT FOR THE ARAFURA AND TIMOR SEAS

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Cover Image: Coral reefs flourish under the clear waters of Wangel Beach, Indonesia.

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EXECUTIVE SUMMARY

In preparation for the updating of the Transboundary Diagnostic Analysis (TDA) for the Arafura Timor Seas (ATS) region, Causal Chain Analysis (CCA) was conducted for three selected priority transboundary issues over a series of five workshops held in September of 2022. Facilitated by the Regional TDA Specialist, Mr. Matt Fox, the five remotely-hosted workshops were joined by a total of 32 participants, which included members of the ATSEA-2 TDA/SAP Regional Working Group (RWG), National Working Groups (NWGs) for Indonesia, Papua New Guinea and Timor-Leste, the National Coordination Units (NCU) and National TDA consultants for Indonesia, Papua New Guinea and Timor-Leste, and representatives from the ATSEA-2 Regional Project Management Unit (RPMU).

The Regional TDA Specialist facilitated a participatory process of issues identification, from which three priority transboundary environmental issues (or problems) were agreed:

Issue #1 - pollution of marine and coastal environments
Issue #2 - ecosystem, habitat and biodiversity decline
Issue #3 - unsustainable fisheries

Inputs on these priority issues 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 trans-boundary 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 ATSEA-2; rather, they are to be managed under existing national or sub-national arrangements.

Using methodologies established under the Global Environment Facility (GEF) International Waters (IW) programme, CCA was then conducted for each identified transboundary issue. Causal chain analysis is a 'systems approach' used to establish the cause-and-effect relationship inherent in transboundary issues. The CCA approach is intended to identify and understand the forces driving transboundary issues in shared environmental assets such as the ATS. Through the CCA workshops, the group identified root causes, indirect drivers, direct drivers and the socio-economic and ecological impacts for the three priority issues identified for the ATS.

Across the three issues, several common root causes were identified, including the impacts of climate change, population growth in the ATS region, tourism growth in the ATS region, and global demand for seafood. 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.

At the same time, the evidence base and monitoring frameworks for many dimensions including fisheries production, biodiversity, IUUF, socio-economic and cultural factors, and climate change impacts has steadily developed, which means that trends may now be more perceptible than they were at the time of the development of the initial TDA and SAP. These will be explored in more detail in the subsequent TDA update.

The results of these workshops will be tabled at the ATSEA-2 Regional Steering Committee (RSC) meeting, before being used as the basis for the 2023 update of the Transboundary Diagnostic Analysis.

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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, National Research and Innovation Agency (BRIN) Indonesia, National University of Timor-Leste, UNDP Indonesia, UNDP Timor-Leste, University of Papua New Guinea.

1. INTRODUCTION

1.1 Context

This Causal Chain Analysis (CCA) report was prepared for GEF/UNDP/PEMSEA Arafura and Timor Seas Ecosystem Action Phase 2 (ATSEA-2) programme by International TDA Specialist, Mr. Matt Fox. The results of the issues identification and CCA will be used to inform the development of updated versions of the Transboundary Diagnostic Analysis (TDA), Strategic Action Programme (SAP) and National Action Programmes (NAPs) for the ATS region in 2022-2023. The TDA provides the technical basis and rationale for the development of the SAP and NAPS, by allowing for the development of evidence-based pathways to action.

1.2 Description of the system

The 'system' considered by this report (also referred to within this document as the 'ATS', or the 'ATS region') is described in detail within the ATS Regional Profile (Hakim et. al., 2020) Broadly, it refers to the marine territories of four littoral nations; Australia, Indonesia, Timor-Leste, and PNG, where they overlap with the semi-enclosed ocean area of the Arafura and Timor Seas.

Figure 1 - the ATS Region (Hakim et. al., 2020)

2. TDA AND CAUSAL CHAIN ANALYSIS; APPROACH AND METHODOLOGY

A series of five workshops was held in September 2022, as follows:

Sep 1 RWG workshop (workshop#1) – RWG inception, initial investigation of priority transboundary issues

Sep 8 RWG workshop (workshop #2) – CCA for Issue #1, Pollution of marine and coastal environment

Sep 15 RWG workshop (workshop #3) – CCA for Issue #2, Ecosystem, habitat and biodiversity decline

Sep 22 RWG workshop (workshop #4) – CCA for Issue #3, Unsustainable fisheries

Sep 29 RWG workshop (workshop #5) – review and refinement of CCAs developed for Issues #1,2 and 3

Figure 2. summarises the TDA/SAP process followed by ATSEA-2. The workshops employed the following approach and framework, as adapted from an existing TDA/SAP methodology established by Global Environment Facility's (GEF) International Waters (IW) programme; the methodology may be viewed at the following link: https://iwlearn.net/manuals/tda-sap-methodology/tdasap-methodology

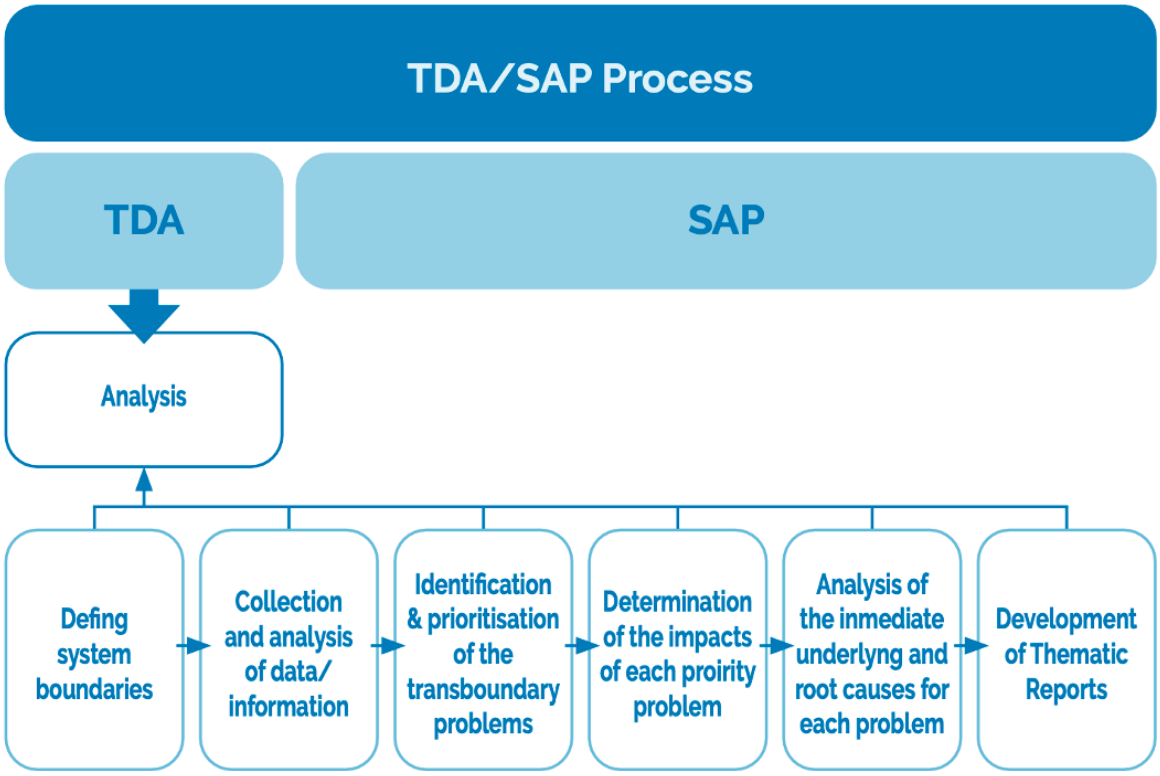

Figure 2 - TDA/SAP process (IW/GEF)

2.1 TDA and identification of priority transboundary issues

Following a TDA inception workshop held in February 2022, a follow-up 'TDA Updating Workshop' was held in Bali, Indonesia on 9 August 2022, in preparation for the updating of the TDA. During the 9 August meeting, representatives discussed the completion of 'country synthesis reports' by National TDA Consultants in collaboration with National Working Groups (NWGs), and highlighted available data and information gaps. Meeting attendees also discussed the formation of a Regional Working Group (RWG) to guide the updating of the TDA. Country representatives discussed the capacities that would be needed by the RWG, and proposed nominees to the group. A timeline was agreed that included the selection of priority issues, and the conduct of causal chain analyses (CCA) for those selected issues.

The RWG was then assembled on 1 September 2022 for the first workshop (virtual) in accordance with its role in assisting with the updating of the Arafura and Timor Seas (ATS) Transboundary Diagnostic Analysis (TDA) and Strategic Action Programme (SAP). 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 specialisations needed for the TDA-SAP updating (Refer to Appendix 2).

The first workshop was facilitated by the Regional TDA Specialist and attended by 21 participants, which included the RWG, National TDA consultants and National Coordination Units (NCUs) in Indonesia, Papua New Guinea and Timor-Leste, and representatives from the ATSEA-2 Regional Project Management Unit (RPMU).[1] The process began with the RWG examining a range of global examples from GEF-funded Large Marine Ecosystems (LME) and International Waters (IW) projects[2] to understand the framework for TDA, which includes the identification and framing of issues and the application of the Causal Chain Analysis methodology to those issues identified. The TDA Specialist also introduced the definition of Transboundary Environmental Issue, adapted from IW/GEF as follows:

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

By examining global examples, the group was able to see that an 'issue' (as defined above) may in fact be a grouping of 'like issues' and that these may be linked by the

[1] Regarding Australia's participation in the TDA updating process, Dr. Andrew Chek (National Focal Point) informed the RPMU that Australia's situation regarding participation in the TDA process has yet to be resolved. RPMU and Australia are in dialogue with regard to potential solutions in the interim to facilitate Australia's inputs into the ongoing TDA process, and to discuss possible future contribution/s to the TDA/SAP process.

[2] https://iwlearn.net/manuals/tda-sap-methodology/development-of-the-tda/identification-prioritisation-of-the-transboundary/examples-of-transboundary-and-shared-environmental/enclosed-seas-and-lmes

values they threaten (e.g., species decline), or in some cases by the threatening process itself (e.g., pollution).

Throughout the September workshop series, national consultants and project teams were running national-level processes in parallel, including the development of Country Synthesis Reports, and hosting national consultations; these inputs were intended to draw out the priorities of each ATS country in consultation with their respective NWGs, for consideration at the regional level. Within the process framework outlined in Figure 3, national consultants, NWGs and project teams were invited to share their current thinking on priority issues in the ATS; noting that these would inevitably focus on those that were of greatest importance to each country, and that they were likely to include problems that were transboundary and national (or sub-national).

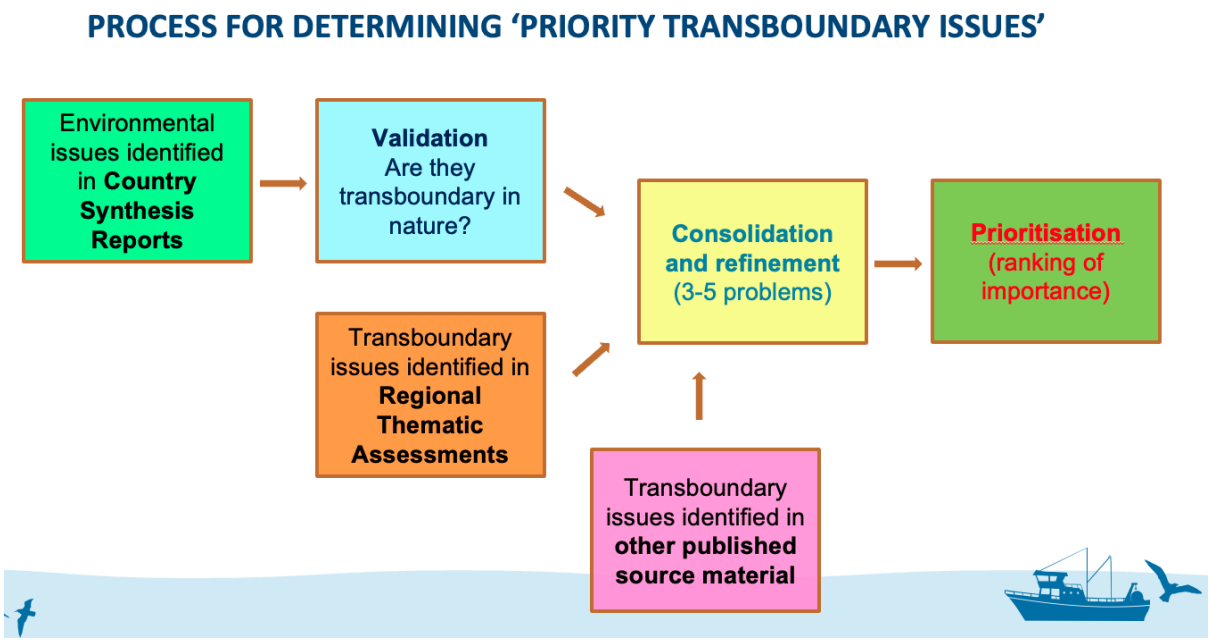

Figure 3 - Process for identifying priority transboundary issues

For the RWG issues selection/prioritisation session, the group was led through a facilitated discussion on *possible* priority transboundary issues (or problems), noting that this could not be finalized until those national-level activities were completed. The discussion began with a review of the 2011 ATS-TDA priority issues, of which there were 5. Prevailing and any emerging priorities from the ATS Regional Thematic Assessments were noted, including fisheries/EAFM-related issues, IUU, marine and pollution studies. Participants were invited to reflect on the range of regional sources of data, and their national-level consultations, and propose some initial inputs on priority TB issues via the Zoom chat function. In thinking through their issues, they were asked to consider the following criteria:

Is it an issue or problem (i.e., not a cause, driver, or impact)?
is it transboundary in nature?
is it within ATSEA's regional mandate to address?

Participants were invited to share several issues each, to be stated succinctly as a *problem.* Participants were instructed to place a letter at the beginning of the response to indicate low, medium or high priority (L, M, H). Facilitators then took each response from Zoom chat and placed it on a coloured sticky note within a template created in *Miro* (an online whiteboard tool) before undertaking a simple aggregation process to group together 'like issues'; this was done through their proximal placement on the virtual white board. Similar issues were grouped together, with high (H) priority issues placed higher on the board. Responses that were national in scale, or which were responses/proposed actions (rather than issues) were placed separately, as were entries that were not 'issues' per se; these included possible solutions, or themes.

The initial issue prioritisation exercise, conducted on 1 September, formed the basis for further investigation and refinement throughout the subsequent workshops held on 8, 15, 22 and 29 September 2022; due to time constraints, these refinements were made concurrently as CCA commenced, and as country consultants continue to complete their national-level activities.

At the beginning of each workshop, prior to Causal Chain Analyses taking place, participants were invited to review and update the Issues map. This was done to allow for any further issues raised in national consultations (which were running concurrently), or by new members to the RWG process.

2.2 Causal Chain Analysis of identified priority transboundary issues

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 allows us to systematically consider the component parts of Transboundary Issues, in order to support the development of strategies that can systematically address the root causes of issues. 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 problems that relate to human behaviour, governance systems, the allocation of resources, and the way that resources are considered by markets.

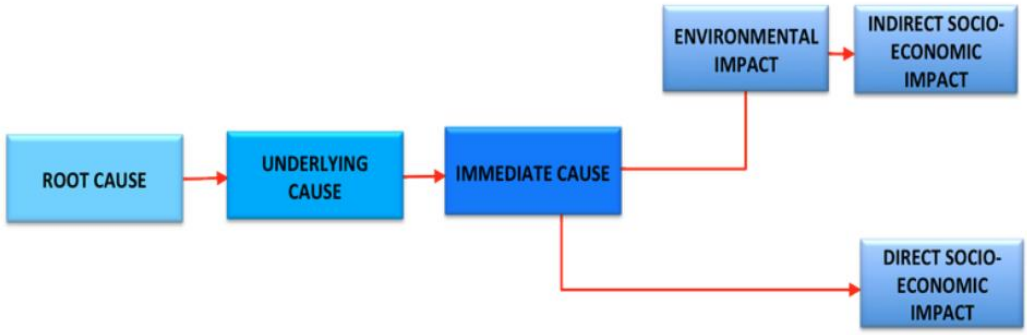

Figure 4 - Causal Chain Analysis overview (Source: GEF/IW)

To conduct CCA, the TDA Specialist facilitated the RWG to develop left-to-right 'causal chains' for the key issues identified in earlier steps, based on the approach outlined in Figure 3 Where possible, common terminology was used across all three issues; for example, a common set of 'root causes' was developed and used across all three priority issues.

CCA process results in the development of conceptual models for the issues prioritised, which include 'causal chains' that link root causes to drivers and impacts (or 'cause-and-effect'). The models for the three prioritized ATS issues are included in this report in their complete form (Figures 5,6 and 7) and summarized in table form (Tables 2, 4 and 5) to assist with readability. While every effort was made by the RWG to assign attributability to issues, it was not always possible; as an example, run-off of sediments could be attributed to multiple sectors and activities, including mining, forestry, agriculture and construction sectors. For this reason, the CCA process focused on capturing the *main* drivers and impacts.

After the initial CCA diagrams were developed with the RWG within the facilitated workshops, the TDA Consultant then refined them to ensure consistency in language, scale and accuracy. The refined CCA diagrams (Figures 6, 7 and 8) were then shared back with the group for further comment and discussion. In addition to the production of the diagrams, a secondary outcome of the process was the discussion of transboundary collaboration by the regional team; each issue was discussed at length by participants, information and knowledge was shared, and country perspectives on transboundary issues were offered. These exchanges are invaluable in establishing the working relationships and partnerships needed to implement a regional programme of action such as the ATS SAP.

3. IDENTIFICATION OF PRIORITY TRANSBOUNDARY ISSUES BY THE REGIONAL WORKING GROUP

The first step in updating the TDA for the ATS is to agree on the priority transboundary environmental issues to be addressed.

3.1 Agreed transboundary issues

Upon completion of the September workshops, the RWG members had agreed on and defined three priority Transboundary Environmental Issues for the ATS, as follows (with dot points highlighting sub-groupings as they appear in Figure 5):

ATS Transboundary Environmental Issue #1: Pollution of marine and coastal environment

- oil spills
- plastic pollution or marine debris
- abandoned, lost and discarded fishing gear (ALDFG)
- land-based pollution and sedimentation

ATS Transboundary Environmental Issue #2: Ecosystem, habitat and biodiversity decline

- deterioration of critical habitats
- climate impacts on ecosystems
- ecological communities and critical habitats
- declining populations of endangered, threatened, and protected (ETP) species
- impacts of maritime industries

ATS Transboundary Environmental Issue #3: Unsustainable fisheries

- unsustainable harvest levels
- fisheries bycatch
- illegal, unreported and unregulated fishing (IUUF)
- gender equity and socio-economic issues
- market and supply chain issues

Further development and refinement of each issue group was also conducted throughout the four CCA workshops held in September 2022, in which issues raised by Regional Thematic Assessments, and other peer-reviewed or published literature was considered, as per the process proposed by the TDA Specialist and agreed to by the RWG (Figure 2.). Figure 5 represents the final output of issues mapping, and Appendix 1 illustrates the development of issues across the 4 CCA workshops leading up to this output. Figure 5 incorporates arrows to 'link' drivers and impacts *across* the three groups; for example, fisheries bycatch is recognized as a driver of declines in populations of some ETP species.

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 group believes it will be expedient in facilitating action. It should also be noted that the current framing of issues is in draft form, and may be subject to further review and refinement in future validation workshops.

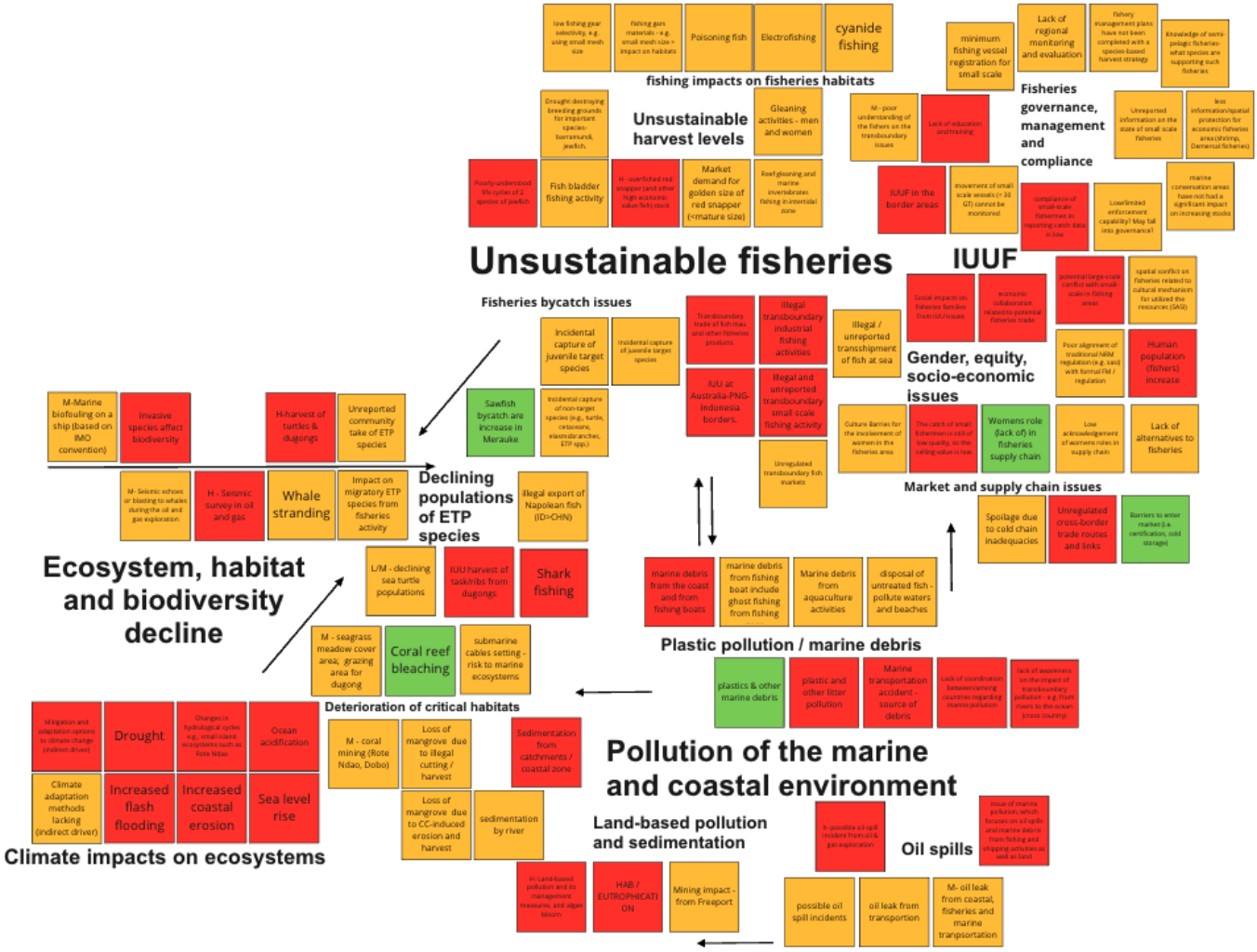

Figure 5 - Mapping of issues on Miro board (September 29, 2022 output). Colours indicate priority as suggested by participants (red – high, orange – medium, green – lower). Arrows indicate connectivity between issues

3.2 Cross-cutting issues: climate change and gender inequality

During the workshops, the RWG discussed whether climate change should be considered a transboundary problem, or a driver of issues. As it contributes to all three issues identified (and particularly to #2), it was agreed that it should be considered a *cross-cutting driver*, rather than an issue in its own right. This is in line with international best practice: the IW/GEF TDA Manual suggests treating climate change as a root cause or indirect driver (rather than as an issue in its own right) as follows "Climate change has been recognised as a significant driver (or root cause) of a number of transboundary

problems in international waters– changes in biodiversity, loss of ecosystems, eutrophication, invasive species are all affected by climate change to a great or lesser extent both currently and into the future.[3]"

As a root cause or indirect driver, climate change *exacerbates* many of the ecological and socio-economic impacts of other transboundary issues; as such, it can be difficult to establish clear attributability. As climate change is caused by the emission of greenhouse gases at global level, mitigation is beyond the scope of ATSEA-2, although in some cases, regional-level adaptation strategies may be appropriate. A vulnerability assessment of the region was undertaken by ATSEA-2 Johnson (2021) and should inform the TDA and subsequent SAP and NAPs.

The RWG also identified gender as an important cross-cutting concern that requires careful consideration in the development of the TDA and the SAP. In considering the socio-economic impacts of the three priority issues, RWG members expressed a likelihood that women may disproportionately experience these effects, and in some cases (such as reduced food security), disproportionately shoulder the burden in responding to them. A detailed Gender Equity and Social Inclusion (GESI) Analysis has been developed by ATSEA-2[4]; this analysis should be considered throughout the SAP and NAP processes to ensure that the impacts of transboundary problems do not exacerbate preexisting gender inequalities.

3.3 Key changes since 2011 TDA

Table 1 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 1 - 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)
- 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	- Unsustainable fisheries - Ecosystem, habitat and biodiversity decline - Pollution of marine and coastal ecosystems

[3] https://iwlearn.net/manuals/tda-sap-methodology/introduction/key-principles-of-the-tda-sap-approach/climate-variability-and-change

[4] ATSEA-2 Programme, (2021). Gender Equality and Social Inclusion Analysis for ATS Region, Bali, Indonesia. 80pp.

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. CAUSAL CHAIN ANALYSIS (CCA) OF AGREED PRIORITY TRANSBOUNDARY ISSUES

As described in Section 3, three agreed priority Transboundary Environmental Issues were identified by the Regional Working Group. The group agreed to commence the causal chain analyses of these three grouped priority transboundary issues (and their corresponding groupings of sub-issues), as follows.

Sep 8 RWG workshop – CCA for Issue #1, Pollution of marine and coastal environment
Sep 15 RWG workshop – CCA for Issue #2, Ecosystem, habitat and biodiversity decline
Sep 22 RWG workshop – CCA for Issue #3, Unsustainable fisheries
Sep 29 RWG workshop – review and refinement of CCAs developed for Issues #1,2 and 3

The following section documents the CCAs conducted by the RWG for the three priority issues identified.

4.1 Issue #1 – Pollution of marine and coastal environments

4.1.1 Description of the problem and transboundary issues

The priority issue as agreed by the RWG consists of the following three sub-issues:

- Plastic pollution and marine debris
- Abandoned, lost and discarded fishing gear (ALDFG)
- Land-based pollution and sedimentation
- Oil spills

All three sub-issues can act as 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, these impacts can contribute to broader cumulative and flow-on regional-level (i.e., transboundary) impacts on marine ecosystems and regional populations of species. Causal chain mapping of pollution-related issues by the RWG is shown in Figure 6, and summaries of drivers, impacts is included in Table 2.

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.

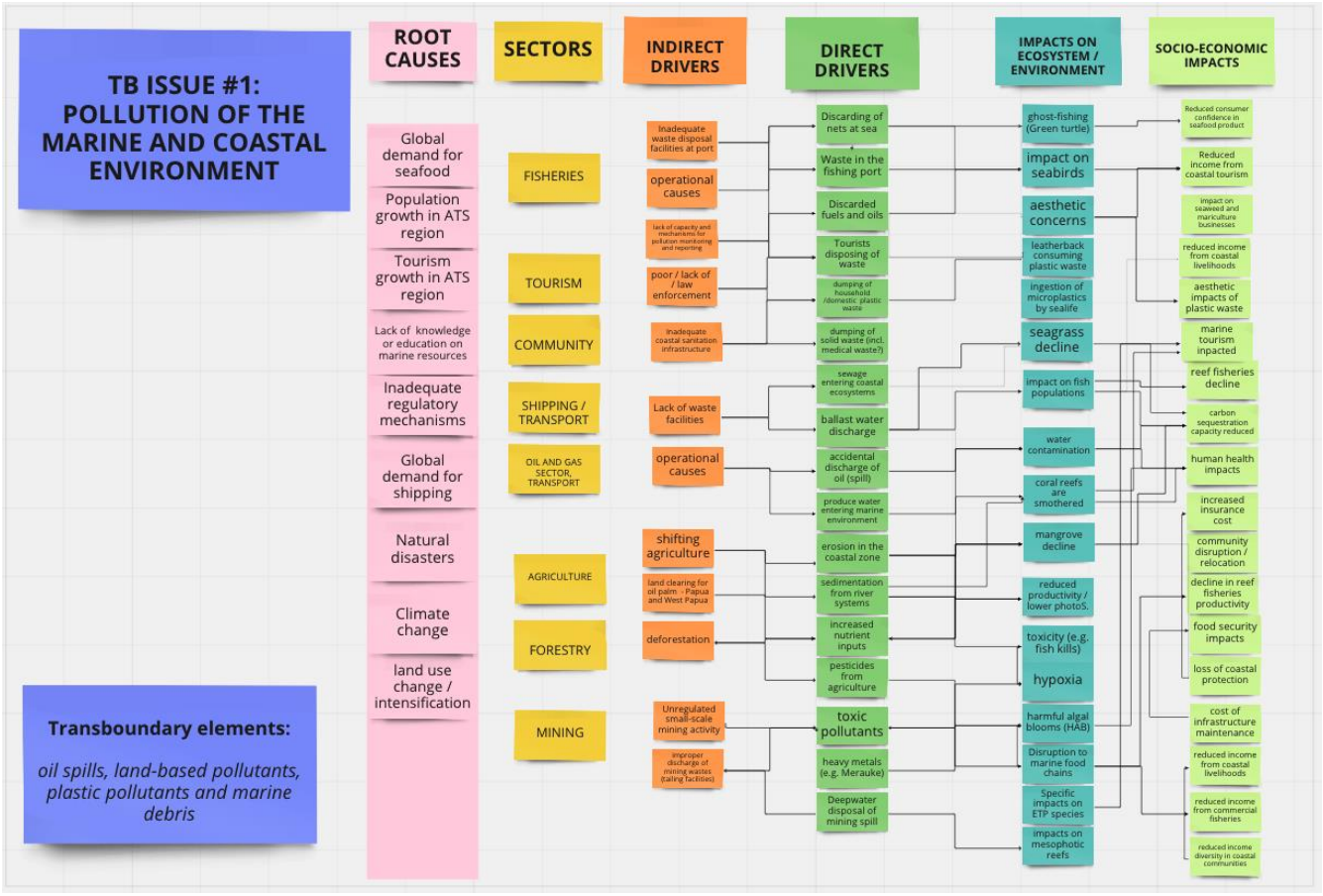

Figure 6 - Causal chain analysis of marine pollution issues, showing causality between root causes, drivers and impacts.

Marine debris

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. 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. 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).

The 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 (esp. 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.

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). 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'. Direct drivers of ALDFG include the 'direct action' of fishers purposely discarding of 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. Noted also are the impacts on ETP species, including sea turtles. Indirect drivers may include inadequate infrastructure for waste disposal facilities (e.g. at port facilities).

Land-based pollution

A second group of impacts relates to those sources of pollution originating *on land*, and are often associated with agriculture, forestry, industrial or mining sectors, or land-use intensification in the coastal zone.

Direct 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 this 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. Climate change was also identified as a root cause; 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.

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.

Oil spills and related pollution

The Regional Assessment on Land and Marine-based Pollution in the ATS region by Dr. Won-Tae Shin (Shin, 2021) highlighted region-wide (oil spill and marine debris) and localized (nutrients, sedimentation from mining, toxic substances from agricultural activities) pollution concerns. Oil spills can be a major concern and the ATS region is vulnerable to oil spills (particularly South coasts of Timor-Leste and Rote islands of Indonesia) due to increase in oil development in the region. 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, or heated.

Other concerns raised by the RWG included bioaccumulation (e.g., mercury bioaccumulation to high trophic level fish species), possible oil spill impacts to seabirds, impacts to seaweed and aquaculture industries, the effects of produced water from oil industries, ballast water, etc., and the need to look also at any specific changes or impacts related to COVID pandemic (such as the disposal of medical equipment and waste, or need for additional medical waste infrastructure). These issues will be explored in detail in the subsequent TDA report.

4.1.2 Justification of its transboundary importance

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 region, growing global demand for seafood products,* and *natural disasters.* While the direct drivers summarized in Table 2 are mostly local in nature, most, if not all of these root causes are regional (i.e., transboundary) or global. Shin (2021) identifies several hotspots that demonstrate the transboundary risk of oil spills.

4.1.3 Causal-chain analysis of drivers and impacts

Table 2 – CCA summary table (drivers and impacts), Pollution of marine and coastal environment

Priority Transboundary Issue:		*#1. Pollution of the marine and coastal environment*		
>	>	>	>	>
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	Altered marine and coastal food webs	Reduced consumer confidence in seafood product
Population growth in the ATS region	Lack of capacity and mechanisms for pollution monitoring and reporting	Waste originating from port facilities	Specific impacts on ETP species	Reduced income from coastal tourism

Tourism growth in the ATS region	Poor law enforcement of environmental laws and regulations	Inappropriate discarding of fuels and oils	Ghost fishing (e.g., turtle)	Impact on seaweed and mariculture businesses
Lack of knowledge or education of marine resources	Inadequate coastal sanitation infrastructure	Plastic waste and sanitation issues related to tourism sector	Impact on seabirds	Reduced income from coastal livelihoods
Inadequate regulatory mechanisms	Inadequate waste facilities in tourism areas	Direct dumping of household waste in coastal communities	leatherback consuming plastic waste	Aesthetic impacts of plastic waste
Global demand for shipping	Legal and illegal operations-related discharge of waste (e.g., by shipping industry)	Sewage discharge in coastal zone	Seagrass decline	Marine tourism impacted
Natural Disasters	Poorly regulated commercial-scale agriculture, inadequate EIA outcomes	Ballast water discharge	Impact on fish populations	Reef fisheries decline
Climate change	Widespread land-clearing for agricultural concessions	Accidental discharge of oil from rigs, shipping and infrastructure (oil spill)	Water contamination	Carbon sequestration capacity reduced
Land use change / intensification	Deforestation and forestry activities	Produced water entering marine environment from gas/oil extractive industries	Coral reefs are smothered	Human health impacts
	Unregulated small-scale mining activity	Erosion in the coastal zone and catchments	Mangrove decline	Increased insurance cost
	Poorly regulated mining concessions	Sedimentation from river systems	Reduced productivity / lower photosynthesis	Community disruption / relocation
	Improper discharge of mining waste / tailings	Increased nutrient inputs from agricultural sector	Toxicity (e.g., fish kills)	Decline in reef fisheries productivity
	Lack of education and public awareness	Pesticide inputs from agricultural sector	hypoxia	Food security impacts
		Direct discharge of heavy metals, toxic chemicals and waste from industrial sources	harmful algal blooms (HAB)	Loss of coastal protection
		Permitted discharge of mining waste from river system into marine environment	Disruption to marine food chains	Cost of infrastructure maintenance
			Impacts on mesophotic reefs	Reduced income from coastal livelihoods
			Ingestion of micro-plastics	Reduced income from commercial fisheries
				Reduced income diversity in coastal communities

4.1.4 Summary of small group discussion on Issue #1, including key priorities for updating TDA/SAP, gaps in the CCA and interim interventions

Direct drivers of marine pollution may originate from land or sea, and they may be accidental, incidental, and illegal or legal. Without exception, the drivers are human-influenced and in many cases, feasible technical solutions exist for their mitigation. These issues therefore present some of the most practical, immediate and achievable opportunities for regional, collaboration-based action.

In the final CCA workshop (September 29), participants were invited to share their thoughts on any key priorities for the revision of the ATS TDA/SAP, gaps in the CCA and possible short-term or interim interventions building on the results of ATSEA-2 initiatives. A detailed and systematic identification of responses and actions will be undertaken in the identification of leverage points in the TDA and subsequent development of the updated SAP.

Possible priorities for consideration in TDA/SAP updating process:

- 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 (PNG)
- 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 (e.g., TL, PNG?)
- Develop a regional platform for oil spill response
- Build national capacity to respond to oil spills and marine debris

4.1.5 References, data sources and potential indicators to be incorporated in TDA

Regional & national assessments, reporting requirements to MARPOL, refer to Country Synthesis Reports (CSRs), reports from Marine Pollution Secretariat under KHLK/ MOEF (Indonesia), Mining compliance report (PNG)

Fonseca, A., Spiller, G (2021). Marine and Land-based Pollution Study on the South Coast of Timor-Leste. Report to the Arafura and Timor Seas Ecosystem Action Project Phase II (ATSEA-2), Dili, Timor-Leste, 78pp.

Shin, Won-Tae (2021). Marine and Land-based Pollution Assessment on the Southern Coast of Rote Ndao Regency, Indonesia. Report to the Arafura and Timor Seas Ecosystem Action Project Phase II (ATSEA-2), Dili, Timor-Leste, 57pp.

Shin, Won-Tae (2021). Marine and Land-based Pollution Assessment in the Arafura and Timor Seas Region. Report to the Arafura and Timor Seas Ecosystem Action Project Phase II (ATSEA-2), Dili, Timor-Leste, 68pp.

Transboundary Diagnostic Analysis Country Synthesis Reports for Indonesia, Papua New Guinea, and Timor-Leste (2022). Report to the Arafura and Timor Seas Ecosystem Action Project Phase II (ATSEA-2)

4.2 Issue #2 – Decline or degradation of marine and coastal ecosystems, habitats and biodiversity

4.2.1 Description of the problem and transboundary issues

This group combines three connected groupings of issues related to ecosystems and biodiversity in the ATS; *deterioration of habitats, ecosystems and communities; declining populations of ETP species; and climate impacts on ecosystems.*

Climate change was identified as both root cause and driver of the issue. Increased sea surface temperature, ocean acidification, altered storm frequency and/or intensity, changes in hydrological cycles on land all contribute to the declines in ecosystems, habitats and biodiversity. The RWG highlighted specific ecosystems likely to be impacted by the impacts of climate change, including shallow coral reefs and mangroves. Johnson (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.

4.2.2 Justification of its transboundary importance

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.

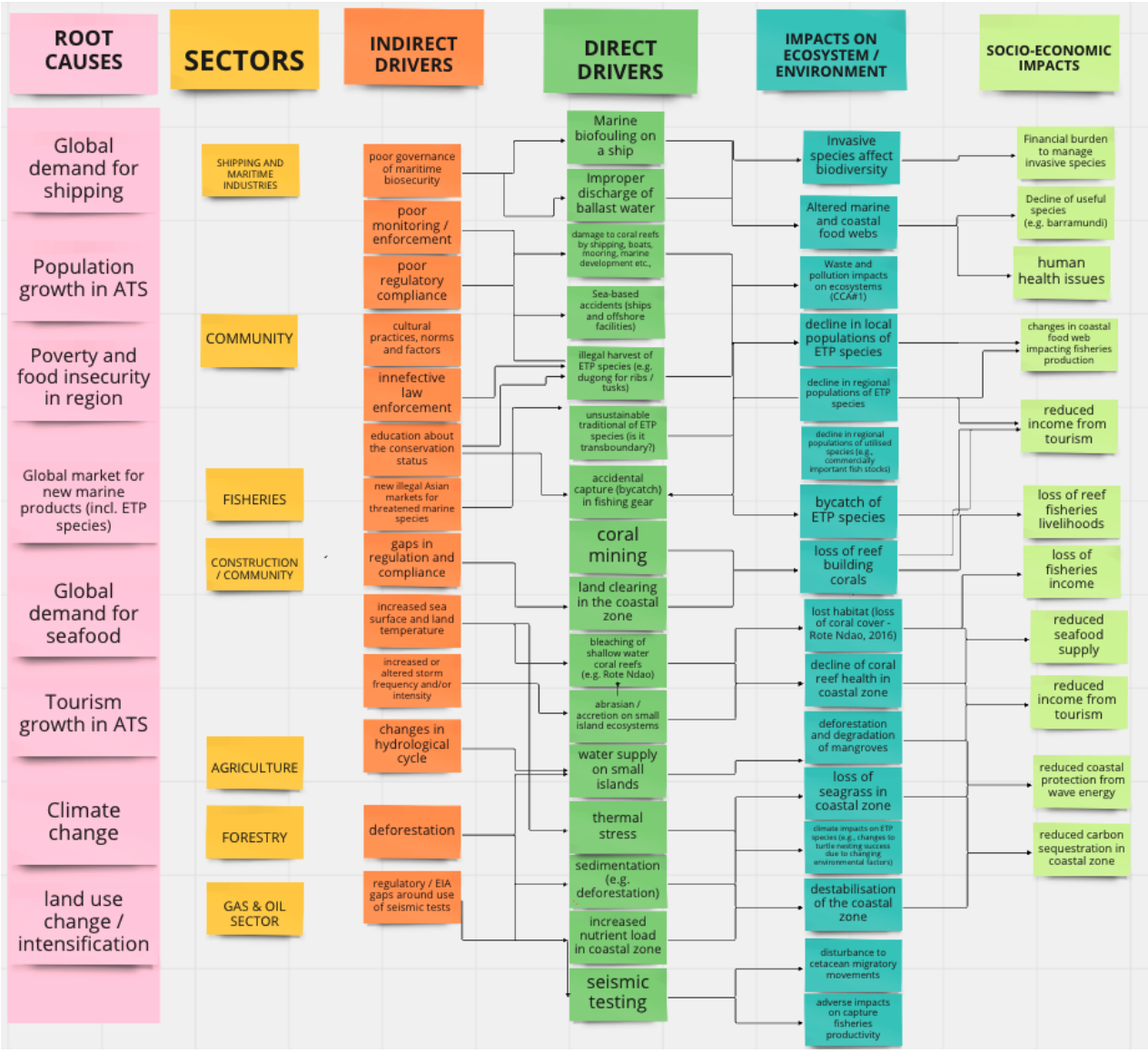

Figure 7 - Causal chain analysis for ecosystem, habitat and biodiversity decline issue, showing causality between root causes, drivers and impacts

Drivers of the issue

Figure 7 demonstrates 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, 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 activity. 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, the trans-boundary nature of organised crime networks related to the illegal trade of marine species and products. 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.

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.

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. Anthropomorphic 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 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.

Also implicit in this analysis is the cumulative impact of these indirect and direct drivers; alone, a single driver may not represent an existential threat to an ecosystem, ecological community or species, but when considered alongside all drivers, it may. An example of this is the traditional harvest of ETP species; populations of turtles, or dugongs for example, may once have been able to withstand local hunting pressure, but when considered alongside contemporary threats such as organized criminal poaching or climate change-driven habitat loss, those cultural harvests may no longer be considered sustainable if they contribute to overall declines in regional populations.

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 below:

Table 3 - 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
	altered marine and coastal food webs

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 region, growing global demand for seafood products.

4.2.3 Causal-chain analysis of drivers and impacts

Table 4 – CCA summary table (drivers and impacts), 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**
Global demand for shipping	poor or inconsistent governance of marine biosecurity	introduction of invasive species through hull biofouling	altered marine and coastal food webs	financial burden of managing invasive species
Population growth in the ATS region	poor, ineffective or inconsistent monitoring and enforcement regimes	introduction of invasive species through improper discharge of ballast water	declines in local and regional populations of ETP species	declines in fish catch
Poverty and food insecurity in ATS region	ineffective law enforcement	damage to reefs by shipping and boating activity, mooring, marina developments	new populations of invasive species in ATS region	public health and human health issues
Global market for new marine products (including ETPs)	gaps in regulation and compliance	illegal harvest of ETP species driven by global trade (e.g.,	loss of reef building corals	reduced income from marine and coastal tourism

		shark fin, dugong rub/tusk)		
Global demand for seafood	regulatory gaps around use of seismic tests	accidental capture (bycatch) in fishing gears	loss of critical habitats	loss of reef fisheries livelihoods
Tourism growth in ATS	poor application and regulatory gaps related to EIA	mining of coral	decline in coral reef health in coastal zone	loss of fisheries incomes and employment
Climate change	poor or inconsistent governance of marine biosecurity	land clearing and land-use change in coastal zone	deforestation and degradation of mangroves	Declines in mariculture productivity
Land use change / intensification in ATS region	lack of fisheries transboundary compliance framework	bleaching of shallow water coral reefs	loss of seagrass in coastal zone	reduced seafood supply / reduced affordability
	lack of budget for fisheries law enforcement	accelerated abrasion/accretion on small island ecosystems	destabilisation of the coastal zone	reduced coastal protection/resilience of coastal communities from natural disasters
	Emerging illegal markets for threatened marine species	changes in hydrological cycles in small island ecosystems	disturbances to migratory movements of cetaceans and other highly mobile species	reduced carbon sequestration in coastal 'blue carbon' ecosystems
	influence of perverse subsidies	sedimentation exacerbated by deforestation of catchments	adverse impacts on fisheries productivity	impacts to delivery of ecosystem services
	well-established regional/cultural trade networks	increased nutrient load in coastal zone	reduced carbon sequestration in coastal 'blue carbon' ecosystems	
	trans-boundary market connectivity among ATS countries	use of seismic testing in gas/oil exploration	declines in populations of useful species (e.g., commercially important fish stocks)	
	organised illegal trade / crime networks	Sea-based accidents (from ships; offshore facilities)	Destabilisation of the coastal zone	
	deforestation from forestry and agricultural industries		Climate impacts on ETP species (e.g., changes to sea turtle nesting success due to environmental factors)	
	cultural practices, norms and factors			
	low education / awareness about conservation status of species, ecosystems			
	lack of livelihood opportunities in coastal communities			

4.2.4 Summary of small group discussion on Issue #2, including key priorities for updating TDA/SAP, gaps in the CCA and interim interventions

In the final CCA workshop (September 29), participants were invited to share their thoughts on any key priorities for the revision of the ATS TDA/SAP, gaps in the CCA and possible short-term or interim interventions building on the results of ATSEA-2 initiatives. A detailed and systematic identification of responses and actions will be undertaken in the identification of leverage points in the TDA and subsequent development of the updated SAP.

Possible interventions raised in relation to Issue #2 include the following:

Possible short-term interventions (i.e. implementation of current ATS SAP)

- Consider the MPA Network Design and Roadmap as a reference, or guide in identifying possible areas for designation of new MPAs (as part of updated NAPs)
- Incorporation of climate adaptation initiatives in conservation and MPA management plans
- Use of ATS-generated biodiversity ATLAS and Marine Spatial Planning tools
- Use of the the regional sea turtle action plan for the ATS region (Pilcher, 2021) as a reference or guide for possible actions to conserve sea turtles.

Priorities and possible strategies for consideration in TDA/SAP updating process:

- 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)
- 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)

4.2.5 References, data sources and potential indicators to be incorporated in TDA

Participants identified the following references:

ATSEA-2 (2021) Atlas of Arafura and Timor Seas: Status, Challenges and Opportunities. (ATSEA-2) Bali, Indonesia. 101pp.

Choesin., Devi, N., Rosleine, D., Pratama, M.F., Kendali, M., and Maria, B,(2021). Valuation of Ecosystem Services in the Arafura and Timor Seas Region. Report to the Arafura and Timor Seas Ecosystem Action Phase 2 (ATSEA-2) Project,Yayasan Konservasi Alam Nusantara and Coral Triangle Center, Indonesia. 45p

Hakim, L., Prananda A.R.A., Pratama, D.R., Fariyanto, Y, (2020). Regional Profile of Coastal and Marine Ecosystems, their Connectivity, Ecological Importance and Socio-cultural Impact on the Arafura and Timor Seas Region. Report to the Arafura and Timor Seas Ecosystem Action Project Phase II (ATSEA-2), Yayasan Konservasi Alam Nusantara and Coral Triangle Centre, Indonesia, 48pp.

Fajariyanto, Y., Hakim, L., and Prananda, A.R.A., (2020) Analysis of Threatened, Charismatic and Migratory Species Distribution around the Arafura Sea. Report to the Arafura and Timor Seas Ecosystem Action Project Phase II (ATSEA-2) Yayasan Konservasi Alam Nusantara and Coral Triangle Centre, Indonesia, 21pp.

Johnson JE, Welch DJ, van Hooidonk R, Tracey, D (2021) Assessing the Vulnerability of the Arafura and Timor Seas Region to Climate Change. Report to the Arafura and Timor Seas Ecosystem Action Project Phase II (ATSEA-2), C2O Consulting, Australia. 112pp.

Pilcher, N., (2021) Status of Sea Turtles in the Arafura and Timor Seas. Report to the Arafura and Timor Seas Ecosystem Action Project Phase II (ATSEA-2) Bali, Indonesia, 84pp.

Transboundary Diagnostic Analysis Country Synthesis Reports for Indonesia, Papua New Guinea, and Timor-Leste (2022). Report to the Arafura and Timor Seas Ecosystem Action Project Phase II (ATSEA-2)

Other sources:

- Coral reef restoration in Indonesia: a review of policies and project (Razak, 2022),
- ATS ecosystem assessments; Rote Ndao, Southeast Aru and Kolepom Island
- Regional coral reef threat assessments from 50 Reefs, Resilient Reefs and others

4.3 Issue #3 – Unsustainable fisheries

4.3.1 Description of the problem and transboundary issues

This priority transboundary issue is concerned with overall sustainability of fisheries activities in the ATS region, both from the perspective of the sustainability 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. Several sub-groupings of 'like issues' were generated in discussions with the RWG, including *issues related to IUUF, fisheries bycatch issues, unsustainable harvest levels, fishing impacts on fisheries habitats, governance-related problems, issues of gender and equity, and market-related issues. These are evident in the CCA output for this issue (Figure 8).*

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 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).

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.

Climate change was identified as 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), certain valuable fisheries habitats are likely to be undermined also. Johnson (2021) identified shallow coral reefs fisheries and associated target species as particularly vulnerable. Further, where stock status is already undermined by other drivers (such as overfishing or water quality), climate change increased the vulnerability of those species.

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 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 socio-economic impacts of unsustainable fisheries in the ATS may relate to 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 following:

Regional food security

- Reduced protein supply
- Increased cost for consumers
- Reduced food security for artisanal fishers
- Reduced fish quality

Management

- Increased costs for management
- Cost of surveillance
- Conflict and/or diplomatic issues between countries
- Conflict between fishing sectors (e.g., commercial v. SSF)

Social impacts

- Increased burden of food insecurity borne by women
- Human rights violations for fisheries workers
- Safety-at-sea issues for fishers
- Reduced income and employment from fisheries

Market issues

- Lost market value
- Lost employment opportunities
- Fish spoilage, waste
- Increased cost for fishing companies (e.g., having to travel further to fish)

4.3.2 Justification of its transboundary importance

This priority transboundary issue is significant in that it considers the use of living marine resources which at times, may span ATS jurisdictional boundaries, and may be influenced by the management of fish stocks within jurisdictions. This issue may be considered transboundary for two reasons; i/ *ecological parameters* such as distribution of fish stocks or habitats may span jurisdictional boundaries, and 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.

Most of the transboundary issues raised in workshops may be captured in the term 'IUUF' which refers to Illegal, Unreported and Unregulated (fishing). Through the Asia Pacific Fishery Commission (AFPIC), the FAO has developed a Regional Plan of Action on IUU (RPOA-IUU) to combat the issue of IUUF across the region. FAO (Wilcox, 2021) identifies four IUUF hotspots in the Arafura Timor Seas, 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" (PNG EEZ) and the Ashmore Reef, Scott Reef and Cartier Island, all within Australia's EEZ.

IUUF was a strong focus of the ATS TDA 2011 and SAP, and significant progress has been made in the past decade, especially within Indonesia's EEZ. These issues will be developed in full in the 2022 TDA update.

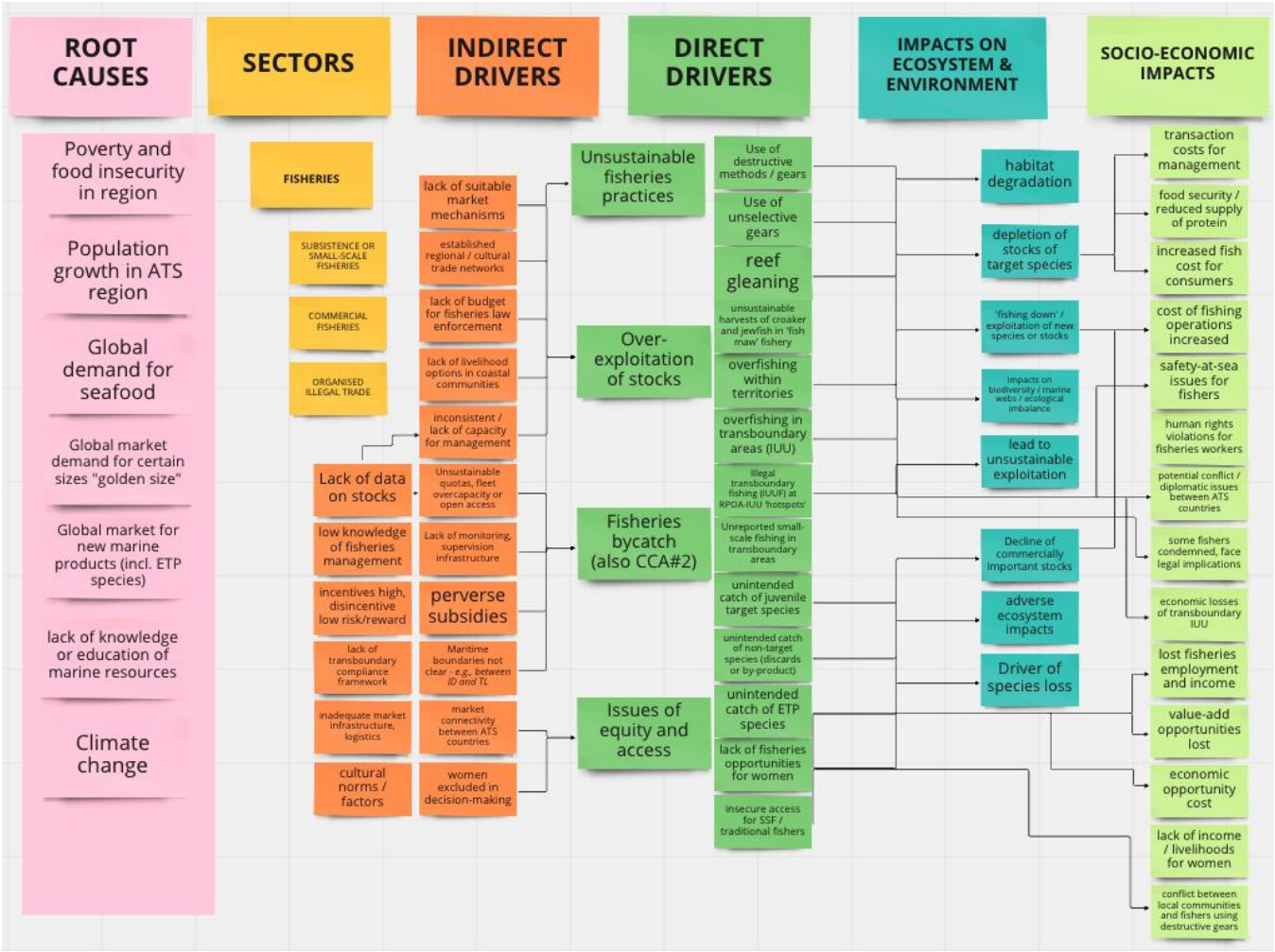

Figure 8 - Causal chain analysis for unsustainable fisheries issue, showing causality between root causes, drivers and impacts.

Root causes identified include *climate change impacts on ecosystems, regional population growth, poverty and food insecurity in region, growing global demand for seafood products*

4.3.3 Causal-chain analysis of drivers and impacts

Table 5 – CCA summary table (drivers and impacts), Unsustainable fisheries

Priority Transboundary Issue:		Unsustainable fisheries		
>	>	>	>	>
ROOT CAUSES	**INDIRECT DRIVERS**	**DIRECT DRIVERS**	**ECOLOGICAL IMPACTS**	**SOCIO-ECONOMIC IMPACTS**
Poverty and food insecurity in ATS region	Lack of data on stocks	Destructive gears (dynamite, potassium, cyanide, electro-fishing)	Habitat degradation (e.g., by use of destructive gears)	Reduced food security in ATS
Population growth in the ATS region	Low knowledge fisheries management among fishers	Gears with low selectivity (mesh, hook size)	Decline / depletion of commercially important stocks	Reduced protein supply

Global demand for seafood	High incentive / low risk for overfishing	Reef gleaning	Phenomenon of 'fishing down' or exploiting new stocks	Increased cost for consumers
Global market demand for certain sizes "golden size"	Lack of transboundary compliance framework	Overfishing within territories by commercial fleets due to inappropriate TAC/quota (catch levels exceeding MSY)	Impacts on biodiversity, marine food webs, ecological imbalance	Reduced food security for artisanal fishers
Global market for new marine products (including ETPs)	Unsustainable quotas, fleet overcapacity, open access arrangements	Unreported catch by SSF	Loss or depletion of non-target species including ETP species, charismatic megafauna,	Reduced fish quality
Lack of knowledge or education of marine resources	Lack of budget for fisheries law enforcement	IUU effort in transboundary areas		Increased costs for management
Climate change	Lack of monitoring, supervision infrastructure	Overfishing within territories by commercial fleets due to inappropriate TAC/quota (catch levels exceeding MSY)		Cost of surveillance
	Some maritime boundaries unresolved, or unclear to fishers (e.g., TL-ID)	Unsustainable harvests of croaker and jewfish in 'fish maw' fishery		Conflict and/or diplomatic issues between countries
	Influence of perverse subsidies	Unintended catch of juvenile target species		Conflict between fishing sectors (e.g., commercial v. SSF)
	Well-established regional/cultural trade networks create or sustain demand for products from unsustainable fisheries	Unintended catch of non-target species (discards or by-product)		Increased burden of food insecurity borne by women
	Trans-boundary market connectivity among ATS countries create or sustain demand for products from unsustainable fisheries	Unintended catch of ETP species		Human rights violations for fisheries workers
	Organised illegal trade / crime networks	Lack of fisheries opportunities for women		Safety-at-sea issues for fishers
	Lack of livelihood opportunities in coastal communities	Insecure access for SSF / traditional fishers		Reduced income and employment from fisheries
	Inconsistent / lack of management capacity	Conflict between fisheries sectors (e.g., commercial v SSF)		Lost market value
	Women excluded in decision-making			Lost employment opportunities
	Cultural norms and factors			Fish spoilage, waste
				Increased cost for fishing companies (e.g., having to travel further to fish)

4.3.4 Summary of small group discussion on Issue #3, including key priorities for updating TDA/SAP, gaps in the CCA and interim interventions

In the final CCA workshop (September 29), participants were invited to share their thoughts on any key priorities for the revision of the ATS TDA/SAP, gaps in the CCA and possible short-term or interim interventions building on the results of ATSEA-2 initiatives. A detailed and systematic identification of responses and actions will be undertaken in the identification of leverage points in the TDA and subsequent development of the updated SAP.

Possible short-term interventions and gaps in the CCA raised in relation to Issue #3 include the following:

Possible short-term interventions (i.e. implementation of current ATS SAP)

- Endorsement and *implementation of the EAFM plan for Red snapper* (still requires RSC endorsement)
- National-level activities under NAPs being implemented
- FIPs now being implemented at national or sub-national level (these represent the best opportunity for collaboration with private sector)
- Collaborative research underway but may be expanded (with university partners)
- The creation of the proposed Regional Stakeholder Working Group presents an opportunity for a new Technical Working Group for Fisheries Management (still requires RSC endorsement)

Gaps/priorities for inclusion in CCA/TDA

'*Fish maw issue*' in Arafura Sea

- The unsustainable harvest of jewfish and croakers species in the Arafura Sea to supply a growing medicinal market is emerging as a key issue
- There is evidence that key stocks are already in decline
- Currently no regulations or catch limits on catch of key species or export of fish maw
- Transboundary in nature, as harvesting and markets span the PNG-Indonesia maritime boundary
- Collaboration on research is needed to understand regional harvest and supply chains. There may be opportunities to develop management plans and integrated economic activity to reduce wastage
- Preferred gear of gillnet is understood by locals as a significant driver of ETP bycatch issues

4.3.5 References, data sources and potential indicators to be incorporated in TDA

The following references and data sources were raised by RWG members as relevant references to be considered in the 2022 TDA update:

Fishwell Consulting (2021). EAFM Plan for Timor-Leste South Coast Red Snapper Fishery. Report to the Arafura and Timor Seas Ecosystem Action Project Phase II (ATSEA-2), Dili, Timor-Leste, 45pp.

Fox, M., Hidayat, T., Knuckey, I., Greenberg, N., Koopman, M., Ribeiro, L., (2021) Scaling up RBM in the ATS: Taking a rights-based approach to management of small-scale red snapper fisheries in the ATS region. Report to the Arafura and Timor Seas Ecosystem Action Project Phase II (ATSEA-2), Dili, Timor-Leste, 75pp.

Johnson JE, Welch DJ, van Hooidonk R, Tracey, D (2021) Assessing the Vulnerability of the Arafura and Timor Seas Region to Climate Change. Report to the Arafura and Timor Seas Ecosystem Action Project Phase II (ATSEA-2), C2O Consulting, Australia. 112pp.

Knuckey, I., Koopman, M., Fox, M. and N. Greenberg (2021). An Ecosystem Approach to Fisheries Management for Red Snapper in the Arafura and Timor Seas – Fisheries Baselines. Report to the Arafura and Timor Seas Ecosystem Action Project Phase II (ATSEA-2), Dili, Timor-Leste, 68pp.

Mitchell, D.K. (2021). Papua New Guinea Legal Framework in Marine and Fisheries; that relates to South Fly, Western Province. Report to the Arafura and Timor Seas Ecosystem Action Project Phase II (ATSEA-2) Eco Custodian Advocates, Papua New Guinea

Wilcox, C., Mann, V., Cannard, T., Ford, J., Hoshino, E and Pascoe, S. 2021. *A review of illegal, unreported and unregulated fishing issues and progress in the Asia-Pacific Fishery Commission region.* Bangkok and Hobart, FAO.

Transboundary Diagnostic Analysis Country Synthesis Reports for Indonesia, Papua New Guinea, and Timor-Leste (2022) Report to the Arafura and Timor Seas Ecosystem Action Project Phase II (ATSEA-2)

Other sources identified by participants:

- IUU Fishing Index 2021
- New stock assessment data from MMAF. (Kepmen KP.19 2022)
- FIP pre-assessments for red snapper & barramundi, shrimp (Indonesia)
- Fisheries loss assessment and fisheries surveillance gap (Bahasa Indonesia draft)
- RPOA-IUU Fishing annual report, and outputs from ATSEA-2 G-20 workshop
- Research on derelict fishing gears (Australia, PT Hatfield, etc.)

4.4 Commonalities among root causes

Across the three key issues identified, several common root causes were identified, as shown in Table 6. While their impacts may be significant, several of these driving forces are quite general in nature (e.g., inadequate regulatory mechanisms), while others are clearly beyond the scope of ATSEA-2 (e.g., global demand for seafood). Nonetheless, they should be considered further in the subsequent review of the TDA, analysed in terms of leverage points, and where appropriate, addressed by the next SAP iteration.

Table 6 - Commonality among root causes

ROOT CAUSE	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	✓	✓	✓
Population growth in the ATS region	✓	✓	✓
Tourism growth in the ATS region	✓	✓	✓
Lack of knowledge or education of marine resources	✓		
Inadequate regulatory mechanisms	✓		
Global demand for shipping	✓	✓	
Climate change	✓	✓	✓
Natural disasters	✓		
Land use change / intensification in ATS region		✓	
Poverty and food insecurity in ATS region		✓	✓
Global market demand for certain sizes "golden size"			✓
Global market for new marine products (including ETPs)		✓	✓

Drivers (both direct and indirect) share commonalities across the region also; the trans-national nature of maritime industries and growing demand for shipping contribute to issues of marine pollution and debris, the steady development of coastal regions contributes to land-use change and intensification, and land-based impacts. Growing demand for seafood, and local food security needs all contribute to overfishing and IUU issues, which in turn contribute to the observed declines in ecosystems and habitats.

Further, the forces of climate change may drive or exacerbate many of the issues discussed in the CCAs, from altering marine and coastal ecosystems and habitats, to altering environmental conditions, and bringing changes to the way coastal communities live their lives in the ATS. As such, it is suggested that climate change is treated as a 'cross-cutting issue' to be considered across the breadth of the TDA and SAP; this will ensure that where appropriate, the ATS community may consider available mitigation and adaptation strategies and actions at the transboundary level.

Lastly, the cumulative impact of these transboundary environmental issues should not be dismissed; in most cases, it will not be a single factor driving a problem, but several. This may be further exacerbated by issues occurring within national jurisdictions. It is for this reason that coordinated regional and national level activity is required, through the development and implementation of an evidence-based SAP and NAPs.

5. CONCLUSIONS AND RECOMMENDATIONS

Through the process facilitated by the ATSEA-2 RPMU throughout September 2022, the ATS RWG and partners have considered the challenges facing the sustainability of the ATS region, and in particular, the transboundary environmental issues facing the Arafura and Timor Seas. In doing so, the RWG has prioritised the following three Transboundary Environmental Issues to be addressed in future collaboration under ATSEA-2;

- *pollution of marine and coastal environments*
- *ecosystem, habitat and biodiversity decline*
- *unsustainable fisheries*

For each of these issues (and their component sub-issues), causal chains were then developed to understand the issue in terms of its specific root causes, indirect drivers, direct drivers, and its ecological and socio-economic impacts. By doing so, it will allow for future actions under the ATSEA-2 partnership, and by national governments to strategically address root causes of issues (rather than symptoms), which may include complex institutional arrangements, socio-economic factors and economic drivers at multiple scales.

In addition to the three priority transboundary issues identified, two 'cross-cutting issues were also identified; climate change (as a root cause and driver), and gender inequality. Key documents have been prepared by ATSEA-2 to ensure that these cross-cutting concerns are addressed throughout the TDA, SAP and NAP process. Johnson (2021) identifies key climate change vulnerabilities across the region, and can help guide adaptation processes. The ATSEA Gender Equity and Social Inclusion (GESI) Analysis (ATSEA-2 Programme, 2021) can help to ensure that SAP and NAP actions don't exacerbate existing gender inequalities, and that efforts are made within these processes to widen the role and participation of women in the response to the transboundary issues identified.

Assuming the Regional Steering Committee's timely endorsement of the three priority transboundary issues identified within, the key steps ahead include the following:

- The development of the full *Transboundary Diagnostic Analysis*, (TDA) which focuses on the three issues identified in this report. It will include additional spatial, temporal and other quantitative data on the issues presented, and further develop the evidence base for each issue, with relevant references and datasets.

- The consideration of 'leverage points', where the technical feasibility, political expediency, cost-effectiveness and (potential) relative impact of solutions and strategies is considered, in order to inform the next iteration of the Strategic Action Programme (SAP).

- Conduct of national and regional TDA validation workshops to review and refine the updated TDA. Refinement of the framing of the transboundary

environmental issues, and the prioritisation of drivers and impacts to continue throughout the TDA updating process, according to the timeline in Table 7.

- Submission of the updated TDA to the RSC for final review and approval to serve as reference for the updating of the ATS SAP and supporting National Action Programmes (NAPs).

Table 7 - Next steps and timeline for TDA updating

Timeline	Activity
W1 Oct 2022	Draft CCA Report completed; share with RWG & NWG
W2 Oct 2022 (Oct. 10)	RWG & NWGs provide feedback/inputs
W2 Oct 2022 (Oct. 14)	Finalize Draft CCA Report for sharing to RSC
W1 Nov 2022	Draft CCA Report tabled at RSC for endorsement of priority transboundary issues and timeline/roadmap for the completion of updated TDA
W4 Nov 2022	Draft TDA Report will be distributed to NWGs*
W1-2 Dec 2022	National TDA Validation Workshops of Draft TDA Report (NWGs)
W3 Dec 2022	Inputs received by TDA Consultant, completion of V2 draft TDA
W2 Jan 2023	TDA Draft V2 shared to NWGs and RWG for comment
W2 Feb 2023	Regional Validation workshop (RWG), completion of V3 draft TDA
Mar 2023	final RSC / RWG feedback on V3 TDA Report, completion

6. APPENDICES

Appendix 1 – Mapping of priority transboundary issues – workshop outputs

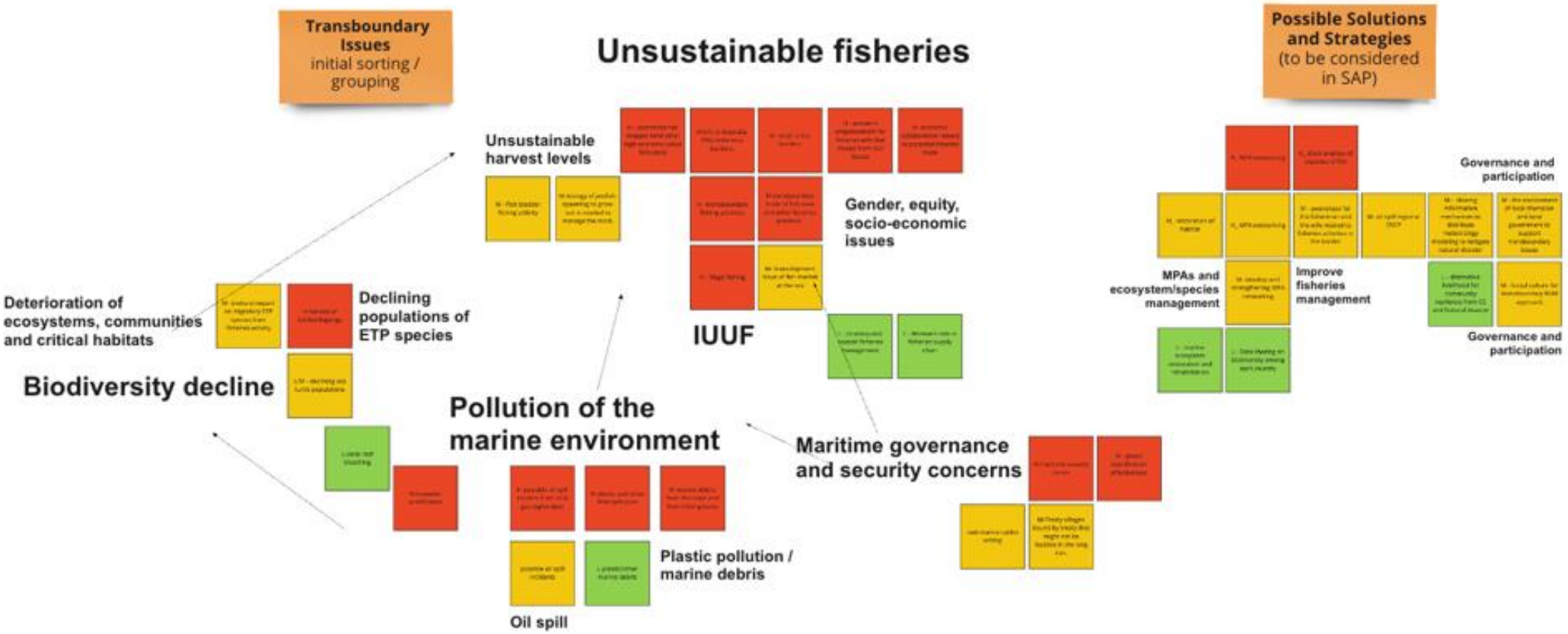

Figure 9 - Issue identification and prioritisation output, September 1, 2022, workshop output

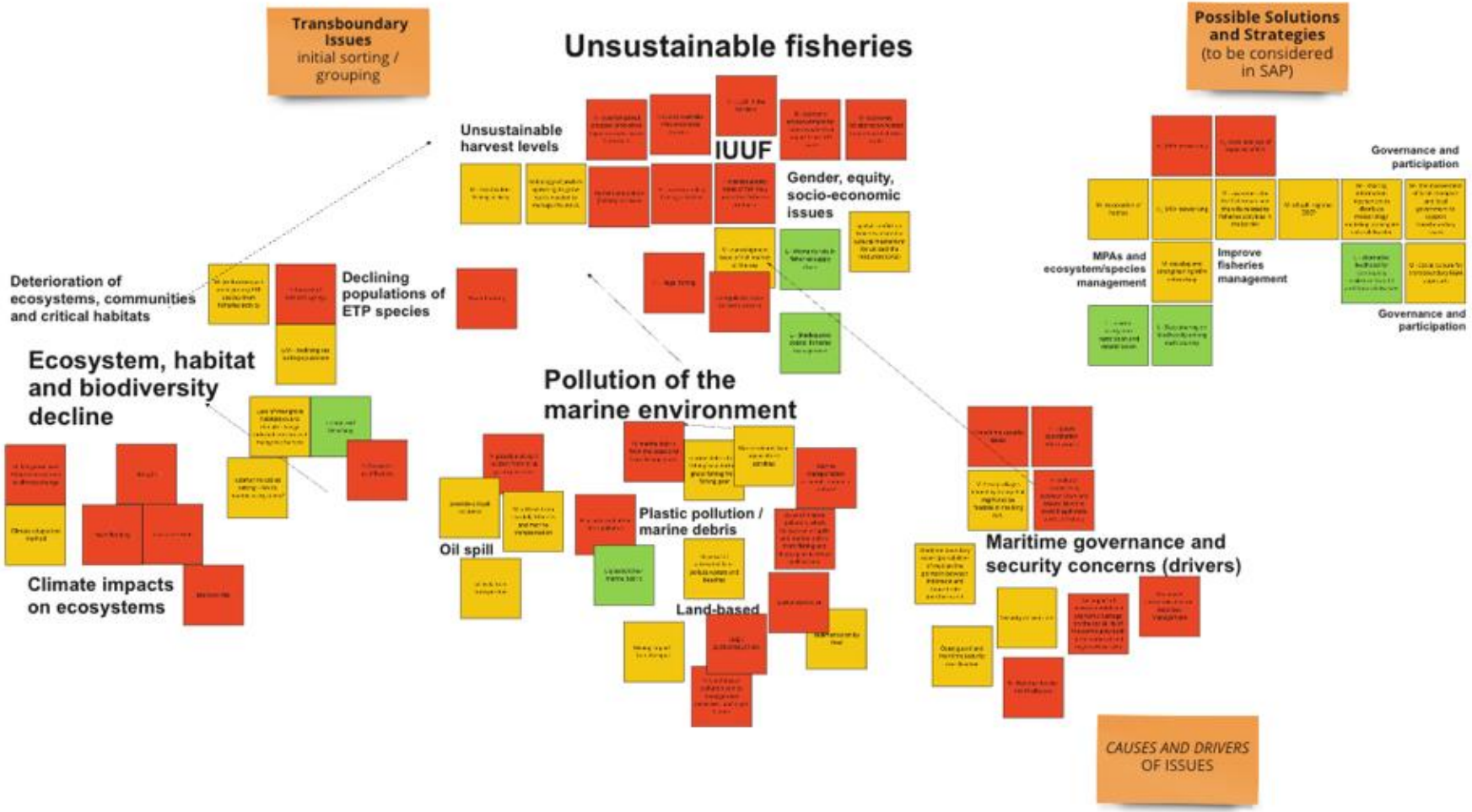

Figure 10 - Issue identification and prioritisation output, September 8, 2022, workshop output (building on previous outputs)

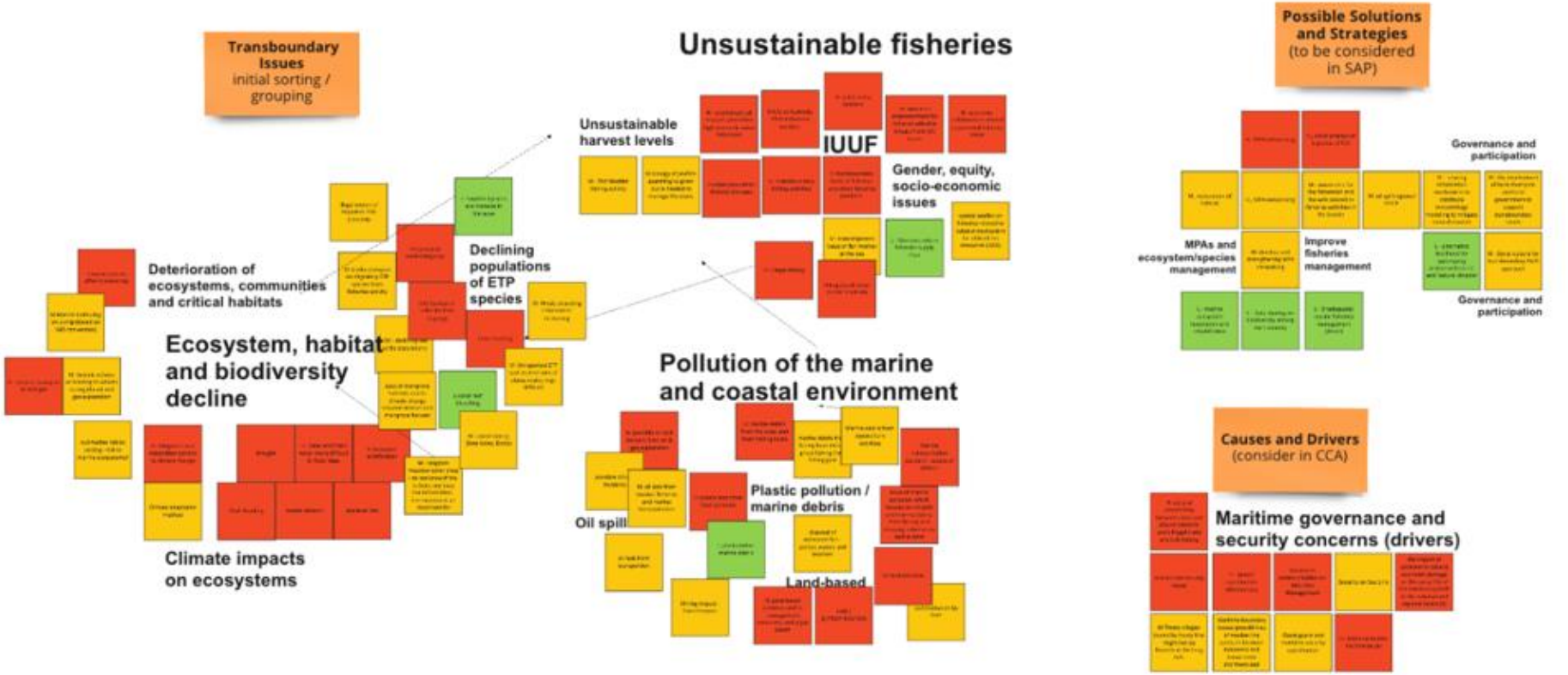

Figure 11 - Issue identification and prioritisation output, September 15, 2022, workshop output (building on previous outputs)

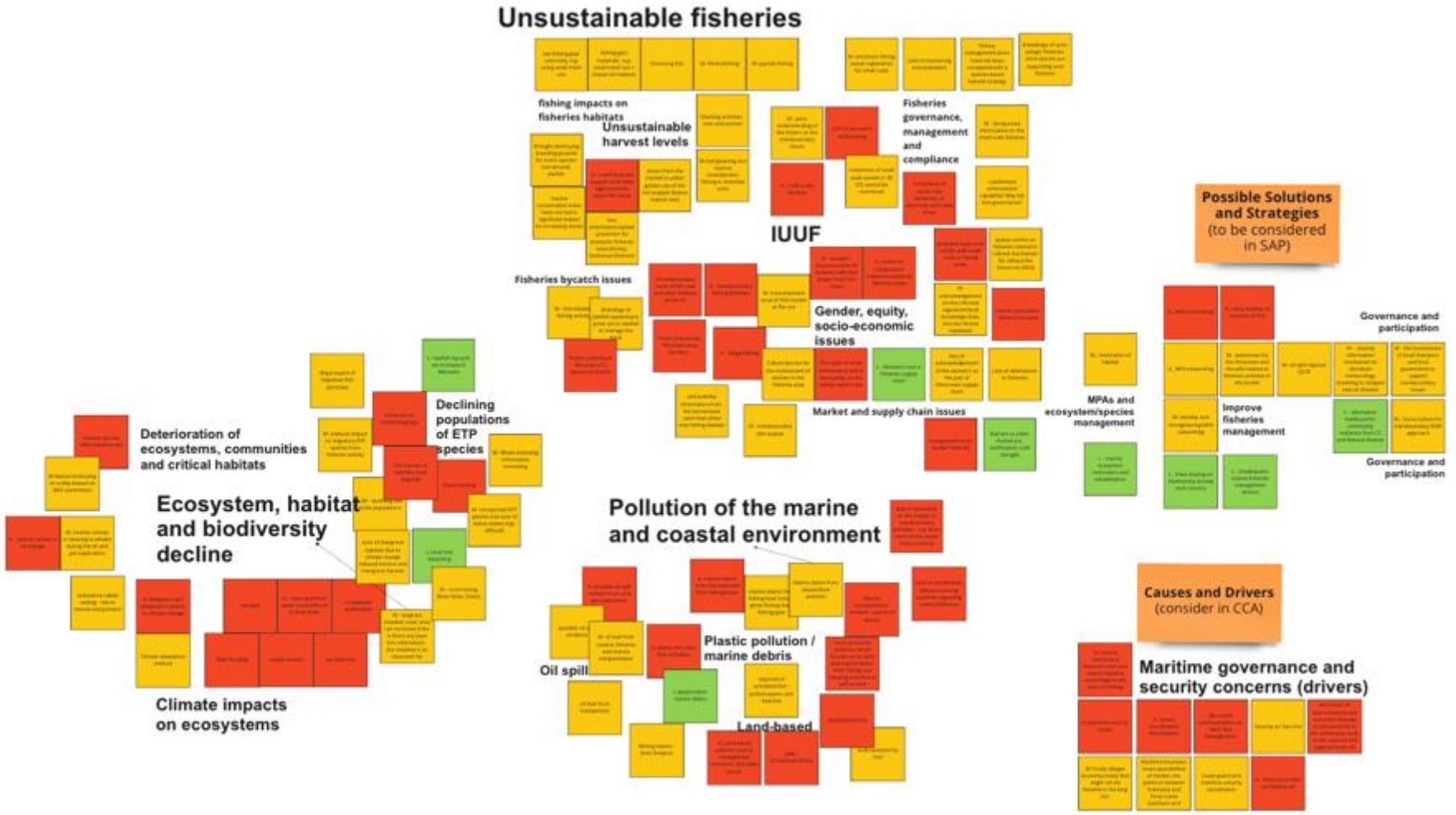

Figure 12 - Issue identification and prioritisation output, September 22, 2022, workshop output (building on previous outputs)

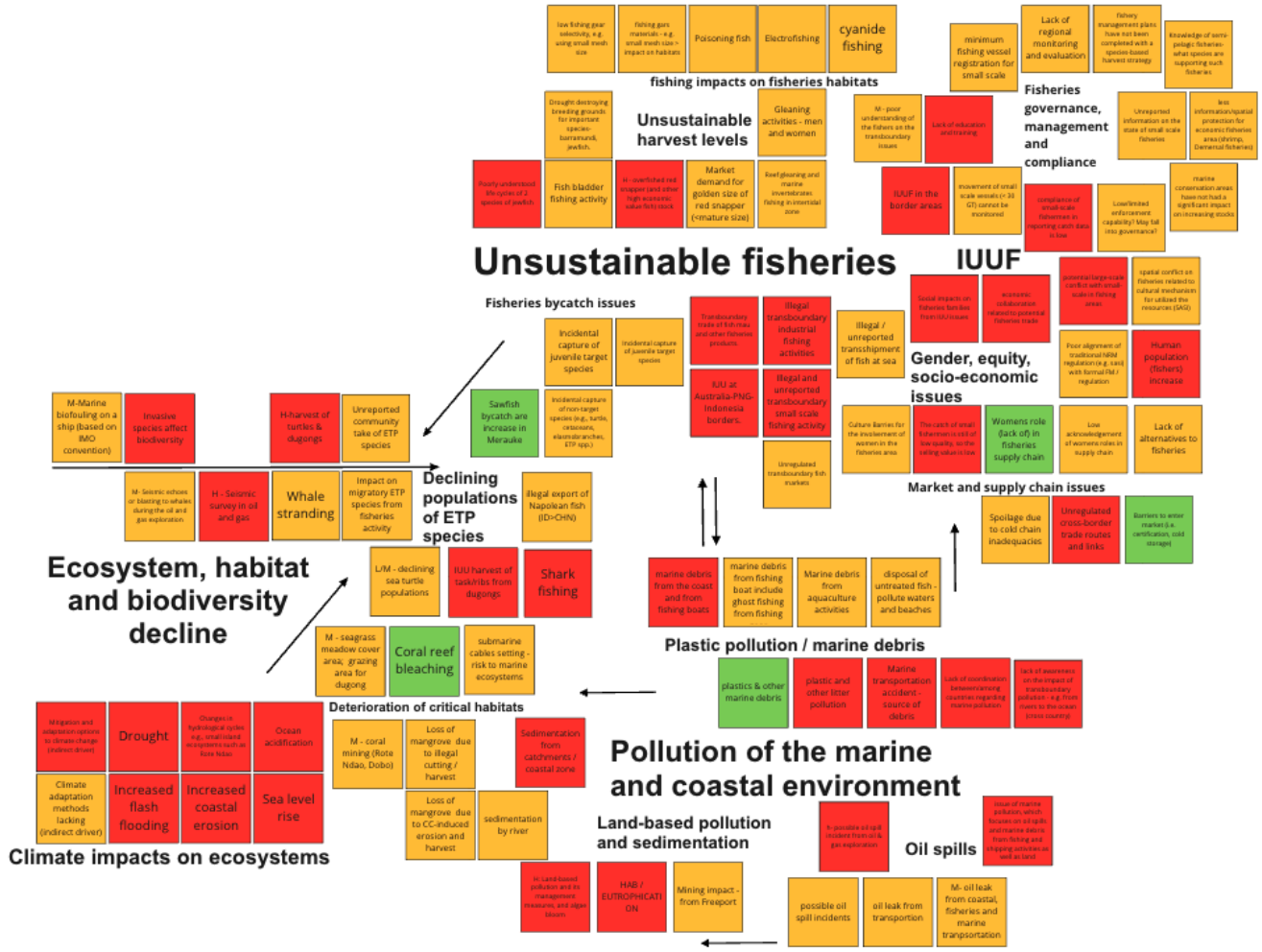

Figure 13 - Completed Issue identification and prioritisation output, September 29, 2022, workshop output (building on previous outputs from Sep 1, 8, 15, and 22

Appendix 2 – Workshop attendance list

List of Participants, Workshops #1-5 (1, 8, 15, 22, 29 Sep 2022)

	Workshop #1 (Sep 1, 2022) **TDA Issues Identification**	**Workshop #2** (Sep 8, 2022) **CCA Issue #1 - Pollution**	**Workshop #3** (Sep 15, 2022) **CCA Issue #2 – Ecosystems & Biodiversity**	**Workshop #4** (Sep 22, 2022) **CCA Issue #3 - Fisheries**	**Workshop #5** (Sep 29, 2022) **Consolidation and review**
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