Sustainable Fisheries Management Plan for Fisheries Management Area 716

INDONESIA

SUBMITTED BY THE USAID OCEANS AND FISHERIES PARTNERSHIP

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About this Document

The *Sustainable Fisheries Management Plan for Fisheries Management Area (FMA) 716, Indonesia* is an Ecosystem Approach to Fisheries Management (EAFM) Plan that has been developed through a collaborative and participatory multi-stakeholder process. The plan was developed and finalized through a series of collaborative workshops, including but not limited to the June 2017 "Integrated Stakeholder Consultation Workshop" conducted in Manado, Indonesia and the February 2019 "Review and Finalization Workshop for a Proposed Sustainable Fisheries Management Plan for Indonesia Fisheries Management Area 716," conducted at the Indonesia Ministry of Marine Affairs and Fisheries (MMAF) in Jakarta, Indonesia.

This document provides a detailed strategic planning framework to ensure ecologically sustainable management of FMA 716's tuna fisheries, including "true" (e.g., yellow fin, bigeye and skipjack) and neritic (e.g., frigate, bullet, longtail; kawakawa; King and Spanish mackerels) and small pelagic fisheries. This plan is proposed for adoption and implementation by MMAF and relevant national and provincial government agencies, the Fisheries Management Committee (FMC), and non-governmental partners focused on fisheries management and biodiversity conservation in Indonesia. This plan complements and supports MMAF Ministerial Decrees and issuances for fisheries management for FMA 716 such as the Fisheries Management Plan (FMP) for FMA 716 through Ministerial Decree No. 83/KEPMEN–KP/2016 and the Fisheries Management Plan for Tuna, Skipjack and Tuna-like species through Ministerial Decree No. 107/KEPMEN–KP/2015. This document may also be of interest as a reference document to technical, private sector, and academic partners working towards fisheries sustainable planning.

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Cover photo: Bitung, Indonesia, fishing port in North Sulawesi, Indonesia. USAID Oceans/Melinda Donnelly

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ACRONYMS AND ABBREVIATIONS

AMFRHR	Agency for Marine and Fisheries Research and Human Resources
CDT	Catch Documentation and Traceability
CDTS	Catch Documentation and Traceability System
CPUE	Catch Per Unit Effort
CTI-CFF	Coral Triangle Initiative on Coral Reefs Fisheries and Food Security
DG	Director General
DGCF	Director General of Capture Fisheries
DGFMS	Director General of Marine and Fisheries Surveillance
EAF	Ecosystem Approach to Fisheries
EAFM	Ecosystem Approach to Fisheries Management
EBM	Ecosystem Based Management
EEZ	Exclusive Economic Zone
EU	European Union
FAO	Food and Agriculture Organization
FAD	Fish Aggregating Device
FM	Fishing Mortality
FMA	Fisheries Management Area
FMC	Fisheries Management Committee
FMP	Fisheries Management Plan
GT	Gross Ton
HE	Halmahera Eddy
IDR	Indonesian Rupiah
IPNLF	International Pole and Line Foundation
ITF	Indonesian Through-flow
ISCW	Integrated Stakeholder Validation Workshop
IUU	Illegal, Unreported, and Unregulated
LIPI	Indonesia Institute of Science
M&E	Monitoring and Evaluation
MCS	Monitoring, Control and Surveillance
MMAF	Ministry of Marine Affairs and Fisheries
MSY	Maximum Sustainable Yield
MT	Metric Ton
NPOA	National Plan of Action
NGCC	New Guinea Coastal Current
NGO	Non-government organization
NSC	North Sulawesi Province
NTN	*Nilai Tukar Nelayan*
PIR	*Perikanan Inti Rakyat*
RDMA	Regional Development Mission for Asia
RPJMN	National Medium Term Development Plan
SB	Stock Biomass
SCS-LME	Sulu-Celebes Sea - Large Marine Ecosystem
SEAFDEC	Southeast Asian Fisheries Development Center
SFMP	Sustainable Fisheries Management Plan
SSME	Sulu-Sulawesi Marine Ecoregion
TA	Technical Assistance
UNCLOS	United Nations Convention on the Law of the Sea
USAID	United States Agency for International Development
USAID Oceans	USAID Oceans and Fisheries Partnership

VMS	Vessel Monitoring System
WCPFC	Western and Central Pacific Fisheries Commission
WCPO	Western and Central Pacific Ocean
WG	Working Group
WSSD	World Summit on Sustainable Development

GLOSSARY OF TERMS

Adaptive management – A systematic process for continually improving management policies and practices toward achieving articulated goals and objectives by learning from the outcomes of those previously employed. The basic steps of adaptive management are to conceptualize; plan actions and monitor; implement actions and monitor; analyze, use, and adapt; and capture and share learning. Active adaptive management is where management options are used as a deliberate experiment for the purpose of learning (Millennium Ecosystem Assessment 2006).

Bycatch – The species caught, whether retained or not, that is not the main target of the fishery.

Ecological well-being – It shows the state or condition of an ecological system as measured by indicators related but not limited to fishery resources production, pollution reduction and, habitat protection and restoration.

Ecosystem approach (EA) – A strategy for the integrated management of land, water, and living resources that promotes conservation and sustainable use in an equitable way. Often used interchangeably with Ecosystem-based management (EBM) (CBD 2000).

Ecosystem approach to fisheries management (EAFM) – An approach to fisheries management and development that strives to balance diverse societal objectives by considering the knowledge and uncertainties about biotic, abiotic, and human components of ecosystems and their interactions, applying an integrated approach to fisheries within ecologically meaningful boundaries. An EAFM is a practical way to implement sustainable development for the management of fisheries by finding a balance between ecological and human well-being through good governance. The purpose of EAFM is to plan, develop, and manage fisheries in a manner that addresses the multiple needs and desires of societies, without jeopardizing the options for future generations to benefit from the full range of goods and services provided by marine ecosystems (Garcia et al. 2003; Food and Agriculture Organization 2003, 2011).

Ecosystem approach to fisheries management plan (EAFM plan) – The output of a planning framework that outlines the integrated set of management arrangements for a fishery to generate more acceptable, sustainable, and beneficial community outcomes.

Ecosystem-based management (EBM) – A management framework that integrates biological, social, and economic factors into a comprehensive strategy aimed at protecting and enhancing the sustainability, diversity, and productivity of natural resources. EBM "emphasizes the protection of ecosystem structure, functioning, and key processes; is place-based in focusing on a specific ecosystem and the range of activities affecting it; explicitly accounts for the interconnectedness among systems, such as between air, land, and sea; and integrates ecological, social, economic, and institutional perspectives, recognizing their strong interdependencies." Sometimes used interchangeably with EA (McLeod et al. 2005).

Fisheries management – An integrated process to improve the benefits that society receives from harvesting fish consisting of (i) information gathering, (ii) analysis, (iii) planning, (iv) consultation, (v) decision making, (vi) allocation of resources, and (vi) formulation and implementation—with enforcement as necessary—of regulations or rules which govern fisheries activities in order to ensure the continued productivity of the resources and accomplishment of other fisheries objectives.

Food security – The availability of consistent and sufficient quantities of food, access to appropriate and sufficient foods, and consumption or appropriate use of basic nutrition and food preparation.

Gender integration – The process of assessing the implications for women and men of any planned action, including legislation, policies, or programs, in all areas and at all levels. It is a strategy for making women's as well as men's concerns and experiences an integral dimension of the design, implementation, monitoring, and evaluation of policies and programs in all political, economic, and societal spheres so that women and men

benefit equally and inequality is not perpetuated. The ultimate goal is to achieve gender equality (UN-OSAGI 2002).

Governance or governance system – The way formal and informal rules are set and implemented. It includes the planning and implementation mechanisms and the processes and institutions through which citizens and governing groups (institutions and arrangements) voice their interests, mediate differences, exercise their legal rights, and meet their obligations.

Human well-being – It shows the state or condition of individuals directly or indirectly affected by the operation of an ecosystem as measured by indicators related but not limited to economic aspects, local capacities, safety at sea, resiliency and food security.

Indicator – A variable, pointer, or index that measures the current condition of a selected component of the ecosystem. The position and trend of the indicator in relation to a benchmark indicates the present status of the component. Indicators provide a bridge between objectives and action.

Livelihood – "How we make our living, the things we use, and the choices we make to ensure that our lives run as we like." A sustainable livelihood, then, is a livelihood that "can continue into the future despite any changes and disasters and without losing that which makes the livelihood possible. This may include food production or being prepared for natural disasters. It is important to remember that income generation may be just one part of a livelihood" (Govan 2011).

Management area – The spatial extent of the land and/or water that is identified for management integration. Management areas, which should be as large as possible, may fall under the jurisdiction of one or more local communities, local governments, provincial or national governments, or a combination of all of these. Management areas are ideally defined by ecological boundaries, resource use patterns, and governance jurisdictions. Examples of management areas include seascapes, marine protected area (MPA) networks, and fisheries management areas (FMAs). Examples of zones within managed areas include various types of MPAs, various types of FMAs, various types of land-based protected or management areas, and others.

Management goal – A broad statement of a desired outcomes; are usually not quantifiable and may not have established timeframes for achievement.

Management measures – Specific controls applied to achieve the management objective, including gear regulations, areas and time closures (see MPA), and input and output controls on fishing effort.

Management objective – A description of a set of activities that, once completed, will achieve the desired outcome. Objectives can be quantified and measured and, where possible, have established timeframes for achievement.

Management plan – An explicit set of rules governing how to apply the principles and framework of natural resource management in a given area. This plan may be adapted to changes in the natural and social environment or upon the basis of new information about how a system functions. It may or may not have a legal basis for implementation.

Marine Protected Area (MPA) – A clearly defined geographical space—recognized, dedicated, and managed through legal or other effective means—to achieve the long-term conservation of nature with associated ecosystem services and cultural values. MPAs include a wide variety of governance types (including community-based areas) and include but are not limited to marine reserves where no extraction is permitted (Dudley 2008; IUCN-WCPA 2008).

Milestone – A step or event that, if achieved, indicates progress toward the completion of an activity and/or objective. "Milestone" is sometimes interchanged with "benchmark."

Monitoring, control and surveillance (MCS) – The overall process and set of activities used to ensure laws, rules, and regulations are complied with.

Objective – What is intended to be achieved. An objective should be linked to indicator(s) against which progress can be measured. Positive or negative change resulting from the achievement of an objective is an outcome.

Operational objective – A short-term objective achievable through management intervention.

Outcome – The change in status, attitude, or behavior that results from a set of management activities. An outcome should be able to be tracked through measurement and/or observation over time.

Stakeholder – Any individual, group, or organization with an interest (or a "stake") in, or who/that can affect or is affected (positively or negatively) by a process or management decision.

Sustainable development – Development (improvement in human well-being) that meets the needs of the present without compromising the ability of future generations to meet their own needs.

Sustainable use – The harvesting of natural resources that does not lead to long-term decline of the resource and biodiversity, thereby maintaining its potential to meets the needs of the present without compromising the ability of future generations to meet their own needs.

EXECUTIVE SUMMARY

This Sustainable Fisheries Management Plan (SFMP) has been developed using the Ecosystem Approach to Fisheries Management (EAFM) framework for sustainable fisheries management planning in Indonesia Fisheries Management Area (FMA) 716, which includes North Sulawesi. It provides information on the area's fisheries-, ecosystem- and human-related issues, operational objectives, indicators, and management measures based on the three core pillars of EAFM: ecological well-being, human well-being, and good governance. The purpose of this SFMP is to provide a detailed strategic planning framework to ensure the ecologically sustainable management of FMA 716's tuna fisheries and small pelagic fisheries. This management plan is intended to provide greater certainty in the day-to-day and long-term management and decision-making processes for all stakeholders.

Access to fisheries resources, which are managed by the Government on behalf of the Indonesian people and future generations, comes with certain obligations for users of the fisheries regarding the proper management and care of fisheries resources. Information herein provides a reference for stakeholders in relation to the management measures that are proposed to ensure the long-term sustainability and optimal utilization and equitable distribution of the tuna fisheries resources. This SFMP also sets out key performance measures to assess the degree to which stated management objectives are being achieved. Annex I provides information on management considerations for small pelagic fisheries in FMA 716. This SFMP complements the Fisheries Management Plan for FMA 716 (Decree 83/2016) and supports the National Plan of Action for Tuna (Decree 107/2015). While this document focuses on FMA 716, it has a specific emphasis on Sulawesi province and Bitung.

This plan was developed collaboratively by the USAID Oceans and Fisheries Partnership (USAID Oceans), the Indonesia Ministry of Marine Affairs and Fisheries (MMAF), as well as other critical, relevant stakeholders including local and provincial government, academic institutions, and non-governmental organizations and development partners. The plan was developed using scientific secondary data, as well as information gathered through field research among the various stakeholder groups in the fisheries sector, including value chain, gender, and labor analyses. The vision for this SFMP is to, "promote the best long-term and sustainable use and business activity of the coastal and offshore resources, the protection of the relevant fishery habitats and environments, and to optimize the socio-economic benefits of the fisheries sector in FMA 716 and support national food security." The plan identified ecological, human-wellbeing, and governance threats and issues facing the area, including habitat protection and restoration, pollution reduction and waste management, fishery resources, food security, sustainable livelihoods, rural infrastructure, as well as stakeholder and institutional participation and empowerment. These threats and issues serve as the foundation for the plan's goals, objectives, and management actions.

Priority ecological operational objectives outlined in the plan include optimizing sustainable catch or fish production, increasing the availability of small pelagic fishery data effort, initiating control of fish aggregating device (FAD) use in FMA 716, and combatting destructive fishing practices. For human well-being, operational objectives include maintaining the fish abundance at the fishing ground, maintaining sustainable fish catch, increasing the quality of fishery products from fish processing industry to the regional economy, and increasing locally-generated revenue from fisheries activities. Operational objectives to achieve good governance include clearly defining the share of authority between central and local governments in managing fisheries, increasing the intensity of the

government in disseminating regulations, executing Ministerial Decree No. 83/KEPMEN - KP/2016 on RPP FMA 716, improving inter-provincial coordination on fisheries management and control of migrant fishers, increasing fisheries surveillance in FMA 716, and increasing the availability of small pelagic fishery data.

Finally, the plan outlines recommended management actions that include implementing catch limits for long lines based on Western and Central Pacific Fisheries Commission (WCPFC) commitments and conducting regular stock assessment to monitor bigeye tuna catch. With regard to the high proportion of juvenile yellowfin tuna caught, the Government must strictly control and implement harvest control measures to reduce the juvenile tuna catch. Skipjack tuna fisheries require management measures to implement catch limits and control the fishing capacity. A live bait fish stock assessment and a study on alternative sources of bait fish are proposed. To obtain additional data on all tuna species, which is now limited, fisheries business actors and fishing companies may be required to submit data as regulated on a regular basis and to develop a catch documentation system (CDTS), complemented with other information as needed for fisheries management. Controlling fishing effort will also directly achieve operational objectives of FAD management and control in FMA 716. To achieve this operational objective, technical measures must be taken to control the number and position of FADs in accordance with MMAF Min.Reg.: No.26 of 2014 concerning FAD management. The Fisheries Management Plan for FMA 716 is guided by Regulation of the Director General of Capture Fisheries Number 15/PER-DJPT/2017 concerning Technical Guidelines for the Operationalization of Fisheries Management Area Regional Secretariats in 11 Fisheries Management Areas of the Republic of Indonesia.

CHAPTER 1. INTRODUCTION

In May 2015, Tetra Tech was awarded the United States Agency for International Development Oceans and Fisheries Partnership (USAID Oceans) Activity, a five-year $19.95 million contract from the USAID Regional Development Mission to Asia (RDMA). USAID Oceans works to strengthen regional cooperation to combat illegal, unreported, and unregulated (IUU) fishing and conserve marine biodiversity in the Asia-Pacific region. USAID Oceans is a partnership between the U.S. Agency for International Development (USAID), the Southeast Asian Fisheries Development Center (SEAFDEC), and the Coral Triangle Initiative for Coral Reefs, Fisheries and Food Security (CTI-CFF) that works with public and private sector partners across Southeast Asia to develop and implement electronic catch documentation and traceability systems, improve sustainable fisheries management using an Ecosystem Approach to Fisheries Management (EAFM), address human welfare and gender equity concerns, and develop public-private partnerships in support of these efforts.

USAID Oceans, the Indonesia Ministry of Marine Affairs and Fisheries (MMAF), and other national stakeholders have worked together closely to develop this Sustainable Fisheries Management Plan for Fisheries Management Area (FMA) 716.

1.1 An Ecosystem Approach to Fisheries Management (EAFM)

The Government of Indonesia, through MMAF, considers EAFM to be the preferred option and best practice for the long-term sustainability of fisheries and the ecosystem services provided to society (e.g., food security, livelihoods, economic security, coastal protection, human health and well-being) (Pomeroy et al. 2015; Andrew et al 2011; Ruckelhaus et al. 2008). In 2003, the United Nations Food and Agriculture Organization (FAO) defined an Ecosystem Approach to Fisheries as "an approach to fisheries management and development that strives to balance diverse societal objectives by taking into account the knowledge and uncertainties about biotic, abiotic, and human components of ecosystems and their interactions and applying an integrated approach to fisheries within ecologically meaningful boundaries" (FAO 2003; Pomeroy et al. 2013). The increased understanding of the interactions among different components of marine ecosystems such as fish, people, habitats, and climate has led to a growing recognition of the need to manage fisheries in the context of their supporting ecosystems.

An EAFM looks beyond seeing a fishery as simply "fish in the sea and people in boats." It focuses on improved fishery management that considers other ecosystem components and can be used to support decision-making (Christie et al. 2007). An EAFM covers the broader marine environment including its natural components, such as coral reefs and mangroves; the environment; and human activities, such as fishers, fishing communities, coastal development, and tourism. The EAFM is a sectoral component of the more holistic ecosystem-based management (EBM), which includes management of all of the other non-fisheries sectors as well, such as coastal development and land-use, shipping and transportation, etc. (WorldFish 2013). The EAFM differs from EBM by balancing societal economic needs with ecological function (Christie et al. 2007). The seven principles of EAFM, as set out in the FAO Code of Conduct for Responsible Fisheries, include (FAO 2003; Pomeroy et al 2013): (i) good governance; (ii) appropriate scale; (iii) increased participation; (iv)

multiple objectives; (v) cooperation and coordination; (vi) adaptive management; and (vii) precautionary approach.

The EAFM can be traced to the 1995 FAO Code of Conduct for Responsible Fisheries. The agreement to develop and facilite EAFM implementation has also been stated in the World Summit on Sustainable Development (WSSD) in 2002 (Johannesburg) and was further developed in Rio de Janeiro WSSD in 2012. In line with all other current fisheries management policies, the Sustainable Fisheries Management Plan for FMA 716 will be conducted under and adopt the principles of an EAFM. Implementation of EAFM is aligned with Article 33 (3) of the 1945 Constitution, Articles Two through Five of the Act No. 5-1990, as well as Article 6 (1) of the Act No. 31-2004, and the FMP for FMA 716 through Ministerial Decree No. 83/KEPMEN–KP/2016.

1.2 Objectives and Vision for the Sustainable Fisheries Management Plan

The *Sustainable Fisheries Management Plan for Fisheries Management Area (FMA) 716* has been developed using the EAFM framework and provides information on fisheries-, ecosystem- and human-related issues, operational objectives, indicators and management measures. The purpose of the plan is to provide a detailed strategic planning framework to ensure the ecologically sustainable management of FMA 716 tuna fisheries, including "true" (e.g., yellow fin, bigeye and skipjack), neritic (e.g., frigate, bullet, longtail; kawakawa; King and Spanish mackerels) and small pelagic fisheries. The plan complements the existing Fisheries Management Plan for FMA 716 (Decree 83/2016) and supports the National Plan of Action for Tuna (Decree 107/2015).

The plan was developed according to the following vision, developed collaboratively and agreed upon by the plan's developing partners:

"To promote the best long-term and sustainable use and business activity of FMA 716's coastal and offshore resources, protect its relevant fishery habitats and environments, optimize the socio-economic benefits of its fisheries sector, and support national food security."

Access to fisheries resources, which are managed by the Government on behalf of the Indonesian people and future generations, comes with certain obligations for users of the fisheries regarding the proper management and care of fisheries resources. This management plan is intended to provide greater certainty in the day-to-day and long-term management and decision-making processes for all relevant stakeholders. Information herein provides a reference for stakeholders in relation to the management measures that are proposed to ensure the long-term sustainability and optimal utilization and equitable distribution of the tuna fisheries resources. This requires that the management plan strike a precise balance between minimizing threats to sustainability objectives while optimizing economic opportunities. This management plan sets out key performance measures to allow for assessment of the degree to which stated management objectives are being achieved. Technical Annexes have been included to provide additional information on management considerations for small pelagic fisheries in FMA 716.

1.3 Rationale for the Sustainable Fisheries Management Plan

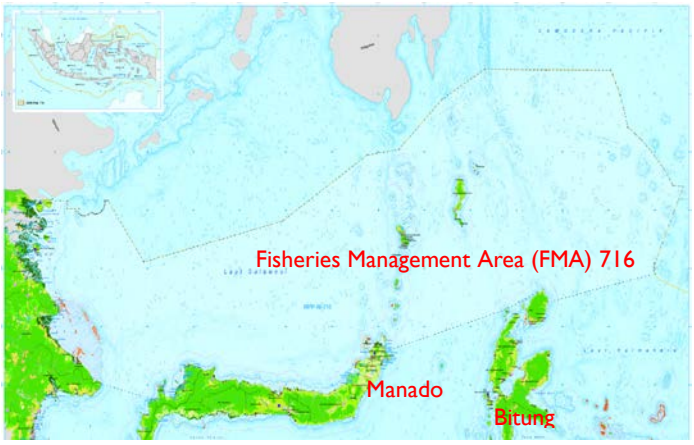


Figure 1. Map of FMA 716

FMA 716 and the adjacent coastal marine waters form part of the Sulu-Sulawesi Marine Ecoregion (SSME), sometimes also called the Sulu-Celebes Sea Large Marine Ecosystem (Figure 1). FMA 716's coastal marine waters have an important role in supporting its fisheries sector, wherein regulatory control and management measures are needed to ensure the sustainability of fisheries in FMA 716, particularly to control fishing activities and the fishing effort for exploited fisheries resources, such as tuna, and manage fishing gears in which 'juvenile or baby tuna' are caught in substantial amounts. Within FMA 716, many economic sectors including maritime trade, shipping, and tourism, share the same geographic space and are developing simultaneously. These sectors interact dynamically with rapid environmental changes, such as climate change, as well as evolving technologies and changing market demands. Research conducted by MMAF's Research Institute for Marine Fisheries has shown evidence of overfishing of important and high-value fish resources in FMA 716, such as tuna which is an important resource base for the area's livelihoods and food security. The absence of an integrated fisheries management plan among this rapid coastal development may have long-term results for the fishery, such as the loss of coastal fishing communities' livelihoods and food security.

Given the growing complexity of coastal areas, it is becoming more difficult to manage their marine fisheries and other economic sectors without a comprehensive, integrated framework for policy, planning, and management. A multi-sectoral fisheries management plan can be used to implement the holistic and comprehensive fishery resource management approaches that are required in order to remain a productive part of marine resource systems. In recognition of the demands on FMA 716 and its importance, this SFMP has been developed for the purpose of conserving the area's marine resources and the associated coastal/marine habitats/environments through appropriate management measures. The plan was developed in a holistic manner, is based on the various scientific findings in the area and considers both the relevant ecological and human dimensions, including biological aspects (especially fish population dynamics and fishing gear/boat technology), as well as the socio-economics of the coastal fisheries. The SFMP covers the whole range of fisheries with special emphases on tuna resources within FMA 716.

This SFMP is consistent with and supports the implementation of ongoing fisheries management efforts for FMA 716, including the National Plan of Action (NPOA) for Tuna, Skipjack and Neritic Tuna Management Plan for Indonesia (2014) and the Fisheries Management Plan (FMP) for FMA 716 through Ministerial Decree No. 83/KEPMEN–KP/2016. It is noted that the NPOA includes a Strategic Plan which provides priority issues, management objectives, targets, indicators, benchmarks, and an action plan for tuna, skipjack and neritic tuna in FMA 716. Regularly scheduled monitoring, control and surveillance (MCS) activities are an important component of the SFMP, led by FMA 716's Provincial Marine Affairs and Fisheries Services and supported by related provincial-level surveillance bodies and stakeholders.

This SFMP provides a set of management strategies to address the issue of fishery resource use conflicts and to control the impacts of various human activities on the fisheries environment. It likewise provides an institutional mechanism to coordinate the various concerned agencies and stakeholders to work together towards achieving common fisheries management objectives. While sectoral fisheries planning remains relevant, the SFMP recommends that it operate within the larger plan framework to protect critical habitats, conserve fishery resources, and promote highly consultative processes.

1.4 Development of the Sustainable Fisheries Management Plan

The *Sustainable Fisheries Management Plan for Fisheries Management Area (FMA) 716* was developed through close collaboration between USAID Oceans, the Indonesia Ministry of Marine Affairs and Fisheries (MMAF), and other national stakeholders. To inform the plan, USAID Oceans conducted an in-depth study using the Rapid Appraisal of Fisheries Management Systems framework over the course of January to June 2017, which consisted of:

1. Secondary data analysis and comprehensive review of existing literature on capture fisheries;
2. Reconnaissance surveys to validate the data/information collected from secondary data analyses and site visits to initiate stakeholder engagement;
3. Field data gathering to collect data on fishing practices and production, fishing-related business activities, costs, earnings and other socio-economic data/information and;
4. Community/stakeholder workshop(s) to validate research findings and discuss implications of capture fisheries and fisheries management in FMA 716, identify and prioritize broad objectives of the fisheries management and issues, formulate operational objectives and indicators for each priority issue, and agree upon required management measures/interventions.

In addition to literature reviews, various data and information generated from 2005 to 2015 from several studies have been incorporated into this plan. These studies included consultative workshops, focus group discussions, field surveys, stakeholder interviews, on-board fishing surveys, and port sampling. These studies were instrumental in identifying opportunities and threats, establishing a body of information and awareness about the fisheries sector, developing the capabilities of various fisheries agencies, enhancing the participation of the private sector, and eliciting commitment from stakeholder groups to pursue the common goal of sustainable development of FMA 716 tuna fisheries.

During the reconnaissance survey in Bitung and adjacent areas, 63 persons out of 75 targeted key informants (KIs) were interviewed, which included fishing vessel captains, owners, technicians and senior crew. Among of the interviewed vessels, 32 were purse seiners, 26 were handliners, and four were pole and liners. Most of the purse seiners interviewed were skippers of fishing vessels of <10 GT and >20 GT where about 60% carry out fishing only in FMA 716, 31% fishing only in FMA 715, and the rest were fishing in both FMA 716 and FMA 715. About 91% of these purse seiners mainly catch small pelagic fish and only 6% of the purse seiners catch consisted of tuna species. About 70% of handliners were in vessels of <10 GT, 18% of them were 10-20 GT, and 11% were >20 GT fishing vessels. During the field work period, 70% of handliners conducted fishing only in

716 FMA, 18% fishing in FMA 715 only, and the rest were fishing both in FMA 716 and FMA 715. Most of the targeted species of these handliners were large tuna. All of the pole and liners being interviewed were in vessels of >20 GT (78 GT and 80 GT). These pole and liners are targeting skipjack tuna, but also sometimes catch baby yellowfin and bigeye tunas. According to information gathered in the field, most of the pole and liners were not conducting fishing operations during 2015 and 2016 due to MMAF's moratorium on ex-foreign fishing vessel (or fishing vessel built oversea) operating in Indonesian waters.

Research findings and results were presented at an Integrated Stakeholder Validation Workshop (ISCW), held June 19-21, 2017, in Manado, Indonesia. The workshop was attended by 102 participants (53% female, 47% male) across groups and sectors, including from MMAF, provincial and local government, local academe, fishing industry members (such as small-scale and commercial fishers, financiers/scalers, retailers, processors, and relevant civil society organizations), research/partners organizations, USAID, USAID Oceans, and SEAFDEC (Annex II). Female representatives from the national government, fishing industry, and USAID Oceans implementing partners outnumbered their male counterparts. Both women and men actively participated in plenary and small group discussions, thereby making their voices heard. Through the workshop, research results were presented from USAID Oceans' fisheries management systems appraisal, fisheries value chain analysis, gender analysis of the fisheries value chain, and labor assessment of fisheries. Participants validated or provided additional inputs to the results, to be used in the drafting of the SFMP. At the workshop, participants identified and prioritized key threats and issues in FMA 716, and began developing plan objectives, indicators, and management actions.[1]

On February 26-27, 2019, USAID Oceans held a workshop with MMAF and supporting partners to review and finalize the proposed SFMP and agree on the next steps needed to socialize, adopt, and implement the plan. The workshop was attended by 74 participants, with equal attendance by men and women, including from MMAF, provincial governments, the Fishing Port Authority, non-governmental organizations, USAID, USAID Oceans, SEAFDEC, and other relevant development partners (see Annex II). Out of the workshop the following activities and timelines were agreed upon.

Participants of Integrated Stakeholder Workshop, June 2017

[1] USAID Oceans, Stakeholder Validation Workshop Proceedings, 2018. www.seafdec-oceanspartnership.org/resource/indonesia-stakeholder-validation-workshop-proceedings

Activity	Date
Updated Draft SFMP reviewed by USAID Oceans	March 15-31, 2019
Updated Draft SFMP reviewed by MMAF and USAID	April 1-30, 2019
Review/comments received from MMAF, USAID	May 3, 2019
Finalization of the SFMP	May 2019
Submission of Finalized SFMP to MMAF	June 30, 2019
Stakeholder consultation (FMA 716 provinces, to be conducted by MMAF in coordination with FMC)	August 2019 onwards

CHAPTER 2. SITE BACKGROUND

This chapter provides background information on FMA 716, including details on the area's geographic features, resources, environmental and socio-economic conditions, an overview of primary stakeholders, as well as the existing policies and regulations supporting fisheries management.

2.1 Geographic Scope

FMA 716's fishing area is contained within the Sulawesi Sea with some higher fishing pressure around the adjacent waters of small island groups and along the coastal waters of the continental shelf, such as along the western coastal areas that contain demersal and shrimp fishing grounds. These coastal waters are part of the relatively newly established province of North Kalimantan, which borders FMA 716 on the west. FMA 716 is bordered on the east by the northern coast of Central Sulawesi, Gorontalo and North Sulawesi Provinces and an area of about 55.85 million hectares (see Section 1.3, Figure 1).

At present, the pelagic fishing grounds in the western part of the Sulawesi Sea are mostly contained along the coast line up to 200 meters isodepth, while in the eastern part (especially in the waters around the Sangir and Talaud islands) fishing groups are found in deeper, more oceanic waters. For the most part, the Sulawesi Sea's waters are characterized as deepwater or oceanic areas, with a very narrow continental shelf area found in the western part of the seas, with some areas consisting of mangroves, estuaries, sea-grass, and areas of coral reef ecosystems, such as around the turtle islands of Derawan of the District of Berau and in the eastern part of the Bunaken National Marine Park of the District/City of Manado.

2.2 Environmental Conditions and Characteristics

The Sulawesi Sea is oceanographically well defined by the Palawan trough to the north, a promontory from Sulawesi Island to the south, and the Bohol Sea between the Visayas and northern Mindanao. The sea is recognized as a large marine ecosystem, comprised of the two large seas (Sulu and Sulawesi) separated by the Sulu Archipelago; and several smaller seas: the Sibuyan, Visayan, and Camotes Seas in the northeast and the Bohol Sea further south between Bohol and Mindanao. These 'marginal seas' are mostly enclosed by island land-masses.

The prevailing environmental/ecosystem components of FMA 716 are primarily deep-sea, with a narrow strip of continental shelf, some mangrove areas, estuaries, and some coral reefs. Shallow water areas provide good fishing grounds for the small pelagic and demersal fisheries are relatively narrow, while a number of estuary and mangrove areas with muddy bottom substrate and sea-grass provide the nursery grounds for some economically important fish and shrimp that are found in the northern part of East Kalimantan province. Some continuous spots of coral reefs are laid from the coastal areas of East Kalimantan and along the northern coasts of Central Sulawesi, Gorontalo and North Sulawesi, ending at the Bunaken National Marine Park where there are exceptional levels of coral species diversity. The richest locations host 25-30% of the reef-building coral species of the entire Indo-Pacific region. This has lended strong support to the selection of Bunaken National Park as one of Indonesia's, and the region's, flagship marine protected areas (MPAs) (Turak and DeVantier, 2003). The Halmahera Eddy current, found in the Sulawesi and Halmahera Sea, may contribute to the area being a hotspot for marine productivity, compared to the surrounding regions. As such, during the northwest monsoon and La Niña events, skipjack tuna catch increases in the western tropical Pacific waters.

Based on these ecosystems, the available fisheries resources of the Sulawesi Sea can be grouped into large pelagic fishes, small pelagic fishes, demersal, shrimp, coral reef fishes, and other biota. The large pelagic group includes large tuna, skipjack, tuna like/frigate mackerel and Spanish mackerel, while the small pelagic includes rounscads, bigeye scad, indian mackerel, trevallies, and anchovies.

2.2.1 Water Current Patterns

Environmental factors relevant to fisheries oceanographic conditions in the Sulawesi Sea, including water patterns and salinity, are closely related to fish stock distribution (Wirtky, 1961). Due to the Sulawesi Sea's location and its proximity to neighboring bodies of water, its waters are heavily connected to and influenced by bordering currents. For example, the Sulawesi Sea is widely open to the Pacific Ocean, allowing its current to enter the Sulawesi in this region; through the Molucca Sea, the Philippines and the Sulu Seas exchange waters with the Pacific Ocean; and through the Makassar strait, which connects the Sulawesi Sea and the Java Sea, results the Indonesian Through Flow (Illahude, 1999) or ARLINDO current. The current in Makassar Strait is supported almost exclusively by waters from the current system from February to September, but from October to January north winds prevail over Sulawesi Sea and the Mindanao current turns back to the east, and the eddy is displaced to the east, with water from the Sulu Sea flowing through the western part of the Sulawesi Sea into the Makassar straits. In the northern part of the Sulawesi Sea, water movement is normally weak and irregular, but movement into the Sulu Sea prevails from March to July and in other months when movement is then towards the southwest (Figure 2).

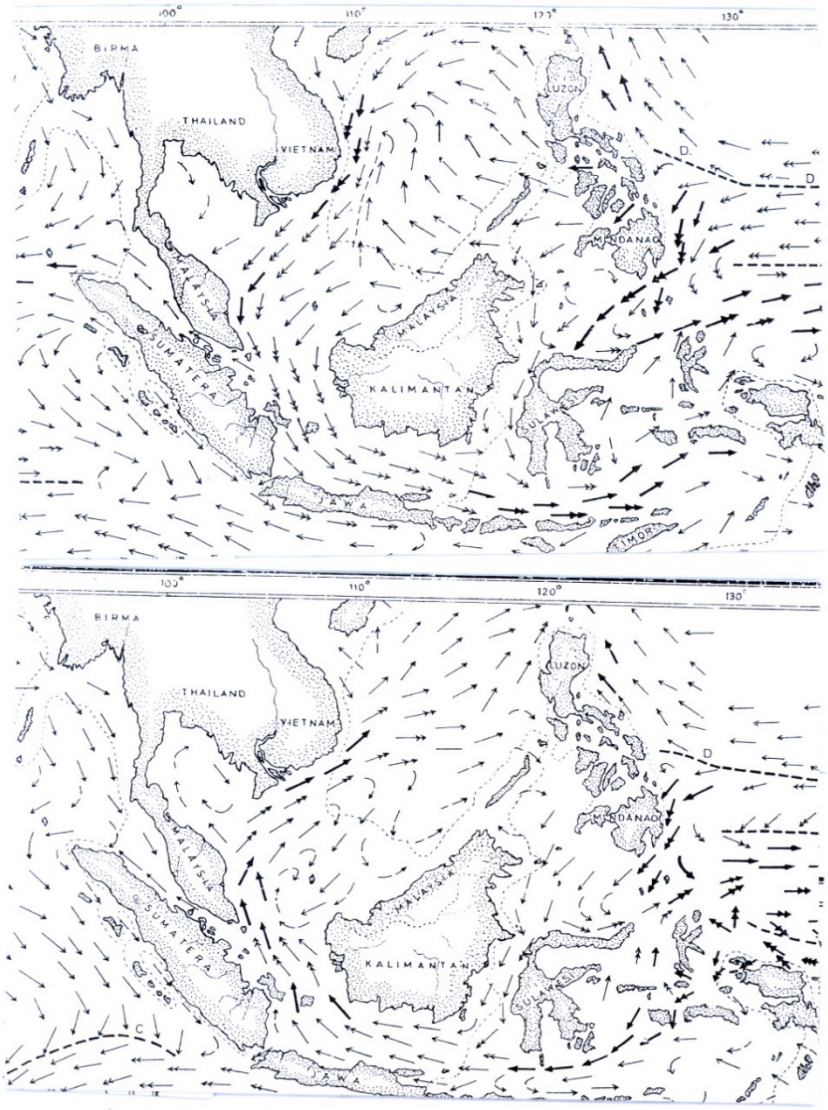


Figure 2. Global surface current in the waters of the Sulawesi Sea and other Indonesian fisheries management areas

Source: based on Wirtky, 1961

This region is considered to be an important link in general circulation, and the junctions between surface and sub-surface circulation. The upwelling on the northwest coast of Australia, for example, is developed from the end of March to the beginning of September when the southeast monsoon blows northwestwards from Australia as an offshore wind. This phenomenon of northwest Australian upwelling likely influences and is extended to the waters in the Bali strait where the fishing season of sardines fisheries is beginning (Wudianto, 2001). In other regions, upwelling is also possible locally or temporarily at other places, to a limited extent, as seen along the coast of China in the vicinity of Hong Kong during the northwest monsoon, or on the coast of Sarawak. On the other hand, upwelling in the region of the Philippines and in the Sulu and Sulawesi Seas is unlikely. The dynamic movement of marine waters in the Sulu-Sulawesi Sea circulates rich nutrients and larval stages of many marine species across political boundaries.

High plankton production is usually accompanied by high fish production. The upwelling along the northwestern edge of the Tawi-Tawi Ridge enriches surface waters that are exchanged between the Sulu and Sulawesi Seas and are circulated around by monsoonal winds. The circulation of waters explain the export of larvae from a spawning ground to distant settlement habitats, e.g., from the Tubbataha Reef to Palawan Island and Sabah, north Borneo, from Surigao to Bohol Sea (Wirtky, 1961).

The stationary high sea level in these regions might prevent ascending movements. In general the representation of hydrographic conditions in different upwelling regions demonstrate a lack of information about so many of these features in this region and the interesting possibilities they

offer for further research. Because of the few observations for most of these upwelling regions, the information given here is only of a preliminary character.

2.2.2 Salinity

In the Sunda Shelf area, small pelagics are very sensitive to environmental changes. As a result of the monsoon, the hydrology varies greatly throughout the year. Salinity is the main factor regulating the distribution of the small pelagic fish population (Atmaja, and Nugroho, 2005). It is further explained that *D. russelli* is a resident species of the Java Sea that show a neritic behaviour, while *D. macrosoma* is a more oceanic species and enters the Java Sea during the south-east monsoon when prevailing conditions are optimal. In the Sulu Sea, there are annual variations of salinity very similar to that east of Luzon, but with a larger amplitude and a lower average salinity. In this region, a rainy season from May to September is clearly developed, while during the rest of the year rainfall and evaporation are almost balanced. During the rainy season, the excess of the rainfall is about 840mm, and the drop in salinity is 1.2 $^{o}/_{oo}$. But with a homogenous layer of 30m, such an excess of rainfall results in a decrease of only 0.9 $^{o}/_{oo}$. Therefore, the inflow of water from the China Sea must contribute to the drop of salinity, and in fact, from July to October, water with salinities between 33.0 and 33.4 $^{o}/_{oo}$ enters the Sulu Sea. The increase of salinity from November to April coincides with the maximum of the inflow of highly saline water from the Pacific.

In the Sulawesi Sea, the phase of the annual variation of salinity is considerably displaced against the Sulu Sea, but the amplitude is about the same. The maximum salinity occurs in September and the minimum in January. Almost throughout the year the Sulawesi Sea is filled with oceanic waters carried by the Mindanao Current. Only during the west monsoon are water masses from the Sulu Sea transported into the Sulawesi Sea when they cause a drop in salinity from October to January. Thus, the distribution of salinity is governed by the strength of the Mindanao Current, and during the northwest monsoon by waters from the Sulu Sea.

2.2.3 Primary Productivity

As reported by Wyrtki (1961), the knowledge about the distribution of factors other than temperature and salinity in Southeast Asian waters, especially in the Sulawesi Sea, is very meager. This is firstly due to the fact that their distribution is particularly complex owing to the mixing of coastal and oceanic waters and the presence of large shelves and land-enclosed deep sea basins. This makes its investigation difficult. Secondly, in this region there is no highly developed fishery, which could warrant an investigation of the environmental factors of its fishing grounds. Thus, the knowledge of the distribution of nutrients, productivity and transparency depends on the work of the larger oceanographic expeditions.

The nutrient content over the deeper portions of the Southeast Asian Waters shows a distribution characteristic of tropical waters. The surface layer is extremely poor in nutrients, with the phosphate content less than 0.2 µg-atoms/L. Within the discontinuity layer, it rises considerably and normally reaches 1.5 µg-atoms/L at its lower boundary. In the intermediate and deep layers, phosphate contents of 2.5 to 3.0 µg-atoms/L are quite normal. It is further mentioned that the influence of the discharge of the rivers on the phosphate content in the sea seems to have been overestimated, because the river water is not as rich in phosphate as normally assumed. The distribution of nitrate and silicate generally correspond to that of the phosphate.

The mechanism of nutrient supply to the surface layer is, however, quite different for the shelves and deep sea. Over shallow waters, the regeneration of the sinking material occurs at the bottom and the nutrients can easily be brought into the euphotic zone by vertical mixing. Consequently, a continuous supply of nutrients to the water masses takes place and enables continuous production. This process makes large parts of the shelves quite fertile and able to maintain a big stock of fish. The replenishment of the surface layers over the deeper portions of the region with nutrients is, however, completely different as it is only by upwelling or by divergent movements in the surface layer that more fertile water from the discontinuity layer can ascend and enter the euphotic zone. But these effects occur only locally and consequently the greater part of the water over the deep sea is of very low productivity.

Interpretation of the Southeast Asian Waters map of the organic production, based on the above mentioned data, shows only the surface values without consideration of the vertical distribution of productivity and the depth of the photosynthetic layer. In this map, the China Sea, Philippine Waters and the Sulawesi Sea have only a small organic production of less than 0.5 g C per m^2 per day. In contrast to these regions the production is high over the Sunda Shelf, in the Gulf of Thailand, the Malacca Strait, the Java Sea and the waters between Sumatra and Borneo, where values of 1.0 g C per m^2 per day are often exceeded.

2.2.4 Halmahera Eddy Current

The Halmahera Eddy (HE) seems to play a more important role than the Mindanao Eddy in the circulation, heat, and salinity exchanges in the western tropical Pacific compared to (Kashino et al., 2013). The HE has its center around longitude 130°E with depth of 50 m and horizontal scale of 500 km and with increasing depth, its center shifts to the North with smaller horizontal scale to be 300 km at depth of 350 m (Figure 3). The HE also plays an important role in controlling the water in South Pacific water masses brought by the New Guinea Coastal Current (NGCC) entering the internal Indonesian waters as part of Indonesian Through-flow (ITF). The eddy also has a strong relationship with the increasing marine productivity in its surrounding waters, even though this study has been less described until recently.

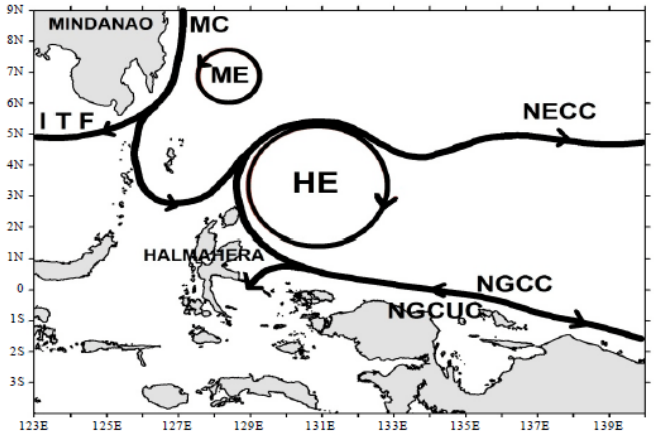


Figure 3. Schematic diagram of current system in the western tropical Pacific Ocean.

MC: Mindanao Current, ME: Mindanao Eddy, HE: Halmahera Eddy, NECC: North Equatorial Counter Current, NGCC: New Guinea Coastal Current, NGCUC: New Guinea Coastal Undercurrent, ITF: Indonesian Throughflow. Source: Harsono et al., 2014.

In general, the clockwise eddy of HE could develop an indentation that is filled by a less dispersed chlorophyll concentration and warm water from the NGCC. However, in the outer ring of HE, a high chlorophyll concentration related to an enrichment of nutrients due to high turbulence along the isopycnal slope may be seen. A pycnocline is the cline or layer where the density gradient is

greatest within a body of waters. The growth rate of phytoplankton is controlled by the nutrient concentration and the regeneration of nutrients in the sea is a very important part of the interaction between the higher and lower trophic levels. The separation due to the pycnocline formation prevents the supply of nutrients from the lower layer into the upper layer. Nutrient fluxes through the pycnocline are lower than at other surface layers. This outer ring of the HE controls the structure of phytoplankton community (Kai and Marsac, 2010 in Harsono et al., 2014). Interaction between cyclonic and anti-cyclonic eddies could generate "local front jets" that could make fragments of high intensity of biological activities (Kang et al., 2004 in Harsono et al., 2014). This is why, the existence of HE could be the cause of this high marine productivity hotspot, compared to the surrounding regions. This implies that during the northwest monsoon and La Nina event, skipjack tuna catch increase in the western tropical Pacific waters.

2.3 Fisheries Resources and Conditions

FMA 716 includes the waters of the Sulawesi Sea and part of the Western and Central Pacific Fisheries Commission (WCPFC) Convention area. Its fisheries are complex and diverse, reflecting the region's extraordinary heterogeneous geography and species diversity. Based on the Fisheries Performance Book 2015 of the Directorate of Fish Resources Management (Director General of Capture Fisheries) and the Ministerial Decree No. 47-2016 concerning the potential estimation, total allowable catch, and level of exploitation of target fish resources in FMA 716, there are several fish resource groups, which include small and large pelagics, demersal, penaeid shrimp, lobster, blue crab, mangrove crab, and squids. The estimated potential yield of fish resources in FMA 716 was approximately 480,000 tons, consisting of about 47% small pelagic fish, 32% large pelagic, 7% coral fish, 11% demersal, 2% penaeid shrimps, and <0.5% combined lobster, mangrove crab, blue swimming crab, and squids (Table 1).

In terms of volume, the artisanal sector brings in the majority of catch, while industrial fisheries contribute considerably more in terms of value, since they target high value catch, such as tuna and shrimp. Major species caught in FMA 716 include tuna and small pelagics such as round scads, sardines, mackerel and a range of reef fish. Fishing gear used includes purse seine (including 'pajeko' - mini seine), oceanic and coastal drift gill net, set gill net, pole and line, bottom long line, trap, squid jig, bouke ami and some types of hand lines. Demersal, penaeid shrimp, mangrove crab and blue swimming crab are primarily caught in the west of FMA716, with pelagic fish are located mainly in the east. Fishing grounds for coral fish, lobsters and squid span the whole of FMA 716, especially along the coastal areas and the small islands, such as in the District of Sangir and Talaud.

Regarding the exploitation level of these resources, it is likely that the optimum fishing levels for coral fish, lobster, blue swimming crab and squid resources are already exceeded as current fishing levels are already greater than the optimum fishing level (*f-current*/*f-opt* > 1.0). Demersal fish and shrimp resources are likely underfished, however, due to the very narrow continental shelf area that usually serves as the fishing grounds for these resources. Further expansion is unlikely as this would lead to the collapse of these reources.

Demersal, penaeid shrimp, and crab resources (both swimming and mangrove crabs) are found in the western part of FMA 716, along the coastal waters of the North Kalimantan Province that provide a shallow continental shelf. The ecosystem found in these waters consists of mangrove, estuary, seagrass, and some spots of coral reef especially around the vicinity of the conservation

areas of Derawan, Sangalaki, Kakaban, Maratua, Panjang, the Samama Islands and submerged reefs and islets. They are located in the Sulawesi Sea, on the coastal shelf part of the Berau Regency. Estuarine ecosystems originate from a number of big rivers in the coastal waters of North Kalimantan province, such as; the rivers of Simenggaris, Sebuku/Tubil, Sembakung, Sesayap, Sekata, Berau/Kayan and Kelai, plus some rivers from Sabah continent. These rivers provide valuable nutrients that cause the waters to be more fertile. Therefore, estuarine ecosystems provide nursery grounds for some demersal fish and penaeid shrimps. Similar cases are found in the coral reefs that provide nursery and fishing grounds for the associated reef fishes such as snappers, groupers, emperors, fusiliers, wrasses and lobsters. Squid resources are found in more pelagic habitats and are distributed throughout coastal areas and deeper, oceanic waters.

From a taxonomical perspective, the fishery resources in the waters of the Sulu-Sulawesi Seas, including FMA 716, are diverse in terms of species. Hence, effective management—as well as sustainable exploitation—requires relevant bio-physical assessments in relation to the life histories and population dynamics of the fishery resources. There are two main fish stocks that are being exploited in the Indonesian side of Sulawesi Sea, which are tuna and small pelagic resources. The average annual production of all fish resources in FMA 716 for the period 2005-2015 consisted of 30% small pelagics, 26% skipjack tuna, large tuna (11.5%), tuna-like (12.7%), coral and demersal food fish (13%) (Table 2). Other fish resources of less than 5000 tons included penaeid shrimp, and less than 1000 tons of squids, crabs and lobster. Altogether, pelagic fish groups amounted to more than 80% of the total recorded fish production in FMA 716 (Table 2). Based on the fish resources exploitation, the current fishing ground of the pelagics fish group is contained mostly in the eastern part of FMA 716, therefore this plan will be focused on the fishing activities with the main fishing base in Bitung Ocean Fishing Port of the North Sulawesi Province.

2.3.1 Tuna Resources

Tuna resources are one of the most economically important large pelagic fish resources, with highly migratory behavior. The tuna, skipjack, and tuna-like fish commonly called 'Tuna-Cakalang-Tongkol' belong to the family of Scombridae. The tuna and skipjack are transoceanic species while tuna-like are considered coastal waters living habitat. The tuna fisherides in FMA 716, notably skipjack, were introduced to Indonesia in Maluku in 1905 and to Sulawesi in the era of the first world war in 1918, by Japanese fishermen though these were unsuccessful. Koo Hara, a Japanese fisheries explorer of Kagoshima Prefecture, introduced it to Bitung in 1927 and at the same time to Ambon of Maluku on his return to Japan. In 1935, the Dutch established a skipjack fishing company in Bitung about 45 km east of Manado City. During the Japanese occupation in World War II, this company was expropriated and under the Japanese administration their skipjack fishing technology and management was transferred to the local fishermen (Mantjoro and Kataoka, 1991). After Indonesia proclaimed her independence, the company was taken over by the government. Since 1951 the management of the company had been handled fully by Indonesians. In 1970 the government issued regulation No. 52 renaming the company to East Indonesian Fishery Co., Ltd. (*PN Perikani Timur*) with branches in Ujung Pandang/Makassar, Ternate, Ambon, and Sorong. After that, Bitung became the only skipjack fishing base in East Indonesia.

The term highly migratory species has its origins in Article 64 of the United Nations Convention on the Law of the Sea (UNCLOS). The Convention does not provide an operational definition of the term, but UNCLOS Annex I lists the species considered highly migratory by parties to the Convention. The list includes tuna and tuna-like species (albacore, bluefin, bigeye tuna, skipjack,

yellowfin, blackfin, little tunny, southern bluefin and bullet), pomfret, marlin, sailfish, swordfish, saury and ocean-going sharks, dolphins and other cetaceans. These high trophic level oceanodromous species undertake migrations of significant but variable distances across oceans for feeding, often on forage fish, or reproduction, and also have wide geographic distributions. Thus, these species are found in both the 200 mile exclusive economic zones and in the high seas outside these zones. They are pelagic species, which means they mostly live in the open ocean and do not live near the sea floor, although they may spend part of their life cycle in near-shore waters. Highly migratory species can be compared with straddling and transboundary stocks. Straddling stocks are found both within an EEZ as well as in the high seas, while transboundary stock have ranges in the EEZs of at least two countries. A stock can be both transboundary and straddling.

Based on Annex 1 of the UNCLOS, FMA 716's highly migratory species include the large tuna group of the genus Thunnus which consists of several species and only one species of skipjack tuna, *Katsuwonus pelamis*. The large tuna species include yellowfin tuna (*T. albacares*), big-eye tuna (*T. obesus*), albacore (*T. alalunga*), southern blue fin *(T. maccoyii*) and long-tail tuna, *T. tonggol*. The tuna and tuna-like fish resources in north eastern Indonesia, which are part of the Western and Central Pacific waters, are assumed to be one unit stock, with relatively stable production data that has increased over the period of 2005 to 2015 (Table 3).

Large tunas in FMA 716, i.e. skipjack, yellowfin and bigeye tunas are estimated to be part of the stock in the western and central Pacific Ocean. Stock assessment research undertaken by USAID Oceans in the development of this plan therefore referred to the results of the WCPFC stock assessment. USAID Oceans reviewed the maximum sustainable yield (MSY), the maximum level at which a resource can be routinely exploited without long term depletion. Recent levels of the spawning biomass of skipjack tuna were found to be well above the level that will support the MSY. The fishing mortality, the loss of fish of all age-classes, of skipjack tuna was estimated to have increased significantly since the beginning of industrial tuna fishing, but fishing mortality still remains below the level that would result in the MSY and was estimated to have decreased moderately in the last several years. Current catches of skipjack tuna were found to be lower than but approaching estimated the MSY. Stocks of skipjack tuna are still estimated to be healthy (WCPFC-SC12-2016/SA-WP-04), while yellowfin tuna stocks are most likely above the level which will support the MSY. Recent levels of fishing mortality of yellowfin tuna stocks are most likely below the level that will support the MSY, and latest catches marginally exceed the MSY (WCPFC-SC10-2014/SA-WP-04). Recent levels of fishing mortality of bigeye tuna stock exceed the level that will support the MSY, and current catches exceed the MSY (WCPFC-SC10-2014/SA-WP-01).

Table 1. Potential estimated fish resources (tons) of FMA 716 (Min. Decree 47-2016)

	Small Pelagics	Large Pelagics	Coral Fish	Demersal	Penaeid Shrimp	Lobster	Mangrove Crab	Blie Swimming Crab	Squids	Total
Potential Yield	222,946	154,329	54,194	34,650	8,465	685	1,969	424	1,103	478,765
Potential Yield (%)	46.6	32.2	7.2	11.3	1.8	0.1	0.4	0.1	0.2	100
Total Allowable Catch	178,357	123,463	43,355	27,720	6,772	548	1,575	339	882	383,011
Expotation Level (%)	0.49	0.74	1.11	0.49	0.75	1.02	0.94	1.09	1.4	
Exploitation Status	Moderate	Fully Exploited	Over Exploited	Moderate	Fully Exploited	Over Exploited	Fully Exploited	Fully Exploited	Over Exploited	

Table 2. Fish resources production (tons) in FMA 716 (DGCF, 2015)

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Average	%
Tuna (YFT, BET, ALB)	13140	11695	16895	14625	26224	12333	29988	36153	38245	51216	25051	11.5
Skipjack tuna	29012	50257	40984	47778	49667	49159	41950	54518	92399	10854	56427	25.9
Tuna-like fish	30593	12378	22686	25587	33420	35478	23127	25518	26326	42808	27792	12.7
Other Large Pelagic	3237	2657	3431	2859	2727	10256	4666	7643	9098	7020	5359	2.5
Small Pelagic	51191	52677	53706	58412	57288	69733	73295	82602	85660	73867	65843	30.2
Coral-Demersal	19061	25536	24969	21758	20738	29226	31466	40200	40742	33195	28689	13.1
Penaeid shrimp	7179	2126	8053	4195	3604	4399	5306	5152	4861	4914	4979	2.3
Lobsters	282	237	308	287	251	297	540	305	212	102	282	0.1
Crabs	928	405	1047	1024	840	885	870	960	1044	1351	935	0.4
Squids	685	995	1190	1311	1181	1221	776	887	849	1091	1019	0.5
Other Miscellaneous	1539	1794	2662	2064	1312	1285	1310	1493	1603	3253	1832	0.8
Total	15684	16077	175931	179900	197252	214272	213294	255431	301039	327364	218209	100.0

Table 3. Catch, effort, and catch per-unit of effort (CPUE) of large tuna fishery in FMA 716 during 2005-2015

Year	Catch (Tons)	Effort (PS unit)	CPUE (tons/PS unit/year)
2005	64,644	2019	32.0
2006	65,973	2182	30.2
2007	65,435	2237	29.3
2008	72,028	2412	29.9
2009	73,645	2294	32.1
2010	55,910	4407	12.7
2011	74,414	6478	11.5
2012	71,931	6387	11.3
2013	68,218	5940	11.5
2014	61,162	5992	10.2
2015	49,321	4056	12.2

USAID Oceans also reviewed the fisheries' spawning potential ratio, which is based on the principle that certain levels of fish have to survive in order to spawn and replenish the stock at a sustainable level. Recent levels of spawning potential of yellowfin tuna stock were estimated to be above the minimum target for sustainability but lower than the optimal level targeted in 2012 (WCPFC-SC10-2014/SA-WP-04). Recent levels of spawning potential of bigeye tuna stock were most likely below the level which will support the MSY, estimated in 2012 (WCPFC-SC10-2014/SA-WP-01).

USAID Oceans also assessed the development of FMA 716's tuna fishery. Based on the distribution of the annual effort of the Indonesian fishing fleet, the optimum production level was surpassed between 2009 and 2010, with the respective effort of 2,294 and 4,407 mini-purse seine units, and an optimum catch per unit effort (CPUE) of about 20.2 tons/purse seine unit/year. The recent status of exploitation (2015) of 716's large tuna fishery, with the calculated CPUE equaling 12.2 tons, was below the optimum level. However, if effort is maintained at the 2015 level, it is likely that the fishery will be recovered. Looking at the CPUE data in 2013, 2014 and 2015–in which the lowest CPUE (10.2) occurred in 2014 but increased in 2015–it is likely that 716's large tuna fishery was in the process of recovery. Similarly to large tuna, the optimum skipjack production level was also surpassed in 2009 and 2010, with the respective effort of 1,788 and 3,435 pole & line units; the optimum CPUE was about 25.6 tons/pole and line/year. The recent status of exploitation (2015) of the skipjack tuna fishery in FMA 716 is below the MSY level, and the fishery is likely in the process of recovery, as indicated by the higher CPUE in year 2015.

2.3.2 Development of Fishing Fleets and the Intensity of Fishery Resources Utilization

Most of fishing fleets operating in FMA 716 are based in Bitung, North Sulawesi Province. The fishing fleet and gears used in the area's exploitation of tuna resources include purse seine, drift gill net, long-line, drift long-line, pole and line, troll, hand line and vertical line. To calculate their annual efforts, USAID Oceans has referenced fisheries statistical catch and effort data from North Sulawesi Province.

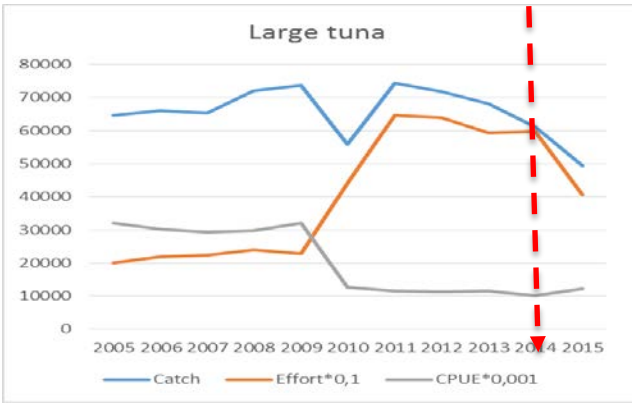


Figure 4. Trend of annual catch, effort and CPUE of large tuna fishery before 2014 moratorium

According to Gulland (1983), catch, effort, and catch per-unit of effort (CPUE) provide the three related characteristics of the fish stock. Catch is the quantity removed by fishing (C); the rate at which fish are removed, or fishing mortality (F), and the catch per-unit of effort (CPUE) is the index of abundance. Following Sparre and Venema (1992), applying the simple model of the Surplus Production Model to Table 3, the trend of annual catch, effort and CPUE can be depicted (Figure 4).

Based on available data, it is likely that the large tuna fisheries in FMA 716, from 2005 to 2015, follow the general pattern of an exploited fishery in which the trend of catch increased following the increase of effort (2005-2011), and the trend of both catch and effort for the following period (2012-2015) were decreased. The overall trend of CPUE until 2014 was decreased, however, the CPUE in 2015 showed a small increase. This is likely due to the enactment of the MMAF Ministerial Regulation No. 56/PERMEN-KP/2014 on November 2014, calling for the temporary moratorium of Capture Fisheries Business Licensing and Min.Regulation No. 57/PERMEN-KP/2014 concerning transshipment at sea for fishing vessel built overseas.

Research undertaken by USAID Oceans to develop this plan revealed varying opinions on the effects of the moratorium. Existing research revealed that large fisheries business owners in Jakarta and Bitung noted that the transhipment policy caused large business losses, as the cost of fishing increased and catch volumes decreased (Hikmayani, et al., 2015), while small-scale fishers felt that they had been getting more fish than in the past (Chodriyah, 2017). USAID Oceans' in-field research revealed consistent findings, with varied reactions across the sector.

Based on the distribution of annual effort, it is likely that the lowest CPUE of approximately 10.2 tons/purse seine unit/year which occurred in 2014, has been increased to 12.2 tons/purse seine unit/year, illustrating that the stock is being recovered. The stock status of large tuna in FMA 716 is in agreement with the WCPFC bigeye tuna stock assessment results, as reported by Harley *et al.*, (2014), and yellowfin tuna assessments by Davies *et al.*, (2014), where:

- Current catches of bigeye tuna exceed the maximum sustainable yield (MSY), indicating overfishing;
- Recent levels of fishing mortality exceed the level that will support the MSY;
- Recent levels of spawning potential are most likely at the level which will support the MSY; and
- Recent levels of spawning potential are most likely at the limit reference point of 20%, as agreed upon by the WCPFC.

For yellowfin tuna, the:

- Latest catches of yellow fin tuna marginally exceed MSY;
- Recent levels of spawning potential are most likely above the level which will support the maximum sustainable yield;

- Depletion has increased steadily over time, reaching a level of 60% of unexploited biomass in 2012, and is higher in the equatorial region four where recent depletion levels are approximately 0.31 for spawning biomass (a 69% reduction from the unexploited level); and
- If stock-wide over-fishing criteria were applied, it would conclude that region four, where FMA 716 is located, are fully exploited.

Indonesia's 200 EEZ amounts to 5.8 million square km. More than 90% of the skipkack fishing boats are concentrated in East Indonesia, especially in Sulawesi, Maluku, Irian Jaya, Nusatenggara, and Timor. In Sulawesi there are two main fishing bases, namely Bitung of North Sulawesi and Kendari of Southeast Sulawesi. Bitung is the base of the enterprise type of skipjack fishery, while the household skipjack fishery is scattered in almost all the fishing village of North Sulawesi.

The main fishing grounds for skipjack in North Sulawesi are Maluku Sea and Tomini Bay. The more intensive fishing area is Maluku Sea and some vessels extend their operation to Tomini Bay. Sulawesi Sea remains deserted from fishing activity, especially live bait fishing. Most live bait is caught in Maluku Sea by lift net or small purse seine. Almost all skipjack fishing boats operate in the coastal area on a daily basis. They return to the port with or without catch because live bait, fuel, oil, foodstuff etc. are provided only for a day trip. Therefore, some fishing companies have recently provided Rumpon and some fishing vessels are designed as multipurpose fishing (Serhaguna) in order to stay out longer and hence, increase the chances of a successful catch. The production is sold mainly to the export market notably to Japan and the rest to local market. Initially, PT Perikani aimed to minimize the fluctuation of fish supply and fish price in the domestic market through its manipulation of fish supply and buying. But, now the company is more oriented to the overseas market than the local market.

Year	Catch	Effort	CPUE
2005	65,138	1,574	41.4
2006	60,608	1,700	35.6
2007	65,934	1,743	37.8
2008	59,808	1,880	31.8
2009	60,891	1,788	34.1
2010	60,190	3,435	17.5
2011	60,159	5,049	11.9
2012	50,271	4,978	10.1
2013	33,236	4,629	7.2
2014	24,782	4,671	5.3
2015	71,372	3,162	22.6

Table 4. Catch, effort and catch per-unit of effort (CPUE) of skipjack tuna fishery in FMA 716 during 2005-2015

A similar phenomenon has likely occured to the stock of skipjack tuna, of which the annual catch, effort, and CPUE are listed in Table 4. It is likely that the dynamic of the skipjack tuna fisheries in FMA 716 in the period 2005-2015 follows the general pattern of an exploited fishery in which the trend of catch was flat following the increase of effort (2005-2011), while in the following period (2012-2014) both catch and effort were decreased, and in the following year (2015) the catch sharply increased while effort decreased. This phenomenon was likely caused by the heavy exploitation of skipjack resources, however, due to the difficulty of obtaining baitfish, some pole and line fishing activities and resulted in decreased effort (Figure 5).

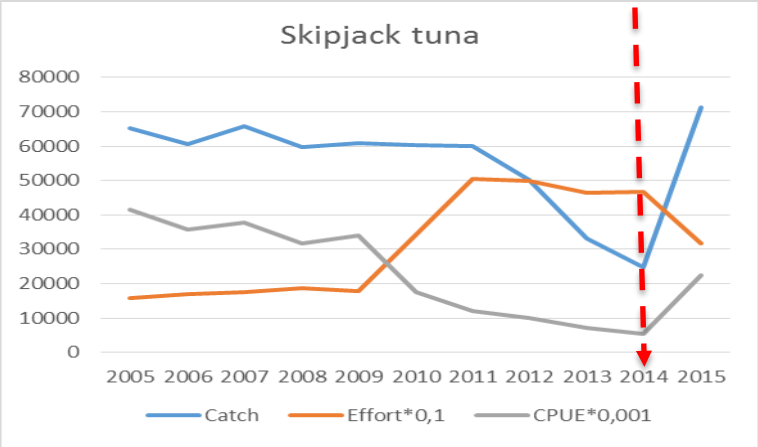


Figure 5. Trend of catch, effort and CPUE of the skipjack tuna fishery before 2014 moratorium

Similar to large tuna, the lowest CPUE of 5.3 tons/pole and line/year occurred in 2014, and increased in the following year (2015) with the CPUE equal to 22.6 tons/pole and line/year—likely due to the process of recovery and as a result of the 2014 moratorium. This illustrates that the dynamics of skipjack tuna fisheries in FMA 716 are in line with the dynamics of the large tuna fishery, in which the higher growth rate of skipjack tuna have led to a higher rate of biomass recovery. This phenomenon is likely in agreement with the stock status of skipjack in the WCPFC area, as reported by McKehnie *et al.,* 2016, where the quantity SBF=0 calculated for the period 2005-2014 is the basis for the limit reference point and is estimated to be a spawning biomass of 7,221,135 mt. The limit reference point is 20%, SBF=0 which is estimated to be a spawning biomass of 1,444,227 mt, while the latest (2015) spawning biomass (SB_{latest}=SB0) is estimated to be 58% of SBF=0 (4,166,815 mt). The quantity $SB_{latest}=SB_F=0$ is more optimistic than estimated in the 2014 stock assessment (0.48) and results from the strong recruitment-driven increase in spawning biomass over the period 2013-2015.[2] Fishing mortality has generally been increasing through time with a moderate decrease in the terminal few years, and for the reference case the fishing mortality reference point $F_{recent}=F_{MSY}$.[3] This indicates that an increase in fishing mortality of 2.2 times is necessary to produce the MSY. Presentation of the results in the form of a Majuro plot shows the steady depletion of the stock over most of the assessment period, along with the increase in the ratio of fishing mortality to fishing mortality at MSY. The stock is still estimated to be healthy however, and is estimated to have been close to 50%, $SB_{F=0}$ for the past decade.

2.3.3 Fishing Vessels and Gear in Use

Fishing vessels are defined as boats that are used directly in fishing operations of fishes/other aquatic animals/aquatic plants, and does not include carrier vessels, used for carrying fish. However, a boat, which is used to carry fishers, fishing gears (including those using stationary fishing gears such as *bagan, sero* and *kelong)*, and fish are included in fishing vessel data that is used to measure the number of active boats. The number of recorded fishing vessels, by category, in the North Sulawesi Provincial Marine and Fisheries Services (DKP) during the period 2005-2014, based on fisheries statistical data published by the MMAF Director General of Capture Fisheries are presented in Table 5. The number of 5GT fishing vessels substantially increased from 2005-2014, while the number of vessels in the 5-10GT and 10-20GT categories slightly increased, and 20-30GT category experienced sharp fluctuations. The annual number of Central Government-licensed fishing vessels fluctuated during 2005-2014 for all vessel categories, likely due to relatively high mobility between FMAs.

[2] SB = Stock Biomass
[3] F = Fishing Mortality; MSY = Maximum Sustainable Yield

Table 5. Number of fishing vessels recorded in FMA 716

Vessel Category	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Provincial Government License										
5 GT	4716	2777	2666	6490	4501	4274	4184	5307	12568	6990
5-10 GT	3055	542	1134	873	1213	1630	826	1345	5720	1994
10-20 GT	1157	348	457	394	389	228	256	280	2850	433
20-30 GT	375	102	121	19	21	30	105	114	300	200
Central Government License										
30-50 GT	50	21	86	8	34	54	66	41	46	79
50-100 GT	30	10	223	214	114	160	158	51	46	43
100-200 GT	19	6	71	83	49	50	45	9	11	14
200-300 GT	15	6	11	6	10	10	8	0	0	2
300-500GT	15	0	8	21	16	4	2	0	0	2
500-1000	0	0	8	8	7	5	3	0	0	2
> 1000-	0	0	1	2	1	1	0	0	0	0

Source: DGCF, 2015

A fishing unit is a technical unit operating in fisheries, comprised by a combination of the fishing boats and gear. The number of fishing units are counted according to the type of gear employed. When a vessel employs two different fishing gears during the course of the year because of the fisheries or weather conditions, the number of fishing units are counted as two. Fishing gears relevant to the tuna resources in FMA 716 consisted of purse seine, drift gill net, long line, drift long line, pole and line, troll, hand line and vertical line. The number of purse seine fishing units has increased in the last ten years from 786 in 2005 to 3723 units in 2014—almost five times the original value (Table 6). Similarly, the number of drift gill nets increased by a factor of four, from 1334 units in 2005 to 4214 units in 2014. During this period, the purse seine and drift gill nets were the most popular—and therefore likely the most effective—gears for tuna fishing in FMA 716.

Table 6. Number of fishing units recorded in FMA 716

Fishing unit	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Purse seine	786	863	898	1,070	933	992	1,108	1,544	3,484	3,723
Drift gill net	1,334	1,396	1,398	1,396	1,377	1,453	1,649	1,947	4,215	4,214
Long line	601	657	655	728	833	200	288	616	924	737
Drift long line	872	872	326	548	548	644	646	678	971	99
Pole and line	496	540	535	562	544	2,364	3,854	3245	699	534
Troll	2,752	2,752	2,752	2,426	2,452	2,460	2,460	2,752	11,365	12,566
Hand lines	2,234	2,329	3,692	2,72	2,431	685	685	2,611	4,686	6,734
Vertical line	120	188	188	322	378	335	335	1,172	891	176

Source: DGCF, 2015

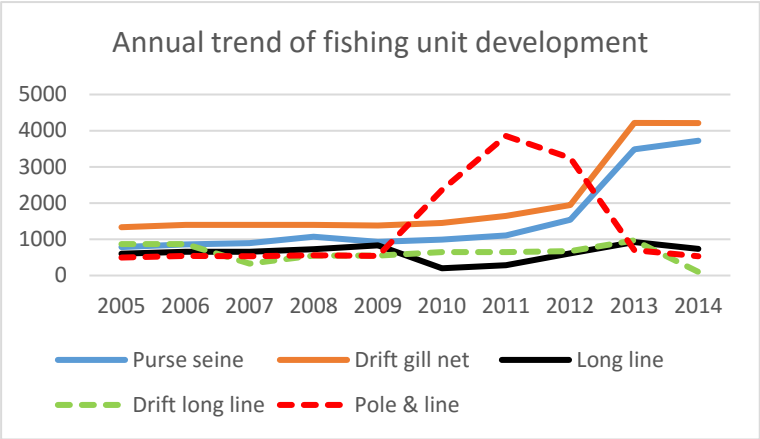


Figure 6. Trends of the annual number of fishing gear units in FMA 716

Source: DGCF, 2015

In this period, it is implied that the two most effective fishing gears of purse seine and drift gill net contributed to higher fishing pressures on tuna resources in FMA 716. The total number of fishing units during this period are far higher than the optimum effort (F_{MSY}), and therefore impose a higher fishing pressure to the fishery. It is recommended that as of 2015, no more additional licenses should have been issued to the fishery, as the fishery is likely in the process of recovery from overfishing.

During this time, other fishing unit use stayed relatively stable, with the exception of pole and line fishing units. The trend of pole and line use during 2005-2009 was flat, but sharply increased for the next two years and reached its height in 2011. For the next three years, until 2014, the trend sharply decreased. One of the problems with pole and line units are their dependency on the availability of live-baitfish, as baitfish can also be easily processed for human consumption.

2.3.4 Use of Fish Aggregating Devices

The use of fish aggregating devices (FADs) in Indonesia's tuna fisheries has been intensively discussed in Widodo *et al* (2016). The early 1980s (Tuasamu, 1985) marked the beginnings of fishers deploying floating FADs in the deepwaters in eastern Indonesia to attract and catch tunas. Industrial-scale purse seining with FADs leads to the indiscriminate catch of tuna, including juvenile yellowfin and bigeye tuna, which is of concern to fisheries managers, primarily because bigeye and yellowfin tuna associated with FADs are younger and smaller than those found in free schools (Harley, et al., 2010 in Morgan, 2011). Further elaboration stated that several negative impacts of FADs on tuna populations have already been observed, including:

- Recruitment overfishing of skipjack tuna in the eastern Atlantic Ocean;
- Decreased health (plumpness) compared with tuna caught in free schools;
- FAD-related behavioral changes in tuna that has led to increases in biomass under FADs (which can make tuna more susceptible to capture), reduced free-school abundance, differences in sizes and ages compared with free-school caught tuna and changes in school movement patterns;
- Increased difficulty of properly assessing the status of individual tuna populations; and
- Overfishing of juvenile bigeye tuna in the Western and Central Pacific Ocean (WCPO).

Anchored FADs in waters as deep as 2000-3000m have since become a dominant practice for tuna fishing in Indonesia's archipelagic waters. Gershman et al. (2015) in Widodo et al (2016) estimated the number of anchored and drifting tuna FADs in global marine waters to be ± 120,680, and of these as many as 29,700 FADs in the WCPO—not including an unknown number of FADs in

Indonesian and Philippine waters. Since 2004, MMAF has issued Ministerial Regulations (Min.Reg.) for various FAD-related fisheries (Min.Reg.No.: PER.30/MEN/2004; PER.08/MEN/2011 and No. 26/PERMEN-KP/2014) and relevant plans (National FAD Management Plan for 2015-2017 (DGCF 2014) and National Tuna Management Plan (MMAF 2015)).

The differences between FAD and non-FAD tuna fisheries have been explored by Bailey and Sumaila (2017), wherein using a simulation model they have developed a multi-species, multi-gear bioeconomic game-theory model to address the trade offs in fishing efforts and economic benefits between purse seine fishers targeting skipjack and adult yellowfin, as well as longline and handline fishers targeting adult yellowfin and bigeye. From the model, a simulation can be run to establish the optimal fishing effort (gear) each player will choose in order to maximize the overall or joint profit from the resource. A yield per-recruit model, which considers growth and mortality, is combined with a stock-recruitment model incorporating density dependent population effects. Recruitment of the three fish stocks is assumed to be based off the Beverton and Holt model (Beverton and Holt, 1957).

Lengths and weights are assumed to follow von Bertalanffy growth equations. Survivorship to age, which is the probability of an individual surviving to a specified age, is assumed to be dependent on additive mortality, that is the summation of natural and fishing mortality. Estimates of natural mortality are strongly age-specific, with higher rates estimated for younger fish. Vulnerability at age is assumed to be dome-shaped for the purse seine fishery and logistic for the longline and handline fisheries, based on the length at which 50% of the population is fully vulnerable to a given gear. Catchability is gear-specific, thus status quo simulations are run assuming that purse seining on FADs occurs, and there is thus juvenile bycatch of both yellowfin and bigeye in the purse seine fishery.

The second simulation assumes that the use of FADs is reduced through a management regulation. For this simulation, maximum profitability is slightly higher than the status quo (by about US $77 million), estimated to be about US $1.24 billion. This maximum is reached with a purse seine effort of 44,000 vessel days, and a longline effort of 28 million hooks set. Under this simulation and scenario, an overall net loss to longliners occurs—a result that requires further investigation. Equilibrium catches for the purse seine and longline fleets are estimated at 1.27 million and 126,000 tons, respectively.

The third scenario assumes that fishing on FADs no longer occurs, and thus, there is no juvenile bycatch of yellowfin or bigeye tuna. This scenario results in the highest equilibrium profit potential, an estimated US $1.35 billion. It is notable that this scenario results in increased profit to both the longline and purse seine fisheries, likely due to the fact that there is more yellowfin biomass available for the purse seine fishery when only adult fish are caught. It should be noted that this profit potential is calculated under the assumption that a price premium is paid for adult fish. The equilibrium effort in this scenario is 44,000 purse seine vessel days and about 30 million hooks set in the longline fishery.

In all three scenarios, profit is maximized at about this same effort combination. With no FAD fishing, equilibrium purse seine catch is about 1.3 million tons, while longline catch is about 154,000 tons. Results from the three scenarios are summarized in Table 7, with the difference between the status quo and the no FADs scenarios totaling approximately US $180 million in net profits.

Table 7. Results of simulation scenarios in regard to net profits

	Species	Status quo			Reduced FAD			No FAD		
		PS	LL	Total	PS	LL	Total	PS	LL	Total
Catch (1000 tons)	Skipjack	1138	0	1138	1109	0	1109	1109	0	1109
	Yellowfin	118	101	219	150	92	242	156	102	256
	Bigeye	7	35	42	8	34	42	0	52	52
	Total	1263	136	1399	1267	126	1293	1265	154	1419
Revenue M US $	Skipjack	1701	0	1701	1663	0	1663	1663	0	1663
	Yellowfin	168	252	240	259	231	490	304	253	557
	Bigeye	10	106	116	12	102	114	0	156	156
	Total	1879	358	2237	1934	333	2267	1967	409	2376
Effort*		46	30		44	28		44	29.6	
Cost M US $		1012	59	1071	968	56	1024	968	59	1027
Net Profit		867	299	1167	966	277	1243	999	350	1349

PS=Purse Seine, LL=Longline; M = Million US $

*Purse seine effort: 10000 fishing days/year, Long line effort: million hooks set/year

2.3.5 Special Environmental Considerations

In 2016, the United States Presidential Task Force on Combating IUU Fishing established a list of "at-risk species" that are particularly vulnerable and threatened by IUU activities. FMA 716 is home to 10 at-risk species, including blue swimming crab, dolphin fish, groupers, red snappers, sea cucumber, shark, shrimps, swordfish, and tuna species. Mangroves, sea grasses, estuaries, and coral reefs are important habitat fisheries and ecosystems available within FMA 716 from along the coastal areas to the deeper waters. These ecosystems are known as 'nursery areas' for most aquatic animals (Turak and DeVantier, 2003), but are faced with numerous challenges and environmental issues.

A very rich coral ecosystem covers most of Bunaken National Park, dominated by fringing reef and barrier reef corals. There are about 390 species of coral recorded in the waters of the park, which includes a 25-50 metre vertical coral wall which is inhabited by 13 coral genus. The seaweeds that can be found here include *Caulerpa, Halimeda*, and *Padina pavonica* species, while the dominant seagrasses, in particular in the islands of Montehage and Nain, are *Thalassia hemprichii, Enhallus acoroides*, and *Thalassodendron ciliatum*. The park is also abundant in different species of fish, marine mammals and reptiles, birds, molluscs, and mangrove species. In total, some 390 species (63 genera, 15 families) of reef-building (hermatypic) scleractinian corals have been recorded. Specific identities of some taxa remain unconfirmed, and several species do not conform closely to any described taxa and may be undescribed, requiring further taxonomic work. Diversity for soft corals and other associated groups (ca. 40 taxa in all) has been significantly underestimated because of difficulties in assigning species-level identifications in the field, and also because of the focus on reef-building taxa.

Overall, diversity is similar to the Wakatobi area (Southeast Sulawesi) and the Milne Bay area of East Papua New Guinea, and substantially higher than the Banda Islands (Maluku) or the North Great Barrier Reef. Diversity is lower than the Sangihe-Talaud Islands to the northeast (ca. 440 reef-building coral spp.) and the Rajah Ampat area of Papua, the most diverse area of the Indo-Pacific (> 500 spp.). Of particular note in this regional comparison, Bunaken National Park exhibits exceptional levels of within-location diversity (mean 155 spp., max. > 200 spp.). Its richest locations host some 25-30% of the reef-building coral species compliment of the entire Indo-Pacific region. This lends strong support to the selection of Bunaken National Park as one of Indonesia's, and the region's,

flagship MPAs (Turak and DeVantier, 2003). About 90 species of fish live in the waters of the park, among them being the emperor angelfish, almaco jack, spotted seahorse, bluestripe snapper, pinkish basslet and two-lined monocle bream. The species of mollusc include the giant clam, horned helmet shells, chambered nautilus, and ascidians. It is claimed that this park has seven times more genera of coral than Hawaii, and more than 70% of all the known fish species of the Indo-Western Pacific.

2.3.6 Bycatch Concerns including Threatened and Protected Species

Bycatch in marine capture fisheries is defined as the retained catch of non-targeted but commercially viable species (referred to as 'incidental catch') plus all discards (FAO 2005). The FAO Code of Conduct for Responsible Fisheries is voluntary, but urges states and fisheries management organizations to adopt appropriate measures to reduce by-catch, discards, and waste. Bycatch has become an increasingly prominent international issue and raises ecological concerns, as some bycatch species of cetaceans (whales, dolphins, and porpoises), seabirds, sea turtles, elasmobranchs (sharks, skates, and rays), and other fish species are particularly vulnerable to overexploitation and slow to recover from large population declines.

For the purposes of this plan, bycatch is defined as the species caught, whether retained or not, that is not the main target of the fishery. The catching of juvenile fish of a target species can lead to both growth and recruitment overfishing, and can thus lead to a decline in the resource of interest. In this context, bycatch of juvenile tuna in the fisheries of the WCPO has been discussed in recent stock assessment and technical reports (Gillett, 2011). Purse seine bycatch is generally higher in the western part of the WCPO, such as in the waters around Philippines, Indonesia, and Papua New Guinea, in an area known as the Coral Triangle. As juvenile tuna grow, they tend to migrate east, resulting in smaller amounts of juvenile bycatch in the waters of the small Pacific Island states and in the high seas.

With regard to the tuna fisheries in FMA 716 in which most fishing gears used are purse seine, there is limited information available at the national or provincial levels on bycatch and discards. The juvenile yellowfin and bigeye in purse seine fisheries are considered as bycatch (Bailey and Sumaila, 2017, in press). A case study reported by Harley *et al.* (2015) provides information on the bycatch obtained from purse seines operated around drifting FADs and around anchored FADs targeting skipjack, yellowfin, and bigeye tuna. There were 17 noted items of by-catch (by-product) from this gear, most of which provide fish of commercial value, such as rainbow-runner, mahi mahi, mackerel scad, and wahoo. Some tuna groups such as *kawa-kawa*, frigate tuna, bullet tuna, and albacore were also caught and considered as by-product. While most by-catch from purse seine fisheries has an economic importance and is not discarded, in some reported cases this further threatens populations of already rare and endangered species such as whale shark that are caught around anchored FAD (Table 8).

Information on bycatch is not available in the North Sulawesi tuna fisheries, however, as part of the WCPO some information regarding bycatch in FMA 716 would likely be similar with the WCPO report that can be found in the Tuna Fisheries Assessment Report No. 15 (Harley et al., 2015), elaborated in Table 8. The tuna fisheries of the WCPO principally target four main tuna species including skipjack, yellowfin, bigeye, and albacore tuna. However, the fisheries also catch a range of other species in association with these. Some are of commercial value (by-products), while many others are discarded. There are also incidents of the capture of species of ecological and/or social

significance ('protected species'), including marine mammals, sea birds, sea turtles and some species of shark (e.g. whale sharks).

Table 8. Catch composition of purse-seine fisheries operating in the WCPO based on observer data of the last ten years

Drifting FAD	%		Anchored FAD	%
Target				
Skipjack	76.5		Skipjack	66.2
Yellowfin	14.8		Yellowfin	25.2
Bigeye	7.9		Bigeye	6.7
Total target	99.2		Total target	98.1
Bycatch/by-product				
Rainbow runner	0.22		Rainbow runner	0.27
Silky shark	0.13		Frigate tuna	0.26
Mahi mahi	0.11		Mahi mahi	0.16
Oceanic triggerfish (unidentified)	0.09		Silky shark	0.12
Mackerel scad	0,.5		Mackerel scad / saba	0.12
Wahoo	0.04		Kawakawa	0.12
Blue marlin	0.03		Oceanic triggerfish (Unident.)	0.11
Black marlin	0.005		Wahoo	0.11
Striped marlin	0.005		Bullet tuna	0.11
Kawakawa	0.005		Blue marlin	0.06
Bigeye scad	0.005		Black marlin	0.06
Albacore	0.005		Great barracuda	0.05
Frigate tuna	0.005		Ocean spotted triggerfish	0.05
Bullet tuna	0.005		Drummer (blue chub)	0.03
Barracudas (unid)	0.001		Albacore	0.03
Oceanic triggerfish (spotted)	0.055		Whale shark *)	0.03
Others	0.005		Others	0.18
Total byproduct	0.8		Total byproduct	1.9

Source: Harley et al., 2015

The information concerning the catch composition of the main tuna fisheries in the WCPO comes largely from the various observer programs operating in the region. Overall, catch (in weight) with anchored FAD sets have a lower bycatch rate of 0.9% and 0.8% for drifting FADs. There is limited interaction with protected species, such as whale sharks and manta rays. Historically, some vessels have deliberately set FADs around whale sharks as they are associated with tuna schools, but this practice has been banned.

Bycatch can alter biodiversity and ecosystem functions by removing top predators and prey species at unsustainable levels (Myers et al. 2007). It also alters the foraging behavior of species that learn to take advantage of discards. Its economic effects include loss of bait, reduced availability of baited hooks when they are occupied with unwanted bycatch species, and concomitant reduced catch of marketable species. The imposition of a range of restrictions, closed areas, embargos, and possible closures and allocation between fisheries, where bycatch in one fishery reduces target catch in another, and bycatch of juvenile and undersized individuals of a commercial species, can adversely affect future catch levels (Hall et al. 2000).

Discarded bycatch also raises a social issue over waste. From 1992-2001, an average of 7.3 million tons of fish were discarded annually, representing 8% of the world's catch (FAO 2005). Prominent bycatch issues include dolphins and porpoises in purse seine fisheries and driftnets; fish discards in shrimp trawl fisheries; and seabird, sea turtle, marine mammal, and shark bycatch in longline, purse seine, gillnet and trawl fisheries (Hall et al. 2000). In commercial tuna fisheries, the incidental bycatch of sensitive species groups (seabirds, sea turtles, marine mammals and sharks) and bycatch of juvenile and undersized tunas are allocation and conservation issues. In addition to problematic bycatch, overexploitation and IUU fishing complicate bycatch management, and are additional conservation issues facing the management of tuna fisheries.

2.3.7 Environmental Concerns Resulting from Biodiversity Changes and Other Uses

Fisheries, by nature, are extractive enterprises and therefore reduce the biomass of exploited populations. But sometimes the level of harvest has been too great, and scientists have shown that some stocks have been reduced to fractions of their unfished levels. Researchers are also now raising new concerns about the multiple impacts of fishing not only on target stocks, but also on other ecosystem components through bycatch (removal of non-target species), indirect effects (the removal of one species leading to the benefit or detriment of another), and habitat impacts (Pauly and Maclean 2003). Furthermore, activities associated with fisheries have global impacts beyond those related solely to depletions of local stocks. This perception has been fueled by a series of highly publicized journal articles and reports (e.g., Pauly et al. 1998a, Myers and Worm 2003) that suggest that fishing wild populations of marine fish and invertebrates has fundamentally altered the structure of marine ecosystems, resulting in severe depletion of populations at high trophic levels and propagating through whole communities of interacting species through indirect effects.

In the case of the Sulawesi Sea's fisheries, concerns include illegal fishing practices carried out by both domestic and foreign fishing vessels that ultimately lead to overfishing. Overfishing poses serious risks as the loss of marine biological diversity can have serious consequences for the stability of marine and coastal ecosystems. An example of the dynamics of the biodiversity index in the demersal fisheries in the Arafura Sea (FMA 718) have been reported by Wagey and Arifin (2008), but it was likely that the phenomenon of trophic changes did not occur. Compared with the exploitation of fish resources in the Arafura Sea which was very heavy, exploitation in the Sulawesi Sea at the same period was likely a bit lower, disregarding the high fertility of the Arafura Sea.

Biological extinction from a directed fishing effort is extremely rare because economic extinction typically occurs first—that is fish becoming too rare to fish profitably. Overexploitation of target fish population, however, can lead to depletion to the point where the stock cannot recover, usually because the depletion of the fish stock often involves other ecological changes. Fishing can also change trophic relationships through changing the relative abundance of predators, prey, and competitors as well as the genetic make-up of populations.

Apart from fishing activities, other activities that impact FMA 716's ecosystem include shipping, tourism, and coastal mining activities. The impact of illegal mining activities can be seen in Bangka, a tiny 48 sq km island situated just off the northern tip of Sulawesi Island, Indonesia in the heart of the Coral Triangle. Bangka is just 30km from Manado, the capital of North Sulawesi province, and borders a marine park that protects two world famous dive sites, Bunaken and Lembeh, although many divers consider Bangka's reefs to be just as impressive. The seascape is a global hotspot of

marine biodiversity, supporting rare species like pygmy sea horses, leaf fish, and dugongs as well as turtles, white tip reef sharks, and even whales. Alleged illegal mining operations are said to be changing the face of the island and threatening the fertile waters that surround it. Under Indonesian law, mining on islands smaller than 2,000 sq km that adversely affects the local environment is prohibited. According to dive operators and local residents, the mining company has already caused extensive environmental damage, including coastal excavation and land reclamation near sensitive coral reefs, yet the company has enjoyed the support of officials at both the local and national level (Langenham, 2015).

IUU fishing practices, combined with overfishing, pose serious threats to the region's biodiversity. Among other impacts, IUU fishing increases uncertainty regarding catch and fishing efforts. This uncertainty and lack of data to assess current fish stocks results in difficulties in formulating and implementing fisheries management plans.

2.4 Socio-Economics of Fisheries

The number of fishing vessel crew members varies with the type of gear and size of the vessel. Purse-seine vessels have an average of 25 crew members. Fishing operations with more vessels tend to have more crew members on each boat, which is found to decrease the profitability per vessel. Since crew members are paid using a profit-sharing system, increases in the number of vessels also results in decreased economic profit per fisher. Fishers' income is highest when the fish stock is healthy and the fishery is operating at the optimum level.

Fish landed in North Sulawesi are consumed both locally and exported, with 31% of Bitung's tuna production Bitung exported and the rest sold to domestic markets. Traditional processing, such as smoke-fish, is undertaken to preserve the catch for local consumption. Tuna is also sold fresh, processed in cans, or is packaged as frozen whole fish, fillet, loin and other forms. Tuna landed in Bitung Port is exported to Asian markets, including Thailand and the Philippines, as well as the United States (US), the European Union (EU), and other international markets. USAID Oceans' rapid assessment of the tuna value chain revealed that Bitung experienced a production drop of 59% in 2015, causing significant economic impacts in the region and changes in trading dynamics. Increasing preferences for sustainable and traceable products from buyers in the US, EU, and Australia also continues to add to production pressures.

The following is an excerpt from a history written by one of the MMAF working units (Mantjoro and Kataoka, 1991):

The skipjack fishery was introduced to Indonesia in Maluku in 1905 and to Sulawesi in 1918 by Japanese fishermen though these were unsuccessful. Koo Hara, a Japanese fisheries explorer of Kagoshima Prefecture, introduced it to Bitung in 1927 and at the same time to Ambon of Maluku on his return to Japan. In 1935, the Dutch established a skipjack fishing company named *Institut voor de Zee Vissert* in Bitung about 45 km east of Manado City. During the Japanese occupation in the war, this company was expropriated and under the Japanese administration their skipjack fishing technology and management was transferred to the local fishermen. As a consequence, the fishery became completely similar to that of Japan.

After Indonesia proclaimed her independence, the company was taken over by the government, but its board of director remained in the hands of the Dutch. Since 1951, the management of the company had been handled fully by Indonesians. In 1960, when the Indonesian Government nationalized all foreign companies, including the skipjack fishing company, the name of *Institut voor de Zee Vissert* was changed to Marine Fisheries Corporation (*Yayasan Perikanan Laut*). Government regulation No. 51 in 1961 enforced the name change again to Indonesian Fisheries Development Co., Ltd. (*PT Usaha Pembangunan Perikanan Indonesia*). In 1970 the government issued regulation No. 52 renaming the company to East Indonesian Fishery Co., Ltd. (*PN Perikani Timur*) with branches in Ujung Pandang/Makassar, Ternate, Ambon, and Sorong. After that, Bitung became the only skipjack fishing base in East Indonesia. Before 1971, the skipjack fishing boats were mostly of 20 GT wooden boats and two or three private skipjack fishing companies started their operations with one or two boats each.

In 1972, the government expanded capital investments to the skipjack fishery in North Sulawesi up to US$150 million, of which 34% was from the government, 34% from the World Bank, 23% from the Bank Indonesia, 9% from the Bank Rakyat Indonesia. The investment resulted in a cold storage of 600 tons capacity, an ice plant, a shipyard, a fishing port, and fuel-oil tank, and 28 fishing boats of 30-40 GT, a longline vessel of 100 GT, and a transportation vessel of 300 GT.

In 1973, based on government regulation No. 16, the name of the company changed to North-central Sulawesi Fishing Co., Ltd. (*PT Perikani Sulutteng*) with a branch office in Jakarta. Meanwhile, the former branches were reorganized into independent skipjack-tuna fishing companies in Kendari, Ambon, Sorong, and Ternate. During the 1970's, several private skipjack fishing companies were established mostly by Chinese entrepreneurs. The last change occured in 1986, when the government decided to promote the people's nucleus company system (Perusahan Inti Rakyat or PIR). This system was first applied to the plantation companies and then extended to fisheries which is called fisheries nucleus company (*Perikanan Inti Rakyat or PIR*). With this policy, a company can serve as a parent company to several or hundreds of household fishermen as its rank and file. In North Sulawesi, *PT Perikani Sulutteng* became the nucleus company serving about 500 canoe fishermen.

The management of the small skipjack fishery can be classified into three patterns; traditional management, delegated management, and a nucleus company. The household skipjack fishery used to work under traditional management. This fishery is operated based on the needs of the daily diet and is free from any legal regulation and taxes. The government could not impose taxes on them since

there is no basis for tax determination. Fisheries income and expenditure are never recorded, so there is no profit or loss in their minds. Sometimes households feel profitable when a sizable amount of money is earned from the catch, even if their expenses are greater than their income. At present, most of these actors become the rank and file of the nucleus company. The delegated management is mostly applied to the private skipjack fishing companies. The owner delegates his vessel to an experienced fisherman on a contract or income share basis. This fisherman serves as a manager (*Pengurus*) who manages the marketing of its catch and reports to the owner weekly. Usually a fish grossier is appointed as *a Pengurus* because he has an established marketing route for the catch. Operation cost is born by the *Pengurus*, while depreciation and major maintenance costs are paid by the owner. The *Pengurus* performs the business, but control is in the hands of the owner through weekly report and sometimes he has informers among the crew.

In the case of an owner with six vessels, he delegates four vessels to a *Pengurus* based in Belang, 85 km south of Bitung and two vessels to another *Pengurus* in Bitung. The owner lives in Bitung and does not take care of his vessels since he has main business like a shop, a trade, and other big companies. The two *Pengurus* who manage these vessels delegate each vessel to a sub-Pengurus hence, a total of six sub-*Pengurus.* Some sub-*Pengurus* serve as fish brokers, but others delegate fish marketing to a fish broker. Therefore, there are three or four levels of delegation to manage the fishing vessels. People's nucleus company was initially applied to the plantation enterprises in 1986, and extended to fisheries which is called *Perikanan Inti Rakyat (PIR)*. Each fisheries nucleus company serves several tens or hundreds of skipjack-tuna fishing boats of household management as the rank and file.

The PIR system was established to solve the marketing problems of small fishermen. The nucleus company buys the catch from many small fishermen and also provides advance money and fishing materials to them. The advances enable the fishing operations to cover their costs and obliges the fishermen to sell their catch to the nucleus company, while only about 20% of the rank and file avail themselves of it. This implies that they need the nucleus company more for marketing of their catch than for loans.

In North Sulawesi, *PT Perikani* has been appointed by the government to be a nucleus company for about 500 rank and file fishermen. The PIR system is based in Popodu village about 200 km south of Bitung, but only 27% of the fishermen are from this village and the rest come from several fishing villages as temporary fishermen. They come for a period of three to six months and then return to their home village with money for their family. In place of their leaves, the other fishermen who returned previously come so that number of fishermen remains constant.

The business relationship between the nucleus company and rank and file fishermen is as follows:

(1) The nucleus company is required to buy the catch of the rank and file fishermen for 650 Indonesian Rupiahs (IDR) per kilogram and also provides Payao (*Rumpon*), ice, and other fishing materials. The nucleus company decides the fish price based on the local market price in consultation with the fisher men. If the price is too low, the fishermen will try to sell it to outside buyers at a higher price.

(2) The rank and file fishermen are required to sell their catch to the nucleus company and

transfer their catch to the collecting vessel which the nucleus company sends to the fishing ground and get the record of the volume.

(3) The rank and file fishermen are formed into 75 members. Each group has a leader with whom the nucleus company consults on any business transaction. The grouping only aims to

facilitate payment. The nucleus company does not pay the fishermen directly, but to the group's leader who distributes it to their members.

The PIR system also aims to minimize the fishing cost of the nucleus company and to increase the productivity of the traditional fishermen. Thus, PT Perikani added the business of buying fish and shifted its marketing strategy by emphasizing the international market. Recently, some private fishing enterprises have changed their management from a conventional one to a nucleus type of company. Private companies with large capital and an established marketing route are eligible to become nucleus companies through subordinating smaller companies as rank and file companies.

2.4.1 Economics of Fisheries

Ex-vessel fish prices (the price of fish at the fishing vessel just arrived from fishing operation), fishing costs, and catch rates are the three key determinants of a fishery's prevailing economic conditions. Changes in each can have significant impacts on the financial viability of vessels operating in a fishery and the returns generated from the exploitation of fish stocks (Skirtun and Reid, 2016). It was stated in this report that economic aspects of fisheries include a historical overview of relative economic conditions and simplistic projections over the next ten years for the southern longline, tropical longline, and purse seine fisheries of the WCPO. Economic conditions were found to have fluctuated significantly in the fishery over the reference period, 1997 to 2015.

In the case of FMA 716, especially for the North Sulawesi Province, one of the most important economic aspects of the fishery is the total value of fish production. Based on the fisheries statistical data published by the DGCF for 2005-2014, the average total fish value of the North Sulawesi Province was 2.014 trillion (t) IDR, with the lowest value of IDR 1.097 t occurring in 2006 and the highest value of 5.294 t occurring in 2014. Other aspects of fisheries economics include handling, processing, and marketing of fish production that generates added-value. In North Sulawesi Province, notably in Bitung, fish processing includes canning for export and traditional fish processing such as smoke-fish and dry-salted fish, mostly for local consumption.

The contribution of the North Sulawesi Province fisheries sub-sector to the national total fish value (2005-2014) fluctuated from a minimum of 2% in 2011 to 5.3% in 2014, with the average of 3.4% (Table 9).

Table 9. Total fish value of the North Sulawesi Province and its percentage to national value

	Total fish value (NSP)	Total value (National, IDR=1,000)	%
2005	1,104,333,930	33,255,308,006	3.3
2006	1,097,343,085	37,162,917,780	3.0
2007	1,592,969,085	45,025,650,747	3.5
2008	1,133,351,930	46,598,552,733	2.4
2009	1,175,001,215	49,527,135,768	2.4
2010	1,373,505,758	59,580,474,171	2.3
2011	1,281,246,073	64,452,537,439	2.0
2012	2,554,197,215	72,016,210,109	3.5
2013	3,539,919,296	93,186,164,810	3.8
2014	5,294,031,864	99,473,348,354	5.3
Average	2,014,589,945	60,027,829,992	3.4

Note: data does not include added-value fish handling, processing and marketing activities

2.4.2 Socio-Economics of Fisheries

Indonesia's Fisheries Statistic system classifies fishers into three categories based on their working time: full time fishers who spend all of their working time for fishing; part time (major) fishers who spend most of their working time for fishing; and part time (minor) fishers who spend a minor part of their working time for fishing.

Table 10. Total number of fishers in the North Sulawesi Province

Year	Full time	Part time (major)	Part time (minor)	Total
2005	20,708	24,627	16,854	62,189
2006	20,838	24,364	16,817	62,019
2007	21,590	25,675	17,571	64,836
2008	24,550	29,195	19,980	73,725
2009	19,135	22,756	15,573	57,464
2010	39,673	23,999	16,424	80,096
2011	20,848	24,793	16,967	62,608
2012	21,931	26,082	17,848	65,861
2013	38,538	45,829	31,363	115,730
2014	53,284	42,080	33,300	128,664

With regard to fishing productivity and income (Table 11), it is assumed that the actual effort of major part time fishers and the minor part time are 50% and 25%, respectively. The total annual fish value is representative of the total number of fishers in each respective year. Therefore, the income per-fisher is the annual total value of fish divided by the total number of fishers in that year. Fisher income in 2014, for example, was estimated to be approximately 64 million IDR.

Jueldy, *et al*., 2014, reported in their study in the four villages around Bunaken National Park (Tatapaan, Wori, Bunaken, and Tombariri) that in obtaining revenues, activities of all fishermen's family members were grouped into three sources, from fishing, agro-industrial or post-harvest, and non-fisheries activities. The contribution of each economic activity among husbands, wives, and children to the revenue was not separated due to various considerations, including that the income post-harvest activities and non-fisheries were overlapping in term of work load allocations among husbands, wives and children, and/or the use of work load of the husband, wife, and children in gaining income from non-fisheries is assumed perfectly substitutive.

Table 11. Types and total number of fishers in North Sulawesi Province (2017)

	Full time	Major Part Time	Minor Part Time	Total Fishers	Value/fisher (IDR million)*)
2005	20,708	12,314	4,214	37,235	29.658
2006	20,838	12,182	4,204	37,224	29.479
2007	21,590	12,838	4,393	38,820	41.034
2008	24,550	14,598	4,995	44,143	25.675
2009	19,135	11,378	3,893	34,406	34.151
2010	39,673	12,000	4,106	55,779	24.624
2011	20,848	12,397	4,242	37,486	34.179
2012	21,931	13,041	4,462	39,434	64.771
2013	38,538	22,915	7,841	69,293	51.086

2014	53,284	21,040	8,325	82,649	64.054

*Note: *) The total fish value in the province divided by the total number of fishers.*

Under these assumptions, the fishing and non-fisheries contributions to household revenues in the four villages, calculated from net profit minus the highest fixed depreciation cost of fishing per year, is: Tatapaan, IDR 56,050,000/year; followed by Wori, IDR 55,040,000/year; Bunaken, IDR 41,510,000/year; and Tombariri, IDR 28,030,000/year, respectively. It is likely that the income of the fishers in these four villages is similar to the average fish value per-fisher from 2010-2014.

2.4.3 Operational Costs and Average Production Values

This section compares operational fishing costs by fishing method, across hand line, pole and line, and purse seine fishers. Data was obtained from USAID Oceans' in-field research and key informant (KI) interviews conducted in 2017.

Handline Fishery

All of the interviewed hand-liners reported that their main catch is tuna, with the most targeted being yellowfin tuna, followed by big-eye tuna. During the survey period, 12 of the 27 handliners also reported catching others species, such as skipjack, marlin, *Julung-julung* and *Maisang*. Most handliners conduct one to three fishing trips per month, or 15 to 46 trips total per year, ranging from 7 to 30 days per trip.

Operational costs for handline fishers were derived from 26 hand-line fishing vessels, of which 19 KIs were using <10 GT vessel capacity equipped with 13-165 HP in-board engine and less than seven crew members, five KIs were using 10-20 GT vessel capacity equipped with a maximum of 120 HP in-board engines, and <10 crew members on board, and three KIs were using >20 GT vessel capacity equipped with maximum of 250 HP engine and <16 crew members on board.

The incurred variable cost of production of <10 GT vessels ranged from IDR 1.7-21.2 million per trip or IDR 63.3-467.3 million per year; 10-20 GT vessels ranged from IDR 8.3-28.2 million per trip or IDR 180.4-902.2 million per year; while >20 GT vessels ranged from IDR 21.5-43.2 million per trip or IDR 387.7 – 1,037.9 million per year.

The fixed-cost of production for <10 GT vessels ranged from IDR 3-360 million per year, reportedly mostly for body reparation, The cost of production for 10-20 GT vessels ranged from IDR 8.5-47 million per year, with minimal reparation expenses in previous year. Costs for fishing vessels >20 GT were not able to be estimated with the amount of data available, and similarly there was not sufficient information available on vessel and engine maintenance and/or reparation.

During the low season, catch per vessel per trip varied between 0-750 kg. On the other hand, during peak season, catch per vessel per trip varied between 400-10,000 kg. The price of tuna ranged from IDR 40,000-60,000 per kg, with price being dependent on the season. During peak season where supply is abundant, the price will usually decrease to as low as IDR 40,000 per kg. While in low season where supply decreases, the price will go up to as high as IDR 60,000 per kg. In a rough calculation, the average value of production of each vessel per trip during peak season is between IDR 16,000,000 to 400,000,000, while in the low season the average value of production of each vessel per trip is between IDR 0-45,000,000 (Table 12 (i)).

Pole and Line Fishery

During the low season, catch per vessel per trip is between 600-5,000 kg, while the peak season is between 9,000-13,000 kg. The price of skipjack in Bitung during the peak and low seasons range from IDR 7,000-13,000 per kg. The price of scads (*Decapterus sp*) is ranging from IDR 10,000 to 13,000 per kg. Accordingly, in a rough calculation, during the low season the average production of each vessel per trip is between IDR 7,800,000-65,000,000, while in peak season the average production of each vessel per trip is in between IDR 63,000,000-91,000,000.

Pole and line fishers accounted for only four of the 65 total key informants in USAID Oceans' research. Of these four, one operated a vessel of <10 GT, and the rest were of >20 GT. Two of the vessels are the largest fishing vessels found in the Bitung Oceanic Fish Port area at 78 GT and 80 GT. Two of the vessels carry out fishing in FMA 715, and two in FMA 716. The most targeted species of this fishery is skipjack.

The variable cost of production of pole and line vessel ranged from IDR 1-50 million per trip or IDR 24,000,000-1,200,000,000 per year. The fixed production cost per year ranged from IDR 36,000,000-250,000,000 (Table 12 (ii)). During the low season, catch per vessel per trip varied between 600-5,000 kg, while peak season varied between 9,000-13,000 kg.

Purse Seine fishery

Twenty-nine of the purse seiners reported that they catch roundscads (*Decapterus spp*), and two also catch tuna. Key informants also explained that purse seiners will usually catch any kind of fish, especially from the small pelagic fish group, including tuna-like species (*Euthynnus spp*), selar (*Selaroides spp*) and mackerel (Scombridae: *Rastrelliger kanagurta*).

During the low season, the catch per vessel per trip ranges between 15-6,000 kg, and 1,000-25,000 kg in the high season. The price of fish varies for each species, although not significantly, ranging between IDR 10,000-16,000 per kg. During low season the average production of each vessel per trip is in between IDR 240,000-96,000,000, while in peak season the average production ranges from IDR 10,000,000-250,000,000 (Table 12 (iii)).

Thirty two of the 65 fishers interviewed were purse seiners, of which 15 operate vessels <10 GT, 15 operate vessels >20 GT, and two operate vessels between 10-20 GT. Nineteen of these operate only in FMA 716, ten in FMA 715, and three in both.

Table 12. Hand line (i), Pole & line (ii) and purse seine (iii) operational cost and related information (2017)

(i)

Size (GT)	Fish Hold		LoA	Machine		#Crew	Fishing Ground		Main Targeted Species	Tot Trip /Year	Total Var Cost of Production /Trip	Total Var Cost of Production /Year	Total Fix Cost of Production /Year
	Unit	Tot Cap (Ton)		Type	Cap (HP)		FMA	Area					
<10	3	5	10 - 17	Inside	16 - 165	5	715	Laut Maluku Utara	YFT, Marlin	24	13,000,000	312,000,000	28,000,000
10 - 20	5	8	14 - 19	Inside	24 - 170	8	715	Laut Maluku Utara	YFT, Marlin	24	18,000,000	432,000,000	45,600,000
>20	5	15	12 - 20	Inside	16 - 250	12	715	Laut Maluku Utara	YFT, Marlin	24	32,000,000	768,000,000	17,000,000

(ii)

Size (GT)	Fish Hold		LoA	Machine		#Crew	Fishing Ground		Main Targeted Species	Tot Trip /Year	Total Var Cost of Production /Trip	Total Var Cost of Production /Year	Total Fix Cost of Production /Year
	Unit	Tot Cap (Ton)		Type	Cap (HP)		FMA	Area					
>20	7	20	20 - 26	Inside	240 - 630	39	715/716	Laut Maluku, Laut Sulawesi	Cakalang	33	32,000,000	1,056,000,000	17,000,000

(iii)

Size (GT)	Fish Hold		LoA	Machine		#Crew	Fishing Ground		Main Targeted Species	Tot Trip /Year	Total Var Cost of Production /Trip	Total Var Cost of Production /Year	Total Fix Cost of Production /Year
	Unit	Tot Cap (Ton)		Type	Cap (HP)		FMA	Area					
<10	3	9	10 - 22	Outside	80 - 150	23	716/715	Laut Maluku, Laut Sulawesi (Lembeh)	Layang, Tongkol	300	6,000,000	1,800,000,000	51,000,000
10 - 20	3	10	20 - 22	Inside	105 - 170	22	716	Laut Sulawesi	Layang	160	18,000,000	2,880,000,000	46,000,000
>20	6	18	20 - 30	Inside	125 - 370	22	716/715	Laut Sulawesi, Laut Maluku	Layang, Tongkol	180	27,000,000	4,860,000,000	89,000,000

Fisher welfare can be measured through the Fisher Farmer Terms of Trade, or the *Nilai Tukar Nelayan* (NTN) indicator, which measures the ability to exchange products (commodities) produced or sold by fishers/fish-farmers compared with the products needed by fishers/fish-farmers for production process (business) and household consumption. The NTN is the ratio between prices received by fishers/fish-farmers index (It) and paid price by fishers/fish-farmers (Ib), where NTN = It / Ib x 100. The Ib consists of two sectors: the household consumption index, that consists of food, housing, clothing, and miscellaneous goods and services; and the index of cost of production and capital formation which includes nonfactors of production, factors of production, wages, others, and capital formation. It and Ib was calculated using modified Laspeyres formula method (BPS, 2014).

If the NTN is greater than 100, it means the purchasing power of fishers/fish-farmers in the time period is better than the base year period, or that the fishers/fish-farmers have a surplus. If the NTN is smaller or below 100 means there is a decline in the purchasing power of the fishers/fish-farmers. Production prices increase faster than consumption prices or fishers/fish-farmer's income increase. As of December 2013, the base year calculation of NTN is the year 2012 = 100. Each province's NTN is calculated every year. Based on the same base year (2012 = 100), of the 33 provinces there are some provinces that experienced a decline of NTN in 2014, compared with December 2013.

Table 13 shows a comparison of the North Sulawesi fishers's NTN with the lowest, highest, and national fishers' NTN level. The NTN of North Sulawesi fishers in 2014 was 105.1, likely illustrating a higher surplus compared with the fishers' NTN at national level.

Table 13. Farmers' Terms of Trade of Fisheries Sub Sector (NTN) by Province, 2014

	It	A	B	Ib	C	D	NTN
North Sulawesi	116.5 3	120.75	108.90	110.86	113.42	105.30	105.11
West Sulawesi	104.98	104.01	106.65	108.61	109.37	106.99	96.65
South Kalimantan	118.58	119.93	114.99	108.98	111.60	104.28	108.81
National (2014)	113.04	114.49	111.98	110.06	112.23	106.45	102.70

Notes: Price Received by Fishers/Fish-farmers Indices (It), Price Paid by Fishers/Fish-farmers (Ib), and Farmers' Terms of Trade of Fisheries Sub Sector (NTN); A=Fishers; B=Fish farmers; C= Household Consumption Index; D= Cost of Production & Capital Formation Index.

2.5 Stakeholders and their Interests

Public participation is a key element of good governance (Coffey, 2005), and there is general agreement that the historical failure to include major stakeholders in meaningful decision-making has contributed to the current crisis in world fisheries and is a weakness of the fisheries management process (Cochrane, 1999). There are many advantages of involving stakeholders in the fisheries management decision-making process. These include facilitating common understanding, establishing trust, resolving/avoiding conflicts, increasing stakeholders' responsibility and accountability, enhancing the legitimacy of management policies and decisions, contributing to more effective enforcement of rules and regulations by increasing the likelihood of compliance, and increasing the acceptance of management arrangements (Coffey, 2005).

Under the scope of this plan, a stakeholder is defined as any party that is affected and/or impacted by the sustainability of fish resources in Indonesian FMA either as individual, group, or organization. Therefore, every stakeholder should be actively involved in Fisheries Management Plan (FMP) processes, from plan preparation to implementation. Because stakeholder characteristics can be very

different from each other and complex, a stakeholder involvement analysis should be conducted to support the FMP planning process, implementation, development, evaluation, and review.

2.5.1 Primary Stakeholders

Primary stakeholders are those directly affected by management. They are important beneficiaries of management but may have low influence, such as fisherfolks, migrants, and fish traders. Their primary interest is the demonstration of best fisheries management practices, particularly on the outcome of increased landings and income.

Fishers (including migrants), Indonesian Fisheries Association (HNSI) - Fishers are the main actor in fishing activities - Livelihoods are dependent fishing activities - Provider of fish raw material - Key actors in supporting FMP - Has to comply with the rules related to fishing activities - Knowledge capacity in FMP needs to be increased through training	**Fish Traders (including migrants), Indonesian Fisheries Association (HNSI)** - Buy fish raw material directly from fisher - Traders or distributors can be providers of raw materials - Sell raw materials to fish processing companies and or/ local market - Sometimes lend money/credit to the fishers or fish farmers - Sometimes determine fish prices
Fish Canning Factories (Fishing industry/fish canners)* - Carry out fishing activities at sea and/or buy fish from fishers - Sell the fish to the fish processing industry - Have potential to carry out IUU fishing activities - Must comply with the related fishing regulation(s)	**Fish Processors** - Require (fish) raw materials to be processed - Buy raw materials from fishers or other sources for processing - Should comply with product safety requirements (local, international, buyers and other) - Carry out processing for added value/product development - Sell processed product to the domestic and/or international markets

**Note: Fish canning factories (members of Indonesia Association of Canning Fish Factory, Asosisi Pengusaha Ikan Kaleng Indonesia, APIKI) in Bitung include: PT. Delta Pasific Indo Tuna, PT. Samudera Mandiri Sentosa ("Rising Star)," PT. Sinar Pure Food International, PT. International Alliance Food Indonesia, PT. RD Pacific International, PT. Carvina Trijaya Makmur, PT. Deho Canning Co. Outside of Bitung: CV. Pasific Harvest, PT. Bali Maya Permai Food Canning Industry, PT. Avila Prima Intra Makmur, PT. Aneka Tuna Indonesia, PT. Banyuwangi Cannery Indonesia, PT. Juifa International Foods, PT. Maya Muncar*

2.5.2 Secondary Stakeholders

Secondary Stakeholders are those not directly affected by management, but directly involved in the process. They may have high influence, such as traditional authorities, landlords, and government officials. Their primary interests are the reforms agreement on governance for sustainable fisheries management, for example research on the Strategic Action Program and the FMP and institutional strengthening, for example on technical assistance for the effective implementation of the FMP model.

Government - Ministry of Marine Affairs and Fisheries (including Bitung Ocean Fishing Port, Bitung Base M&F Surveillance)*	**Local Government (Provincial Marine & Fisheries Services, DKP: North Sulawesi, District/City DKP- Manado, Bitung, Minahasa, Sangir, Talaud, etc.)**

- Prepare and set up regulation in relation with exploitation and management of fish resources - Manage fish resources exploitation, - Assist and provide infrastructures/facilities for fishers/fish farmers/fish processors - Act as mediator between association, fisheries business and fishers	- Prepare and set up management/utilization regulations in accordance with its authorization/jurisdiction - Carry out control efforts on resource explotation in accordance with its authorization/jurisdiction - Assist and provide infrastructure/facilities for fishers, fish farmers/fish processors in accordance with their authorization - Provide mediation between association, trader and fishers in accordance with their authorization
Navy and Police - Carry out law enforcement in fisheries.	**Scientific Groups (including Sam Ratulangi University, Bitung Fisheries Academy, Jakarta Fisheries University, IPB, LIPI, AMFRD (Balitbang KP), Fisheries Education & Training (BP3) Bitung** - Provide accurate and up to date data and information for decision maker(s) - Provide appropriate personnel for education and industry - Provide skilled labor (observer on board, etc). - Contribute innovations and new technology - Provide public services and public education.

**Note: Other ministries and related institutions include: Ministry of Environment and Forestry, Ministry of Tourist (Pariwisata), Ministry of Transports, Ministry of Mining.*

2.5.3 External Stakeholders

External Stakeholders are not directly involved, but can be influential, including fish consumers, scientists, and those with conservation and development interests (such as FAO's Fisheries and Aquaculture Department and other NGOs).

Fish Consumers	
Scientists, Conservationists, Development Organizations (such as FAO Fisheries and Aquaculture Department)	
Navy and Police - Carry out law enforcement in fisheries	**Fisheries-Related Associations (such as APIKI, GAPPINDO)** - Mediator between government and fishers - Fishers propose/submit their aspirations to government through association - Associations act as fishers' representative
NGOs (HNSI, MSC, SFP, WWF, TNC, CTC) - Work as a government partner (central and local) - Act as a bridge between government (policy makers) and community (users) - Should be involved in the FMP and Action Plan preparation processes	**Local Leaders** - Customary leader is community leader that has power, authority, responsibility, and deep relationships with each member of their group - Assist in building concensus, and provide advisory services for problem solving

- In certain cases, NGOs carry out advocation on government policies or possibly preparing social interventions - Name of institution, among others: HNSI, MSC, SFP, WWF, TNC, CTC etc.	
Other Partners (WCPFC, SEAFDEC, NOAA, FAO) - Assist in building concensus, strengthen partnerships and increase mutual collaboration - Assist in increasing understanding and public awareness on the importance of aquatic resources management	

2.6 Gender Profile of the Tuna Fisheries Industry

Based on findings from USAID Oceans' Gender Analysis, conducted in the Bitung area in 2016-2017, men own the majority of the fishing vessels, while only a small portion are owned by women. Of those interviewed for the study, male fishers were predominantly 36 to 45 years of age (66% of those interviewed in the gender analysis), and the majority with a low level of education, with junior high school as the highest level of education achieved. During the fishing trip, some crew also conduct reproductive work, such as cooking and cleaning various parts of the vessel. While there is no discriminatory government policy restricting women's involvement in capture fisheries, the decision not to engage as heavily as men in capture fisheries was reported as being made by the women and is generally supported by their husbands and families. Local culture also reinforces the idea that women are not fit to work as fishers in the sea, as the sea holds great danger.

Women's involvement in capture fisheries includes several activities before and after fishing operations, i.e. preparation of supplies and documentation, sorting, icing, selling, recordkeeping and net mending. Men carry out part of these activities, others by women, and the rest are conducted together. Before going out to sea to fish, men and women need to prepare fuel, ice, bait, food, cigarettes, first aid, overthe-counter drugs, and complete permits and other administrative requirements. Most of the work are carried out by men (owners, skippers, or managers of fishing vessels) because they are the ones who know most about the needs of the crew on board during fishing operations. Some women carry out this work as well. Women who are involved in these activities generally have experience to assist the owners, the skippers, or the managers in the preparations.

After the vessel returns to the port from sea, the buckets, baskets and cold boxes for unloading and transporting fish are provided done by mostly men, i.e. a few women also do this work. However, unloading the catch, procuring block ice, crushing ice into smaller pieces, and loading fish to transport vehicles are all performed by men because these tasks are considered to require speed, skills and physical strength that men are uniquely suited for. Women also do not want to do these activities because they consider heavy physical work that they consider they are not well physically suited. Some women are involved in sorting and icing the fish , although most of the work is performed by men. The involvement of women here is to help men to perform these activities quickly.

Women are most involved in fish processing, and marketing and trading. In fish processing, especially at the small-scale level, most business owners are women (60% of those interviewed in the gender analysis. In addition to being the owner, they also act as managers. In large-scale processing, women generally work as laborers in the production department. The majority of women who work in small-scale fish processing, particularly as owners and managers, are between 36-45 years of age and

their educational attainment varies from elementary to high school. Although most business owners are women, all laborers who work in the production of smoked skipjack tuna are men. Locals consider the work done by these male laborers to be too risky for women because it involves the use of bamboo that could hurt hands if one is not careful.

The process of selling fish and bookkeeping are mostly done by women or by both women and men. However, there are also some men who carry out these activities alone. Although not many, some women also perform some reproductive activities, like mending fishing nets, but men perform the majority of these activities while some are carried out by both men and women.

Men dominate fishing activities; however, women are not legally prohibited from owning fishing vessels or working as fishers. There are no gender-discriminatory laws that inhibits women's rights to own property, including fishing vessels. In fact, this gender-neutral legal structure creates an opportunity to push for gender equity in the fisheries sector. In Bitung, several women own fishing vessels. At certain occasions and conditions, there are women who also go fishing, but the involvement of women in fishing activities is overall less significant than that of men.

In large-scale fish processing plants that produce processed fresh fish, frozen fish, and canned fish, the majority of the workers are women. Most of these women work in the production department and only a few work as administration personnel; they rarely occupy management positions. Most of these female laborers are aged 26 to 55, have an average family size of one to three children category, and have completed on average junior or senior high school, with average work experience of three to ten years.

In fish marketing and trading, the involvement of women is also very significant, with women working as both the wholesalers and retailers. As wholesalers, women are fewer in number than men, but as retailers, women are the majority. Most of the women who work as wholesalers and retailers are 26 to 45 years old with educational achievement from elementary to high school. The average family size is one to three children, and women have an average of at least ten years of work experience.

The gendered profile of the tuna fisheries industry in Bitung can be classified into three segments: capture fisheries, processing, and marketing. The involvements of women in capture fisheries are rare due to cultural norms and societal beliefs that reinforce what kind of work is appropriate for each sex. Thus, men dominate the capture fisheries, while women are more involved in fish processing and marketing. In the communities of Lembeh and Glan, women not only dominated small-scale fish processing activities but also own more than 60% of the businesses. Similarly, in large-scale fish canning processor plants, the majority of workers are women.

Women are involved in these activities, as they require skills that are culturally suited to women, such as beheading, skinning and loining, packing, weighing, and filling with oil or brine, and seaming/washing the cans. Men, on the other hand, perform activities that require more physical work, such as sterilization or retorting, cooling, and casing up and storing. Men and women perform some tasks together such as labeling the can. Women also dominate fish vendor activities while only around 25% of men perform these activities. Women sort and sell the fish, while men transport the fish within and out from fish landing sites. Research illustrated a variety of gender-specific issues along the tuna value chain in Bitung that may influence the actions and decisions of men and women differently.

More detailed information on gender roles within Indonesia's tuna industry and gender issues in the Bitung area can be found in the USAID Oceans Gender Analysis report. The analysis provides more in-depth information about the involvement of men and women in the tuna value chain, the opportunities and constraints, and recommendations to address gender inequalities in sustainable fisheries management.

2.7 Fisheries Institutions

Article 33(3) of the Indonesian Constitution stipulates that the land, waters, and natural resources therein are basic assets for the people's prosperity and should, therefore, be utilized to the greatest benefit of the people. Marine fish stocks are classified as natural resources, with the management of marine fish stocks inside of provincial waters under the responsibility of provincial government, and those beyond the boundary of provincial waters the responsibility of central government, i.e., MMAF. The jurisdictional aspects and the management of fisheries resources according to the recent Law No. 23-2014 concerning Local Government are presented in Table 14. Additionally, the MMAF is currently in the process of establishing "FMA-based fisheries management authority."

Table 14. Jurisdiction of marine affairs and fisheries

Central Government	Provincial Government	District Government
- Management of capture fisheries beyond 12 nm - Estimation of national fish stock and total allowable catch (JTB) - Issue fishing licenses for fishing vessels >30 GT and < 30 GT using foreign investment/employment - Appoint the location for national and international fishing port development and management - Issue permits for fishing and transport vessels of > 30 GT - Registration of fisheries vessels of > 30 GT	- Management of capture fisheries up to 12 nm from the coastline - Issue fishing licenses for fishing vessel >5 GT up to 30 GT - Appoint the location for provincial fishing port development and management. - Issue permits for fishing and transport vessels of 5 to 30 GT - Registration of fisheries vessel of >5 GT up to 30 GT	- Empowerment of small-scale fishers in the district/city areas - Management and administration of fish landing/auction (Tempat Pelelangan Ikan, or TPI)

Institutions related to fisheries management can be roughly divided into two groups—government and non-government institutions. The DGCF has divided fisheries areas into eleven FMAs to manage fishery resources that are shared among fishers from different provinces (Ministerial Regulation of Marine and Fisheries No. Per.01/Men/2009 concerning Fisheries Management Area, FMA). The Directorate also initiated the establishment of the Coordinating Forum for the Management and Utilization of Fishery Resources (*Forum Koordinasi Pengelolaan Pemanfaatan Sumberdaya Ikan*) for each FMA. The forum committee consists of representatives from DGCF, Provincial/District Government Fisheries Services, and other government agencies. The main tasks of the committee include the allocation of fishing effort, coordination in the issuance of fishing licenses, monitoring of the utilization of fish stocks, implementation of the surveillance and evaluation of management measures. Table 15 also provides jurisdiction aspects and the management of fisheries according to the recent Law No. 23-2014 concerning Local Government must be taken into consideration in terms of coordination and implementation of fisheries management actions.

In re-assessing the state of the fish stocks in Indonesian waters, the DGCF has been supported by the National Commission for Fish Resources Assessment. The commission is composed of Indonesian scientists working with DGCF, the Central Research and Development for Fisheries/Research Institute for Marine Fisheries (P4/BPPL), Indonesia Institute of Science (LIPI), the National Institute for Aeronautics and Space, the Agency for the Assessment and Application of Technology (BPPT), and Universities (IPB-Bogor, UNDIP-Semarang, UNIBRAW-Malang, UNSRAT-Manado, UNPAJ-Bandung).

According to Law No. 45-2009; an FMA is the fisheries management area for fishing, fish culture, conservation, research and development that covers inland waters, archipelagic waters, territorial waters, contagious zone and the exclusive economic zone. Fisheries management is defined as "*all efforts, including the integrated processes in the collection of information, analysis, planning, consultation, decision making, resources allocation, and implementation and enforcement of the laws or and regulations in fisheries, carried out by Government or other authority directed to achieve continuous productivity of aquatic living resources and the agreed objectives"* (Law No. 31-2004). Fisheries management provides integrated activities among MMAF institutions and/or Fisheries Services towards sustainable fisheries.

The most important element in fisheries management is the data and information needed as bases for fishing license allocations. These data are expected to be obtained from fishing and research vessels via fishing logbooks, which stakeholders are required to submit to the government by a 2010 MMAF-issued regulation (Min.Reg. No. 18-2010). In practice, regulation implementation is still facing many constraints and data is not consistently received. The second most important element of fisheries management is the compliance of the fishing actors. The latest information from DGCF shows that logbook submissions were only received from 20% of the total number of registered and licensed fleets, with lacking data quality.

As a result of limited participation and data, fisheries management policy is quite weak. Until recently, the '*open access'* policy has still been applied, and the heads of some provinces are demanding an increase in 'local income' (Pendapatan Asli Daerah) from the fisheries sector. This increased demand has in turn led to increased issues in the issuance of fishing licenses and contraventions to the principles of sustainability underlined in the Code of Conduct for Responsible Fisheries.

In the implementation of fisheries management within MMAF, there are at least three institutions of the first echelon level involved:

- AMFRHR (Agency for Marine and Fisheries Research and Human Resources) - one of the sources of data and information from research results.
- DGCF (Director General of Capture Fisheries) - a source of data and information from fishing actors and also as the fishing license authority, assisted by Provincial Fisheries Services.
- DGMFS (Director General of Marine and Fisheries Surveillance) - among others, responsible for the enforcement and promotion of fishing actors' compliance.

DGCF's policy for licensing will be based on data and information collected from other institutions. To be affected, policies should be supported by appropriate data and information, with compliance enforced by the DGMFS. Fisheries management policies for all FMAs are currently directed towards an ecosystem approach or ecosystem approach to fisheries management, which underscore the importance of reliable data.

Several fisheries management-related institutions and their roles can be elaborated within the implementation framework for Monitoring, Control and Surveillance (MCS): MMAF/DGMFS, Ministry of Transports, the Navy, Police, Marine Security Coordination (Bakorkamla), Supreme Court (MA) and State Prosecutor (KEJAGUNG) as reflected in the Min.Reg. No. KEP.50/MEN/2012 concerning the National Plan of Action to prevent, deter and eliminate IUU Fishing 2012-2016, as follows:

- Minister of MMAF - issues National Policy in the utilization of fisheries resources.

- MMAF-AMFRHRD/National Commission for Fish Resources Assessment (including subsidiary institutes such as the Research & Development Center for Fisheries (P4) and Reseach Institute for Marine Fisheries (BPPL) - provides/analyzes biophysical data of fisheries and their environment & socio-economics data, from research results.
- MMAF-DGCF/Min.Transports, DG of Sea Communication - involved in fish stock assessments; provision of fisheries statistical data; observer, logbook and port inspection data; and management regulations/licensing.
- Navy, Police, MMAF-DGMFS, Agency for Marine Security Coordination (Bakorkamla), Supreme Court, State Prosecutor - carries out Enforcement of Laws and Regulations; Vessel Monitoring System (VMS) and sighting; monitoring VMS and enforcement; handle violations, prosecutes.
- MMAF-DGMSM (Marine Spatial Management) and related institutions - provision of regulation and imlementation for marine/fish resources protection, conservation and rehabilitation.

Several subsidiaries of central Government institutions related to fisheries management in FMA 716, that can be directly involved are:

- Bitung Oceanic Fishing Port (*Pelabuhan Perikanan Samudera*)
- Marine and Fisheries Resource Surveillance Base *(Pangkalan PSDKP Bitung*)
- Marine and fisheries Training Institute (BP3) Bitung
- Loka Riset Oseanografi-LIPI, Tandurusa-Bitung
- Fisheries Academy Bitung
- Faculty of fisheries - Sam Ratulangi University, Manado
- Navy - Bitung base
- Police/Coast Guard
- Research and Development Center for Fisheries (P4-Jakarta)
- Research Institute for Marine Fisheries (BPPL-Jakarta)
- Local government institution include Provincial Marine and Fisheries Services

2.8 Constitution, Acts, and Regulations

FMA's fishing fleet consists of small, medium, and large-scale fishing vessels—of which 95% are small scale vessels, consisting of non-power and outboard motor boats, and small fishing vessels of <5GT. Members of the small-scale fishing fleet are not required to have a fishing license to operate. Thus, only 4.8% of Indonesia's fleet, ranging between 5 to <30GT, are required to have fishing licenses issued by the Provincial Fisheries Services to operate. Fishing vessels greater than 30 GT (only 0.3% of the total fleet) must obtain a fishing license from MMAF to operate. To manage fisheries in FMA 716, MMAF has issued the FMP for Tuna, Skipjack and Tuna-like species through Ministerial Decree No. 107/KEPMEN–KP/2015 and FMP for FMA 716 through Ministerial Decree No. 83/KEPMEN–KP/2016. These regulations are backed by longstanding commitments from the Government of Indonesia, outlined below.

Article 33, Verse 3, 1945 Constitution of the Republic of Indonesia*: The land, the waters and the natural resources within shall be under the powers of the State and shall be used to the greatest benefit of the people.*

According to this Article, the fish resources in the Sulawesi Sea (FMA 716) provide natural/waters resources and therefore have to be controlled by the State and should be utilised for the purpose of welfare of Indonesian peoples. These resources have to be effectively utilised to support food sovereignity, especially the fish protein supply that is excellent for the growth of the nation's intelligence. Thus, the sovereignity of Indonesia in the exploitation of the Sulawesi Sea fish resources has to be strenghtened, and this sovereignity will also provide a large contribution to the employment opportunities aboard fishing vessel, in fish processing, and in other supporting land-based facilities. The realisation of these arrangements especially with regards to the fish resources utilisation will need some lower legal support in the form of fisheries resources exploitation and management.

Act No. 31/2004, pertaining to Fisheries, became the legal foundation for fisheries management in Indonesia:

Chapter 1, Article 1, Verse 7: *Fisheries management is every effort, including integrated process in information collection, analyses, planning, consultation, decision making, allocation of fish resources, and implementation and law enforcement of the regulations and rules in fisheries sector carried out by the government or other authorities which are aimed to reach sustainability of aquatic resources productivity and agreed objectives*.

It is further stated that fisheries management is implemented based on sustainability principles. The fish resources management policies are supported by Ministerial Regulation. In regards to fisheries resources management, the Minister determines the type, number, and size of fishing gear; type, number, size, and as well as placement of auxiliary fishing gear; requirements or standard operational procedure of fishing; and fishing vessels monitoring system. At the international and regional level the government cooperates with neighboring countries or other countries in the context of conservation and fisheries resources management in the high seas and actively participate in the membership of regional and international institution/organization in order to cooperate in the regional and international fisheries management.

With regards to the fishing activities it is stipulated that every Indonesian person or institution that will carry out business in the fishing sector and/or fish transporting sector in Indonesia's FMA (FMA-RI) is required to have: (i) Fishing Bussines License, or '*Surat Ijin Usaha Perikanan (SIUP)*'; (ii) Fishing Permission Letter, or '*Surat Ijin Penangkapan Ikan (SIPI)*'; and (iii) Fish Transporting Permission Letter, or '*Surat Ijin Pengangkutan Ikan (SIKPI)*'.

Other Regulations - The issuance of a Fishing Business License has to be supported by the recommendation from a local capture fisheries sector association or organization that is registered in the MMAF. This system is meant to reduce the impact of overfishing, and facilitate the monitoring. Other related FMA 716 regulation, is the decree that regulate the moratorium of new permission for fishing gear and auxiliary fishing gear. The moratorium applies only to new licensing of fishing gear and auxiliary fishing gear. The banned fishing gear and auxiliary fishing gear (in relation to fishing gear used in the WCPFC Convention Area) are purse seine for large pelagic fishes for fishing vessels more than 200 GT in size in all fishing grounds, and FADs (Fish Aggregating Devices) in Indonesia's Exclusive Economic Zone. Several other regulations and policies that support tuna fisheries management in the high seas, notably pertaining to Fish Capturing and/or Fish Transporting in the High Seas; Certification of Captured/Landed Fish; Fishing Vessels Registration and Marking; Fishing Log Book; Control of Quality and Safety Assurance System for Fisheries Products.

2.9 National Development Plans

2.9.1 National Long-Term Development Plan (RPJPN 2005-2025)

In accordance with Article 4, Law Number 25 on National Development Planning (2004), the National Long Term Development Plan (RPJPN 2005-2025) has been drawn up as a continuation and renewal of earlier stages of development planning in Indonesia. The RPJPN aims to achieve the development goals as mandated in the Preamble to the Constitution of 1945. This long term plan involves conducting institutional restructuring while simultaneously keeping pace with other nations. The vision and mission of the RPJPN 2005-2025 is to establish a country that is developed and self-reliant, just and democratic, and peaceful and united.

For reasons of planning and efficiency, the plan is divided in four stages, each with a lifespan of five years. These four stages are the four separate medium term plans called the National Medium Term Development Plan (RPJMN) and are designed to begin and end in turn with national changes of office. Through these medium term plans, separate governments can set their own priorities for national economic development, on the condition that these priorities are in line with the long term RPJPN.

2.9.2 Medium Term Plans

As mentioned above, the RPJPN is divided in four separate medium term plans (RPJMNs) which all have a life span of five years. Of these four plans only the first one has been finished, with the second plan currently in progress. The basic scale of priorities and strategies of the respective RPJMNs are summarized in the following:

1. The First RPJMN (2005-2009) - Unfortunately, this RPJMN was executed during a period of external shocks brought on by the Global Economic crisis in the United States and Europe. Although Indonesia was still able to show growth during this period, these external shocks did cause a negative impact, especially on social indicators such as poverty eradication and addressing unemployment, also impacted by the fuel subsidy cuts in 2005 which caused high inflation.
2. The Second RPJMN (2010-2014) - Aims at greater consolidation of the reform of Indonesia in all fields by emphasizing endeavors for increasing the quality of human resources, including the promotion of capacity building in science and technology and the strengthening of economic competitiveness.
3. The Third RPJMN (2015-2019) - Aims for the greater consolidation of development in a comprehensive manner in all fields by emphasizing attainment of economic competitiveness on the basis of competitiveness of natural resources and the quality of human resources and by the increasing capability to master science and technology.
4. The Fourth RPJMN (2020-2025) - Aims to realize an Indonesian society that is self-reliant, advanced, just, and prosperous through the acceleration of development in various fields by emphasizing the realized economic structure that is more solid on the basis of competitive advantage in various regions, and is supported by quality and competitive human resources.

The Government of Indonesia has officially announced the Midterm National Development Plan (RPJMN 2015-2019) through the Presidential Regulation No. 2-2015, signed by the President. This was done in the framework of the implementation of the provision of the Law No. 25-2004, Verse

19 (1) concerning the National Development Planning System. Based on this regulation, government will prioritize the national development to achieve food security, energy and marine resources management in the next five years.

2.9.3 MMAF Strategic Plan

Referring to the task, function and authority mandated by the National Law and Regulation to the MMAF and elaboration of the mission for the national development, there are three pilars of the formed MMAF misson: Sovereignty, Sustainability, and Prosperity.

Sovereignty - to realize the sovereign development of marines and fisheries, in order to support economic self-reliance through marine and fisheries resources guradiance and reflecting Indonesian character as archipelagic country. The current notion of state sovereignty contains four aspects: territory, population, authority and recognition, which include domestic sovereignty, interdependence sovereignty, and international legal sovereignty.

Sustainability - to realize the sustainable marine and fisheries resources management. A conventional idea of a sustainable fishery is that it is one that is harvested at a sustainable rate, where the fish population does not decline over time because of fishing practices. Sustainability in fisheries combines theoretical disciplines, such as the population dynamics of fisheries with practical strategies, such as avoiding overfishing through techniques such as individual fishing quotas, curtailing destructive and illegal fishing practices by lobbying for appropriate law and policy, setting up protected areas, restoring collapsed fisheries, incorporating all externalities involved in harvesting marine ecosystems into fishery economics, educating stakeholders and the wider public, and developing independent certification programs.

Prosperity - to realize a prosperous marine and fisheries community, progressive, autonomous and having personality character in its culture. Prosperity is the state of flourishing, thriving, good fortune or successful social status, which often encompasses wealth but also includes other factors which can be independent of wealth to varying degrees, such as happiness and health.

Some primary concerns around sustainability are that heavy fishing pressures, such as overexploitation and growth or recruitment overfishing, will result in the loss of significant potential yield; that stock structure will erode to the point where it loses diversity and resilience to environmental fluctuations; that ecosystems and their economic infrastructures will cycle between collapse and recovery; with each cycle less productive than its predecessor; and that changes will occur in the trophic balance (fishing down marine food webs).

Objectives for marine and fisheries development:

Sovereignty:

- Increase surveillance in the marine and fisheries resources management.
- Develop fish quarantine system, quality control, fish product safety, and safety fish living resources.

Sustainability:

- Optimize marine spatial, conservation and marine biodiversity.
- Increase sustainability of business in capture fisheries and aquaculture.
- Increase competitiveness and logistical systems of the marine and fisheries products.

Prosperity:

- Build capacity for human resources and community empowerment

- Innovation of science and technology development in marine and fisheries.

2.9.4 Fisheries Management and Conservation Policies

Fisheries management is every effort carried out by the government or other authorities which are aimed to achieve sustainability of aquatic resources, productivity, and agreed objectives, including the integrated processes of information collection, analyses, planning, consultation, decision making, allocation of fish resources, and regulation implementation. Thus, fisheries management is implemented based on sustainability principles.

The first conservation policy was legally announced through the Republic of Indonesia Act No. 5 of 1990 concerning the Conservation of Living Resources and their Ecosystem, with the following considerations:

- That Indonesia's living resources and their ecosystem, which are bestowed by God Almighty and have an important role for human life, need to be managed and utilized sustainably, harmoniously, and in line with, as well as in a balanced way for the welfare of present, and future generations of human beings in general and Indonesians in particular;
- That the development of living resources and their ecosystems are generally an integral part of suistainable national development base upon "Pancasila" (The Five Principles);
- That all elements of living resources and their ecosystems basically are interdependent and inter influencing, so that, deterioration and extinction of one element leads to damaging, ecosystems as a whole; and
- That conservation efforts are necessery to promote the sustainable utilization of living resources and their ecosystems, so that, living resources and their ecosystems are always maintained and able to create a balance and be integrate in development.

The main purpose of this Act as stipulated in the provisions that; conservation of living resources and their ecosystems shall be based on the principle of harmonious and balanced sustainable utilization of living resources and their ecosystems; is intended to sustain living resources and balance ecosystem in order to enhance of human welfare and quality of human life; shall be the responsibility and obligation of the government and the people; shall be brought about through protection of life support system, preservation of plant and animal species diversity and their ecosystems, and sustainable utilization of living resources and their ecosystems.

Fish resources is part of the aquatic living resources in which their conservation has been stipulated in the Act No. 31-2004 concerning fisheries, that conservation of fish resources is all efforts on the protection, conservation, and utilization of fish resources, including the ecosystem, types, and genetic to ensure the existence, availability, and continuity by continuously maintaining and improving the value of the quality and variety of fish resources.

Further elaboration of fish resources conservation are found in the Government Regulation No. 60 of 2007 concerning the Conservation of Fishery Resources, in which stipulate that: conservation of fishery resources is an effort to protect, conserve and use fishery resources, including their ecosystem, species, and genetic to guarantee the existence, availability, and continuation by still preserving and increasing the value of quality and variety of fish resources. Conservation of ecosystem is an effort to protect, conserve, and use the ecosystem function as a habitat supporting of fishery resources in the present and in future. Conservation of fish species is an effort to protect,

conserve, and use the fish resource, to guarantee the existence, availability, and continuation in fish species for the present and future generations, and conservation of fish genetic is an effort to protect, serve, and use the fish resource, to guarantee the existence, availability, and continuation of fish genetic resources for the present and future generations.

In the implementation it is further stipulated that conservation of fishery resources is executed in accordance with the principle of: usage, justice, partnership, distribution, unity, transparency, efficiency , and sustainable. In addition to the principle conservation of fishery resources is executed in accordance with precautionary approach, considering science evidence, balance with local wisdom, community-based management, unity development in coastal area, prevention of excessive fishing, development of environmentalty friendly fishing gear and method, equilibrium of socio-economic condition of society, sustainable use of diversity, structural protection and natural function of water ecosystem that is dynamic, protection of type and quality of fish genetic, and adaptive management.

Conservation of ecosystem is executed through the protection of fish habitat and population, rehabilitation of fish habitat and population, research and development, usage of fishery resources and environmental service, development of social and economy of society, supervising and controlling; and/or monitoring and evaluation. Types of ecosystem related to fishery resources consist of sea, seagrass, coral reef, mangrove, estuary, beach, swamp, river, lake, and reservoir.

Other laws supporting EAFM include: Law No. 1/2014 Amending Law No. 27/2007 on Coastal and Small Islands Management with the objective to protect, conserve, rehabilitate and utilize the resources of coastal and small islands in sustainable manner. The law provides for the use of zoning plans for marine resources and marine areas. Law No. 26 of 2007 a general law with the principal purpose of regulating use, planning and control over space, waters and land, including management of marine and coastal resources and us of Spatial Use Management. Law No. 32 of 2009 Concerning Environmental Protection and Management to create environmentally sustainable development through planning policies and rational exploitation, development, maintenance, restoration, supervision and control. This is a comprehensive law on environmental management in Indonesia. National regulations that govern fishing and marine resource management in Indonesia are shown in Table 15.

Table 15. National Regulations on Fishing and Marine Resource Management

Regulation	Key Points
Theme: Conservation and Fish Resource Improvement	
Government Regulation 60/2007 Concerning Fishery Resource Conservation	Fully supports the utilization of EAFM concept in Fisheries management in Indonesia. It also supports full stakeholder involvement in the conservation of fish resources, that the national (central) government and or regional government in accordance with their rights to manage conservation area can involve the community through a partnership program.
MMAF Regulation No. 20 of 2008 Concerning Utilization of Small Islands and Surrounding Waters	Takes EAFM into account in the planning and management of the small island and surrounding waters. Gives a clear definition of who has the right to manage and use the small islands and its surrounding waters. The government is obliged to provide permits to whoever (individual or corporation) apply for it, in accordance with the valid law.

Regulation	Key Points
MMAF Regulation No. 13 of 2014 Concerning Marine Protected Area Network	Supports MPA networks, quite similar approach offered by EAFM, which is holistically taking ecological and socio-economic aspects into account in order to protect and preserve the ecosystem and its functions, as well as providing food, income and livelihood for the society.
MMAF Regulation No. 21 of 2015 Concerning Partnership on Management of Marine Protected Areas	Establishes a partnership system with the local community in managing the aquatic conservation area based on two main parties. First, the management organization unit, who represents the provincial government, and second, the local community including the traditional/tribal community, NGOs, corporations, research institutions, and higher education institutions. The two parties propose and discuss several programs, on aquatic conservation area management. The result of the discussion then will be sent to the governor to be released as provincial regulations/permits and to be implemented by both parties.
MMAF Regulation No. 30 of 2010 Concerning Management and Zonation Plan of Marine Protected Areas	Supports the management of MPAs in Indonesia through practice of some of the EAFM principles by considering the human, marine ecosystem, and interconnection between stakeholders holistically.
Theme: Gear and Fishing Zoning Regulation	
MMAF Ministerial Regulation No. 71/2016 Concerning Fishing Zones, Placement of Fishing Gear and Auxiliary Fishing Gear in FMAs	Provides for gear-based fishing zoning and allowable fishing gear and auxiliary fishing gear (i.e. FADs, lights, etc.) Manages input measures such as banning some fishing gears, technical specification of fishing gears.
MMAF Ministerial Decree No. 47/2016 Concerning Estimation of Fisheries Potential in Indonesian FMAs	Establishes maximum sustainable yield and exploitation status for each FMA.
Theme: Managed Access to Indonesia Fishery	
MMAF Regulation No. 56 of 2014 Concerning the Moratorium of Provision of Fishing Permit in Indonesian Fisheries Management Area	To ensure the sustainability of fisheries resources and prevent overfishing in Indonesian waters, as well as IUU fishing practices. This particular decree prohibits the ex-foreign made vessels to operate in Indonesia water. This MMAF decree is one step toward managed access for fisheries in Indonesia from foreign vessels.
Presidential Decree No. 115/2015 The Task Force on Prevention, Detention and Elimination of Illegal Fishing	Created to investigate IUU fishing, develop policy recommendations, carry out fisheries license reform, monitor and support enforcement operations, and strengthen coordination among enforcement agencies by developing tracking systems. Enforcement engaged in anti-IUU fishing operations include the Indonesian Navy, the Indonesian Marine Security Board, or Coast Guard (Bakamla, the National (Water) Police and the Maritime Council.

The National Plan of Action (NPOA) for Tuna, Skipjack and Neritic Tuna Management Plan for Indonesia (2014) includes a Strategic Plan which provides priority issues, management objectives, targets, indicators, benchmarks, and an action plan for tuna, skipjack and neritic tuna in FMA 716.

The management objectives and targets for tuna, skipjack resources and its ecosystems for FMA 716 as stated in the NPOA are presented in the following table.

Table 16. Management Target in Indonesia FMAs 716

OBJECTIVE 1	
ASPECT	**MANAGEMENT OBJECTIVE**
TUNA, SKIPJACK AND ITS ECOSYSTEM	To realize tuna, skipjack management and its ecosystem sustainably
1	Implementation of catch limit of big eye tuna species for longline based on provisions on WCPFC in 3 years
2	Implementation of catch limit of yellow fin tuna species for *longline* based on provisions on WCPFC in 3 years
3	Implementation of information dissemination on procedure for fishing in high seas pocket to 3 business actor associations in 3 years
4	Implementation of study on mitigation on climate change impact on tuna and skipjack by 100% in 3 years
5	Implementation of study on use of *branch line nylon* in longline by 100% in 3 years
6	Implementation of study on a *Risk Based Assessment (RBA)* of tuna fishery to *Ecosystem* (bycatch and ERS) based on type of fishing gear by 100% in 5 years
7	Implementation of study on composition of fishing gear purseine production by using fish aggregating device by 100% within 5 years
OBJECTIVE 2	
ASPECT	**MANAGEMENT OBJECTIVE**
MANAGEMENT	The increase in compliance with the implementation of legislation on tuna and skipjack catching, bycatch and ERS.
1	Implementation of notification on fishing vessel that will conduct activity at *sea transshipment* at Pacific Ocean of western and central Part and Eastern Part by semester to WCFPC and IATTC in 5 years
2	Implementation of preparation of list of active vessels by 100% by 5 years
3	Implementation of provisions on ban on storage on board and landing of bycatch by 100% in 5 years
4	Availability of mitigation act equipment of *Ecologically Related Species* (ERS) on board by 100% in years
5	Implementation of meeting between scientist, manager and stakeholder by annually in 5 years
6	Implementation of provisions on ban on purse seine catching operation by using fish aggregating device for 4 months in 3 years
7	Implementation of provisions on observer on board for purse seine by 100% in 3 years
8	The increase in compliance with the implementation of fishing logbook by 50% in 5 years
OBJECTIVE 3	
ASPECT	MANAGEMENT OBJECTIVE
MARKET REQUIREMENTS	Fulfillment of market requirements for tuna, skipjack
1	Preparation of *supply chain* system document of tuna and skipjack from Indonesia EEZ of Sulawesi Sea and Pacific Ocean by 100% in 3 years.

The management objectives and targets for neritic tuna management for FMA 716 as stated in the NPOA are presented in the table below.

Table 17. National Target of Neritic Tuna Management

OBJECTIVE 1	
ASPECT	**MANAGEMENT OBJECTIVE**
NERITIC TUNA RESOURCES AND ITS ECOSYSTEM	To realize Neritic Tuna management and its ecosystem sustainably
NATIONAL TARGETS	
1	Implementation of socio-economic survey to Neritic Tuna fisherman by 100% in 5 years
2	The increase in *coverage level national observer program* to become 5% for vessel above 30 GT in 5 years in 11 Indonesia FMA.
3	The increase in statistic data validation frequency to become twice in a year in 5 years.
4	Implementation of study on mitigation act of bycatch and ERS in fishery Neritic Tuna by 100% in 5 years.
5	Implementation of study on restriction of purse seine catching operation by using fish aggregating device by 100% in 5 years
6	Implementation of protection of fish habitat at extent of 15.5 million hectares by 100% in 5 years
7	Implementation of fish apartment construction by 10,000 modules by 100% for 5 years
8	Implementation of primary data collection program of Neritic Tuna production at port/fish landing place for vessel equal or below 30 GT by 5% in 5 years
OBJECTIVE 2	
ASPECT	**MANAGEMENT OBJECTIVE**
MANAGEMENT	The increase in compliance with implementation of legislation on Neritic Tuna catching, *bycatch* and ERS
NATIONAL TARGETS	
1	Implementation of optimization of VMS program of fishery fleet catching Neritic Tuna by 100% in 5 years
2	Implementation of optimization of inspection program of fishery fleet catching Neritic Tuna at port by 100% in 5 years
3	Preparation of provisions on ban on poaching by 100% in 3 years
4	The increase in Indonesian participation in *intra-regional* and regional cooperation in Neritic Tuna management in 4 organizations in 5 years
5	Implementation of development of Neritic Tuna fishery business pattern by 100% in 5 years
6	Implementation of capacity building of business actor and association
OBJECTIVE 3	
ASPECT	**MANAGEMENT OBJECTIVE**
MARKET REQUIREMENTS	Fulfillment of market requirements for Neritic Tuna
NATIONAL TARGET	
1	Preparation of Certificate of Ecolabelling-Indonesian Neritic Tuna Production by 100% in 5 years

2.10 Identified Gaps in Policy, Information, Management and Coordination

Until now, Indonesia has not had a specific legal framework/law (policies and legislations) for addressing or implementing EAFM. However, there is adequate legal coverage in the form of several policies which include Act 31-2004/ 45-2009 concerning fisheries, Law No. 5-1990 concerning ecosystem conservation, Law No. 6-1996 concerning Indonesian waters and several MMAF Ministerial Regulations and Decrees, which cover, for example, Fish Aggregating Devices management, Community-Based Fisheries Management, and Protected Areas that compliment and support EAFM. Government bodies, NGOs, and other stakeholders are currently implementing elements of EAFM, but they don't have the impact that they could with a clear EAFM policy, implemented through management plans that focus on target species and their supporting ecosystems.

Information on fish biology and fish population dynamics of large tuna, skipjack tuna, round scads and other small pelagic fishes and their interactions in FMA 716 are essential to sustainable resource management. Information on size of first maturity, for example, can lead to the issuance of regulations for minimum legal catch size. In FMA 716, for example, research participants noted that as one of the migratory species, the small pelagic fish in FMAs 715, 716 and 717 need to be simultaneously assessed as this species group are likely to form '*one unit stock*' in these FMAs. Incorporating these species into EAFM management implementation requires formal arrangements and/or management coordination among FMAs, which is currently is not present.

Currently, Fisheries Management Plans are formulated by MMAF, but socialization through stakeholder consultations has not yet been formally established as part of the process. Stakeholders should be included in consultations and participate at all stages of the process to ensure stakeholder involvement sufficiently represents the breadth of views. The range of interest, aspirations and numbers of stakeholders are likely to be greater than for conventional management. Great care will also be needed to maintain transparency, credibility and ownership in the outcome. Although the formal Fisheries Management Plan for FMA 716 has been legally declared in the form of MMAF Ministerial Decree No. 107/KEPMEN-KP/2015, concerning FMP for Tuna, Skipjack and tuna-like species (TCT), and Ministerial Decree No. 83/KEPMEN-KP/2016 concerning FMP of FMA 716, so far consultative processes have not been regularly arranged.

Currently, tuna fisheries are managed on the basis of single-species stock assessments, but with the increasing requirement for sustainable management of co-occurring species (e.g. bycatch, threatened and endangered species), there is increasing effort by a range of orgals nizations to collect detailed data on the structure of the Pacific Ocean pelagic ecosystem. This effort occurs through observer programs (e.g bycatch composition and quantities), trophic analyses (e.g. stomach contents, stable isotopes), and mid-trophic level sampling (e.g. acoustics and net sampling of micronekton and zooplankton). Despite the highly valuable information they provide on the knowledge of the ecosystem structure and functioning, the collection of observer data is still relatively recent, with low coverage. Moreover, trophic analyses and mid-trophic level sampling are conducted on a project-by project basis and are not continuous in space and time, thus limiting their use for long-term monitoring and EAFM (Allain, et al., 2011).

The key EAFM gaps identified by stakeholders and referred to in the development of this plan include:

- The need for an EAFM policy that is formally endorsed by the MMAF;
- No specific EAFM provisions in the current legislations at the National and Provincial Level Government. This needs to be addressed by inserting EAFM-specific provisions in any related Fisheries Law/Legislation, Conservation Laws and formal incorporation of EAFM provisions in the Local-Level Government;
- Fisheries Management Plans implement conventional management approaches, which can be improved by modifying the management plan provisions to allow for the management of fisheries and ecosystem;
- Fisheries officers, NGO technical officers, and community field practitioners lack knowledge and experience in EAFM to conduct awareness and be effective in the implementation of EAFM. This can be addressed through training on EAFM; and
- To address the gaps identified above and build capacity for the implementation of EAFM the report suggests development of an EAFM module to be developed and delivered through the Faculty of Fisheries and Marine Science, Fisheries College and Faculty of Natural Resources Science.

2.11 Current Initiatives on Catch Documentation and Traceability and Associated Partners

To bolster its downstream electronic traceability capabilities, in August 2018, MMAF launched the National Fish Traceability and Stock System (STELINA) with support from the USAID Oceans program. STELINA accommodates and complies with international market requirements, including the United States' Seafood Import Monitoring Program (SIMP) and the European Union (EU) regulations which aim to combat IUU fishing and ensure food safety. STELINA is a downstream, government-hosted traceability system led by the MMAF Director General of Product Competitiveness that, in addition to housing traceability data captured throughout Indonesia's fisheries, will synthesize data from Indonesia's more than ten existing systems that currently and disparately host fisheries information. STELINA has also been designed to operate with high interoperability, allowing data exchange between the system of the MMAF and external systems of the private sector (e.g., processing companies).

MMAF and USAID Oceans have been working with local government, private sector and non-governmental partners to pilot STELINA, and other complementary eCDT initiatives, such as Indonesia's electronic fishing logbook (e-Logbook) initiative, in the program's learning site of Bitung, Indonesia. In October 2018, the Government of Indonesia, announced its plans to "implement the electronic fishing e-logbook to Indonesian fishing vessels…in collaboration with fishing port authorities (central and local governments), and USAID Oceans to improve the quality and quantity of data as a foundation for making strong policy in fisheries management." Since the announcement, the e-Logbook has been rolled out for utilization aboard large-scale fishing vessels to capture data at the point-of catch and be fed into STELINA to enable traceability throughout the value chain. The e-logbook is accessable to the captain in the form of a tablet with easy to select options for the different categories of entry. As of early 2019, STELINA and the e-Lobook were actively being used and tested by a group of First Mover partners, with support from organizations including the International Pole and Line Foundation and Asosiasi Perikanan Pole and Line dan Handline Indonesia.

Apart from government-led initiatives, several additional traceability technologies have been developed and implemented in recent years to bolster traceability capabilities and fisheries management efforts. Through a partnership between USAID Oceans and Inmarsat, a private sector technology company, and their Indonesia-based partner, PT Sisfo, the Pointrek two-way communication VMS has been launched on medium- and large-scale vessels in Bitung, Indonesia. Unlike traditional VMS, Pointrek's two-way communication allows communication to and from a command center or shoreside users and the vessel, as well as real-time catch reporting. The system uses a custom web-based application which can connect via Inmarsat's satellite networks to enhance businesses and monitor the movement of vessels, including data such as: speed, heading, distance, weather information and two-way communications. Pointrek VMS provides real-time VMS and electronic catch data via a mobile tablet, installed onboard. The system offers person-to-person communication from ship to shore by offering onboard Wi-Fi to connected mobile devices via text message, email, and conventional SMS technology.

To address the unique needs and challenges faced by small-scale fishers in providing traceability data, USAID Oceans developed "Trafiz," a mobile catch documentation application that enables the first buyer or fish supplier to collect and submit traceability data, in lieu of the at-sea data entry technology that is suitable for medium- and large-scale vessels via the Pointrek system. Trafiz is an Android-supported mobile application for small-scale fish suppliers and buyers that provides a first data entry point for seafood products originating from small-scale fishers. Trafiz enables data collection at the landing site, allowing users to enter and submit catch data via a mobile device and cellular connectivity. Trafiz also includes value-added user functions that support loan and payment management and other tools that add user value. Trafiz supports catch reporting, as well as business functionalities that help small-scale fishers manage their business.

USAID Oceans has also worked with its partners to develop a solution for small- and medium-scale processors. TraceTales, developed by USAID Oceans' grantee Yayasan Masyarakat dan Perikanan Indonesia (MDPI), enables small- and medium-scale processing companies to capture data throughout the processing stage. With the system, processors can quickly and easily compile the information required by various national and international traceability requirements, thereby ensuring the company's access to valuable export markets, as well as bring paper-based record keeping online for improved business and resource management.

CHAPTER 3: MAJOR THREATS AND ISSUES

An Integrated Stakeholder Consultation Workshop (ISCW) was conducted in June 2017, in Manado, Sulawesi Utara Province to identify threats and issues in the fisheries of FMA 716 as input to the development of the Sustainable Fisheries Development Plan for FMA 716. The ISCW was conducted by the DGCF, in collaboration with Marine Affairs and Fisheries Services (DKP) of North Sulawesi Province, the USAID Oceans and Partnership, and Sam Ratulangi University. The workshop was attended by 52 representatives of the MMAF Secretariat General, the DG of Marine and Fisheries Competitiveness, the DGCF, the DG of Marine and Fisheries Surveillance, Agency of Marine and Fisheries Research and Human Resources, the DKP of North Sulawesi Province, the DKP of Bitung Municipality, Bitung Ocean Fishing Port, Fishers Association, large and small-scale fish processing units, NGOs, the University and Fisheries Training Center, and relevant local government institutions. The ISCW was also attended by officials of the USADS/RDMA in Bangkok, USAID/ASEAN in Jakarta, USAID/Indonesia in Jakarta, and CTI-CFF Regional Secretariat in Manado.

During the ISCW, participants were divided into three groups, i.e., ecological well-being, human well-being, and the ability to achieve good governance, and asked to identify threats and issues and to prioritize them using qualitative risk assessment methods to determine the appropriate level of management response (Fletcher et al., 2002). Risk assessment involves testing the potential consequences for each problem/risk and the likelihood that it can occur from fisheries activities. The risk value is calculated as follows:

- Value of Risk = Consequence x Possible = Impact x probability,
- Consequences = severity of the problem (negative impact on efforts to achieve goals) if not handled satisfactorily;
- Possible = probable probability of problems occurring in existing governance systems.

The threats and issues include ecological well-being (e.g. habitat protection and restoration, pollution reduction and waste management, fishery resources); human well-being (e.g. food security, sustainable livelihoods, rural infrastructure); and ability to achieve good governance (e.g., participation, empowerment, institutions). Altogether, there were 30 issues identified related to ecological well-being, 28 issues related to human well-being and 22 issues related to ability to achieve. These were further prioritized to 13 priority issues on the contribution of fisheries to ecological well-being, 15 priority issues on the contribution of fisheries to human well-being and 12 priority issues on the ability of the fishery to achieve (Table 18).

With regard to the ecological well-being, the participants were concerned about the high demand for anchovy to be used as live bait and human consumption leading to potential overfishing, limited data on fish production and fishing effort, limited information on the bycatch of longliners, and catch of bigeye tuna exceeding the MSY level in the WCPO. The Indonesian catch limit of bigeye tuna by longline set by the WCPFC of about 5,889 tons/year has not fully been utilized. This is due to the limited availability of the long line fishing fleet based in this FMA, which is likely due to the lack of compliance to the enactment of the Ministerial Regulation No. 56/PERMEN-KP/2014, concerning the temporary moratorium for capture fisheries licenses. Other critical concerns were focused on Fish Aggregating Devices (FADs) that interfere with fish migration, the increasing catch of juvenile bigeye and yellowfin tuna by purse seine vessels using FADs, and destructive fishing practices using explosives materials around FADs. High demand for anchovies have led to overfishing and subsequently to the scarcity of live bait for skipjack pole and line fishing operations. Because of the

scarcity of live bait fish together with the inability to comply with the moratorium (eg. renewal of vessel documents), the Bitung-based pole and line fishery is on the brink of a collapse.

Among the prioritized human well-being issues were concerns regarding increasing operational cost due to further distance to travel to fishing grounds, decreased incomes for fishers, decreasing fisheries production to the regional economy, low skipjack selling prices resulting from low quality catch. Decreases in the quantity and quality of catch affect processing activities, employment opportunities, and the income of coastal community members. Meanwhile, fishery cooperatives are not able to optimally support fishers business, and the employment opportunities of local fishers are lower than the opportunity of foreigner fishers. These conditions, in turn, affect the contribution of fisheries to the provincial economy and food security.

In further regard to the human aspects of the fisheries, a gender analysis conducted by USAID Oceans in 2017 and assessments presented during the ISCW showed that women and men have different access and control to resources in each node along the tuna value chain. In capture fisheries, access to and control over assets related to these businesses, including fishing vessels, fishing gears, information, catch, and financial resources, are dominated by men, a logical conclusion as the majority of fishing vessels in Bitung are owned by men. Likewise, the skippers, crews, and staffs are all men. Men perform many activities in this business, including the preparation of fishing operations, such as completing permits and provision of fuel, block ice, groceries, and cigarettes; conducting fishing operations; landing fish and reporting the catch to marine and fisheries agency. In addition, as business owners, the involvement of women in this business is limited to selling fish and manage the finance function. In terms of access to capital, there was no perceivable difference between male business owners and female business owners, except for the access to capital from the banking sector very limited and challenging for local business owners and is rarely availed of.

USAID Oceans' research also showed that men have more knowledge about fish capture, while women have more knowledge in fish processing and marketing. Although some women have good knowledge about fishing activities, they do not choose to work as fishers because of the wide-held cultural beliefs and perceptions that women are unsuited to work as fishers due to physical factors, as well as women's responsibility to take care of home and children. In contrast, men who are knowledgeable about fish processing and marketing and choose to work as fish processors and fish wholesalers do not face constraints from societal beliefs and perceptions. Women in fish processing are considered to have more challenges than men, despite their knowledge of fish processing, as they often have to work a full day, even when they are pregnant or breast-feeding.

The priority issues of the fishery's ability to achieve good governance was lack of effective implementation of the fisheries management plan issued through MMAF Ministerial Decree No. 83/2016 on FMA 716 as mandated by Fisheries Act No. 31 of 2004. With the enactment of the Law No. 23/2014 concerning Local Government, there was lack of implementation related to central and local government authority and coordination in marine fisheries management; there is an observed lack of government intensity to communicate/disseminate regulations as well as government direct assistance; and there is an absence of a cross-provincial coordination systems and fisheries surveillance to ensure compliance of people to fisheries policies and laws in FMA 716 as well as the neighbouring FMAs. Also impacting the fisheries are the number of unregistered and operating vessels in FMA 716 that are not yet registered at WCPFC secretariat, which may result in low compliance levels with the WCPFC; weak control of migrant fisher between provinces; lack of surveillance of fisheries resources; and limited data on fish production and fishing capacity of fleet that targeting the small pelagic fish species.

Table 18. Prioritized fisheries and ecological issues

No	Issues in Ecological well-being				Cons	Like	Risk	Priority * = low, *** = high
1	A. Target species		Issues					
	Tuna	Bigeye tuna	1	Catch limit about 5889 ton / year (based on NPOA/WPCFC) by longliners	4	3	12	**
			2	Limited fleet (long line, only 2 boats)	4	2	8	
			3	Overfishing (if not exceeding catch limit 5889 ton / year)	4	2	8	
			4	Limited data on production and fishing effort	3	3	9	*
		Yellowfin tuna	5	Not over fishing	4	2	8	
			6	Size Baby tuna captured more and more	3	3	9	*
			7	Limited data on production and fishing effort	3	3	9	*
		Skipjack	8	Not yet over fishing	4	2	8	
			9	Fleet development opportunities	3	3	9	*
			10	Limitations of anchovy for live bait -> Pole and line fishing gear	4	3	12	**
			11	Limited data on production and fishing effort	3	3	9	*
	Small pelagic	Roundscads	12	Stock relationship in FMA 715, 716, 717	4	2	8	
			13	High demand for consumption and bait fish needed lead to potentially overfishing	4	3	12	**
			14	The size of fish caugh (juvenile) due to small mesh size of the net eg. gillnet (potentially for overfishing)	4	2	8	
			15	Limited data on production and fishing effort	3	3	9	*
		Anchovy stock	16	High demand, but stock is limited;	4	4	16	***
			17	Limited data on production and fishing effort	4	3	12	**
2	B. Bycatch	Longline	*18*	Sharks, turtles, dolphins, dugongs, coelacanth	4	1	4	
		Purse seine	*19*	Sharks, turtles, dolphins, dugongs, (juvenile fish)	4	1	4	
		Pole and line	*20*	Selective - No issue	4	1	4	
		Gillnet	*21*	Localized	4	1	4	
		Ghost fishing	*22*	Abandoned fishing gear (nets)	4	1	4	
4	General Ecosystem							
	Biodiversity	FAD	23	Excessive number of FAD and Blocking fish migration	3	3	9	*
			24	Data limited	3	2	6	
5	C. ERS	Ecological Related species						

		Longline	*25*	Sea bird	4	2	8	
			26	*Raja laut* (Coelacantch)	4	2	8	
			27	Data limited				
	Habitat		*28*	Destructive explosive fishing	3	3	9	*
			29	Destructive poison fishing	3	2	6	
			30	Destructive fishing using stones	2	1	2	

Note: (Cons = Consequences; Like= Likelihood)

Table 19. Prioritized Human Well-being Issues

Aspect		Issues in Human Well-being	Cons	Like	Risk	Priority * = *low*, *** = *high*
Economic aspect	1	Fishing ground goes so far that operational costs are high	4	3	12	**
	2	Decreasing revenue/income from tuna fishery	4	3	12	**
	3	Decreasing revenue/income from skipjack fishery	4	3	12	**
	4	Selling price is not prime because the quality of the catch is low	4	3	12	**
	5	Decreased incomes due to lack of raw materials for the processing of smoked fish	4	3	12	**
	6	Low quality of fish catch for processing fish raw materials	4	3	12	**
	7	Earning shared system (less benefitial to fishers)	4	2	8	
	8	Income increase for small scale fishers	4	2	8	
	9	Gap income between owner, crews and fishers is not significant	2	2	4	
	10	Logistics provided by the owner on request from crews	2	2	4	
Regional economy	11	Fisheries contribution to the regional economy declined	3	3	9	*
	12	Household income around the fish processing unit decreased	3	3	9	*
	13	Decrease of foreign exchange from export of fish processing	3	3	9	*
	14	Skipjack fish resources under-exploited	3	3	9	*
	15	Opportunities to increase longline fishing fleet and purseseine	3	3	9	*
Skill	16	Lack of knowledge about post-harvest fish handling resulted in low quality	4	3	12	**
	17	Lack of knowledge about fishing ground	3	2	6	
	18	Working ethic of local fishers are lower than foreign fishers	3	3	9	*
Social aspects	19	The role of fishers cooperatives is not optimal because of limited capital	3	3	9	*
	20	Food security and food safety of protein sources related to catch and low quality of fish	3	3	9	*
	21	employment opportunities in the fisheries sector declined due to many of non-operating ship fleets	4	2	8	

Aspect		Issues in Human Well-being	Cons	Like	Risk	Priority * = low, *** = high
	22	Limited capital (money/goods debt)	4	2	8	
	23	Conflict with migrant/foreign fishers (Philippine)	3	2	6	
	24	The role of small-scale fish processing cooperatives is not optimal because of limited capital and management skills	3	3	9	*
Safety and Labor/ fishers protection	25	For small-scale enterprises there is no government regulation that ensures the safety and protection of fishermen's work	4	2	8	
	26	Fishing ground is so far that the safety of fishermen is threatened	4	2	8	
	27	Insurance fishers	4	2	8	
	28	Certificates of ownership for fisher's land of	3	2	6	

Table 20. Prioritized Governance Issues

Issues on ability to achieve good governance				Cons	Like	Risk	Priority * = low, *** = high
Regional		1	Many of tuna fishing vessels not yet registered in WCPFC	3	4	12	**
		2	The need for data on the dynamics of tuna and skipjack fisheries for management in the WCPFC area	4	3	12	**
National	Governance	3	There is no derivative rules on the authority of the central and regional governments under Law no. 23/2014	4	4	16	***
		4	Lack of government intensity to communicate / disseminate dissemination of regulations, direct government assistance	4	4	16	***
		5	The are many conflicting regulations (the Fisheries Protection Act) v. The Act on fisheries and the Transportation Law on the definition of small fishermen	4	2	8	
		6	Regulations on the sharing distribution of fishery products that are not relevant anymore (Law No. 16 of 1964) (UU Bagi hasil perikanan)	4	2	8	
		7	The lack of consistency from government and the compliance of business actors in the utilization of marine space (RZWP3K)	4	2	8	
	Management	8	The absence of integrted data and information among ministries, agencies and local governments as a reference for fisheries management planning	4	2	8	
		9	There is no implementation of KepMen KP 83/2016 on FMP FMA 716	4	3	12	**

Issues on ability to achieve good governance				Cons	Like	Risk	Priority * = *low*, *** = *high*
		10	There is no mechanism for integrating local wisdom with regard to local and national regulations	4	3	12	**
		11	The absence of a cross-provincial coordination system in FMA 716	4	3	12	**
		12	Lack of facilities and human resources for supervision in FMA 716	3	3	9	*
		13	The absence of FMA- 716 institutions	4	2	8	
		14	Low Compliance of fishermen on logbook submission (logbook data is not accurate)	4	2	8	
		15	Many institutions / agencies handling fishery business permits	4	2	8	
		16	The number of agencies / agencies surveying/observing the activities of fishing vessels at sea which leads to inefficient fishing activities	4	1	4	
		17	Limited data on production and capacity for tuna fishing	3	3	9	*
		18	Limited availability of production data and skipjack fishing capacity	3	3	9	*
		19	Limited production data and small pelagic fishing capacity	3	3	9	*
		20	Limited production data and anchovy fishing capacity	3	3	9	*
Environment		21	Pollution from domestic sewages, land, and B3 waste affects marine ecosystems	4	2	8	
		22	La Nina event affect the catch (related to climate change)	4	1	4	

Table 21. Results of Group Discussions: Priority Issues

(1) ECOLOGICAL WELL-BEING

No.	Target species		Corresponding No. Table 18	Issue
1.	Tuna	Big Eye	1	Catch limit of about 5889 tons / year by longliners
			4	Limited data on production and effort
		Yellowfin tuna	6	Baby tuna caught, increased
			7	Limited availability of production data and fishing effort
		Skipjack	9	Fleet development opportunities
			10	Limitations of anchovy supplies for live bait in Pole and line fishery
			11	Limited data of production and fishing effort of SKJ
2.	Small pelagics	Scads (*Layang*)	13	High demand for consumption and fish requirements so that potentially overfishing
			15	Limited data on production and fishing effort
3.	Other fish stock	Anchovy	16	High demand but limited stock;
			17	Limited availability of production data and fishing effort
4.	General ecosystems	Biodiversity - FAD	23	Excessive number of FADs could block fish migration
		Habitat	28	Destructive fishing using explosives materials

(2) HUMAN WELL-BEING

No.	Issues
1	Fishing ground further/increased operational costs
2	Decrease in income from tuna fisheries
3	Decrease in income from skipjack fishery
4	Selling price is not prime because of the low quality of the catch landed
5	Low quality of fish raw materials for processing
6	Decrease in revenues due to lack of raw materials for proces-sing smoked fish
7	Fisheries contribution to regional economy decrease
8	Decrease of foreign exchange from export of fish processing
9	Household income of the community around the fish processing unit decreases
10	Skipjack fishery resource under-exploited
11	Opportunities to increase long line and purse-seine fishing fleets in the WCP area
12	Resilience and food safety of protein source (volume and low quality of catch)
13	Roles of fisher's cooperatives not yet optimal due to lack of capital
14	Lack of knowledge about post-capture fish handling resulting in low quality
15	Local fisher working ethic is lower than foreign fishers
16	Lack of alternative livelihoods for fishers

(3) ABILITY TO ACHIEVE GOOD GOVERNANCE

		Corresponding No. in Table 20	Issue
Regional		6	The number of tuna fishing vessels not yet registered at WCPFC
		18	Requirements for data on the dynamics of tuna and skipjack fisheries for management in the WCPFC area
National	Governance	1	There is no derivative rules on the authority of the central and regional governments under Law no. 23/2014 There is a lack of capacity by local governments to implement Law No. 23/2014*
		2	Lack of government intensity to communicate /disseminate regulations, government direct assistance.
	Management	3	The absence of implementation Min. Dec. 83/2016 on RPP FMA 716 Lack of adequate budget for implementation*
		4	The absence of integrated mechanisms on local wisdom in the field of capture fisheries on local and national regulations
		5	The absence of a cross-provincial coordination system in FMA 716
		7	Lack of facilities and human resources for supervision at FMA 716
		19	Limited data on production and capacity for tuna fishing
		20	Limited availability of production data and skipjack fishing capacity
		21	Limited availability of production data and small pelagic fishing capacity
		22	Limited availability of production data and anchovy fishing capacity
			Illegal, unreported and unregulated fishing

**Additional inputs during the SFMP Review and Finalization Workshop (26-27 February 2019)*

CHAPTER 4: GOALS

Following the EAFM framework, EAFM goals are grouped into three clusters, with a goal developed for each cluster to address the prioritized issues and problems. A goal is a general statement of the desired state towards which the stakeholders are working and is characterized by the following features: brief, relatively general and visionary. The goals are what are needed to be achieved so that the vision set for the SFMP becomes a reality. Goals will be expressed as outcome statements.

The goals are intended to support the vision:

To promote the best long-term and sustainable use of the coastal fishery resources, the protection of the relevant fishery habitats/environments and to maximize the socio-economic benefits of the fisheries sector in FMP 716.

As agreed during the SFMP Review and Finalization Workshop in February 2019, MMAF proposed that the goals align with the Fisheries Management Plan for FMA 716, based on Ministerial Decree No. 83/KEPMEN–KP/2016.

Table 22. Goals to Address the Priority Threats and Issues

Pillar	Goal
Ecological Well-Being	Realized management of fisheries resources and their habitats
Human Well-Being	Increased economic and social benefits of sustainable fisheries for the human being welfare
Good Governance	Active participation of stakeholders and compliance to fisheries management

CHAPTER 5: OBJECTIVES AND INDICATORS

At the ISCW conducted in June 2017, following the identification and prioritization of threats and issues, participants developed operational objective and indicators for each of the prioritized issues. These were further validated and finalized at the February 2019 workshop held in Jakarta (Table 23). An operational objective is a formal statement detailing the desired outcome of management, which are related to the overall goal and address the key issues identified and prioritized by stakeholders. In general, an operational objective should be achievable within available resources and within a defined timeframe. Objectives serve as the basis for determining the management actions required and deciding on ways of measuring progress towards achieving the objective. Each priority threat or issue can have more than one objective associated with it, depending upon what is to be accomplished. An indicator tracks the key outcome identified in the operational objective and provides a measure of how well management is performing.

For ecological well-being, the participants identified several operational objectives for the top prioritized issues including optimize sustainable catch or fish production, increase the availability of small pelagic fishery data effort, initiate control of FAD use in FMA 716, and combat destructive fishing practices.

Table 23. Results of Group Discussions: Ecological Well-Being Priority Issues, Operational Objectives, and Indicators

No	Target species		ID # Table 18	Issue	Operational objectives	Indicator
1.	Tuna	Big Eyed Tuna	1	Catch limit of about 5889 tons / year by longliners	Realize BET management of longliners and purse seiners and its ecosystem sustainability (link to NPOA Objective, p/ 26)	Big Eyed Tuna catch, CPUE

No	Target species		ID # Table 18	Issue	Operational objectives	Indicator
			4	Limited data on production and effort	Improve availability of BET fishery data	Proportion of BET capture business actors submitting data as required by regulation (compliance to catch reporting) and using electronic logbooks
		Yellowfin tuna	6	Baby tuna caught, increased	Control of fishing for juvenile tuna	Proportion of captured juvenile tuna
			7	Limited availability of production data and fishing effort YFT	Improve availability of fishery data YFT	Proportion of YFT capture business actors submitting data as required by regulation (compliance to catch reporting)
		Skipjack	9	Fleet development opportunities	Management of skipjack fishing capacity and mini-purse seiners	Capacity for skipjack fishing
			10	Limitations of anchovy supplies for live bait in Pole and line fishery	Initiation of live bait fish control for skipjack pole & line	Live bait fish
			11	Limited data of production and fishing effort of SKJ	Improving availability of SKJ fishery data and improved reporting mechanisms	proportion of SKJ fishing business actors submitting data as required by regulation (compliance to catch reporting) and electronic logbooks
2	General ecosystems	Biodiversity FAD	23	Excessive use of FADs; impacts on fish migration; poor regulatory enforcement; ecosystem impacts	Improved FAD management and regulatory implementation in FMA 716	Number and position of FAD; number of conservation and management measures
		Habitat	28	Destructive fishing using explosives materials	Combat illegal fishing practices with explosives and destructive fishing gears	Number of fishing offenses with explosives and destructive gears

For human well-being, the participants identified operational objectives for the top priority issues, such as maintaining the fish abundance at the fishing ground, maintaining sustainable fish catch, increase the quality of fishery products from fish processing industry to the regional economy, and increase locally-generated revenue from fisheries activities.

Table 24. Results of Group Discussions: Human Well-Being Priority Issues, Operational Objectives, and Indicators

No.	Issue	Operational objectives	Indicator
1	Fishing ground further/increased operational costs	Maintain sustainable production rate	CPUE
2	Decrease in income from tuna fisheries	Maintain sustainable production rate	CPUE
		Maintain sustainable production rate	Production
		Establish sustainable net income of tuna fishery	Fisher Income
3	Decrease in income from skipjack fishery	Maintain sustainable production rate	CPUE
		Maintain sustainable production rate	Production
		Promote sustainable skipjack fishery income	Fishermen profit/ income
4	Low selling price due to poor quality*	Improving the quality of the catch on board Improve post-harvest quality* Improve cost structure*	The proportion of good quality fish landed
5	Low quality of fish raw materials for processing	Improve quality of fish in transport to processing unit	Proportion of good quality raw material in processing unit
6	Decrease in revenues due to lack of raw materials for processing smoked fish	Maintain sustainable production rate	Production
			CPUE
		Maintain sustainable supplies of raw materials from other regions	Supply volume from other regions
7	Fisheries contribution to regional economy decrease	Maintain sustainable contribution from fishing	Fish Production
			CPUE
		Improve the quality of fishery products from fish processing	Production processed
		Revenue (PAD) from fisheries	PAD from fishery
8	Decrease of foreign earnings from export of fish processing	Manage export of processed fishery product	Volume and value of export of processed fish
9	Household income decreases due to the fish marketing and processing	Improved marketing and fish processing business activities	Access to more markets
			The amount of labor in the fish processing
11	Safety and human rights concerns for fishers	Improved safety at sea and human and rights for fishers	Fewer fisher safety incidents
			Better working conditions and rights for fishers
12	Resilience and food safety of protein source (volume and low quality of catch)	Maintain sustainable production rate	Fish production
		Sustaining fish resources	CPUE
		Improvement in post-harvest practices	Proportion of catch fish in landing with good quality

No.	Issue	Operational objectives	Indicator
13	Roles of fishers' cooperatives not yet optimal due to lack of capital	Improving the role of cooperatives in supporting the business of fishers and fish processors	Improved services provided by cooperatives
14	Lack of knowledge about post-capture fish handling resulting in low quality	Increase knowledge and skills in fish handling of post-harvest technology	Improved safety and quality of fish
15	Low local fisher working skills	Improve the working skills of local fishers	Skills training provided
16	Lack of alternative livelihoods for fisher households	Increase availability of alternative livelihoods	Fisher households with alternative livelihoods
17	Lack of information on socioeconomics of fishers	Improve information on the socioeconomic aspects of fishers	More data on socioeconomics of fishers

**Additional inputs during the SFMP Review and Finalization Workshop (26-27 February 2019)*

For ability to achieve good governance, the participants identified the need to define clearly the share of authority between central and local governments in managing fisheries, increase intensity of the government in disseminating regulations, execution of the Ministerial Decree No. 83/KEPMEN - KP/2016 on RPP FMA 716, improve inter-provincial coordination on fisheries management and control of migrant fishers, increase fisheries surveillance in FMA 716 and increase the availability of small pelagic fishery data.

Table 25. Results of Group Discussions: Ability to Achieve Governance Priority Issues, Operational Objectives, and Indicators

Governance Level	ID # Table 20	Issue	Operational objectives	Indicator
Regional	6	The number of tuna fishing vessels not yet registered at WCPFC	Raise awareness of business actors related to ship registration mechanism at WCPFC	Number of vessels registered at WCPFC
	18	Requirements for data on the dynamics of tuna and skipjack fisheries for management in the WCPFC area	Collecting fishery data as required on a regular basis and reporting to WCPFC	Proportion of fishing business actors submitting data as required by regulation using electronic logbooks
National Governance	1	There is no derivative rules on the authority of the central and regional governments under Law no. 23/2014 Lack of capacity to implement the Law No. 23/2014 (Provincial and District))*	Clear-cut the authority sharing in fisheries management and harmonization of legislation	The publication of NSPK (Norms, Standards, Procedures, and Criteria) and its derivative regulations and harmonized legislation
	2	Lack of government intensity to communicate /disseminate regulations, government direct assistance.	Increase government intensity in disseminating regulations and direct government assistance	Frequency of socialization, communication media, and involvement of stakeholders

Governance Level	ID # Table 20	Issue	Operational objectives	Indicator
National Management	3	Limited implementation Min. Dec. 83/2016 on RPP FMA 716	Implement Min. Decree 83/2016 on RPP FMA 716	Realization of action plan RPP FMA 716
			Implement fishery management plan	The proportion of licensed fishing vessels and/or registered
				There is a reference point for fishing control
				There are control rules
			Establishing or strengthening institutions to manage FMA 716	Establishment of FMA 716 management institution
	4	Limited integrated mechanisms on local wisdom and local rights in the field of capture fisheries on local and national regulations	Review and accommodate local wisdom and rights as well as central regulations	Study on local wisdom and rights
				List of local wisdom and rights that need to be accommodated
	5	Limited/Lack of national and cross provincial coordination systems in FMA 716	Empower FMC Use FMC for coordination and cooperation	Improved cooperation and coordination between national and provincial and cross-provincial
	7	Lack of facilities, human resources and budget for management of FMA 716	Improved resources (facilities,capacity of human resources, budget) for management of FMA 716	Budget allocation and staff
	19	Limited data on production and capacity for tuna fishing	Improving the availability of tuna fishery data	The proportion of fishing entrepreneurs submitting data according to regulations using electronic logbooks
	20	Limited availability of production data and skipjack fishing capacity	Improve availability of skipjack fishery data	Proportion of fishing business actor submitting data as required by regulation using electronic logbooks
		Conflict and intrusion into nearshore waters from other fishers*	Tenure rights supported for nearshore fishers	Less conflict over fishing areas in nearshore waters
		Lack of capacity for MCS*	Improve MCS activities	More patrols and higher compliance
		IUU fishing*	Control IUU fishing	Develop an electronic catch documentation traceability scheme

**Additional inputs during the SFMP Review and Finalization Workshop (26-27 February 2019)*

CHAPTER 6: MANAGEMENT ACTIONS

At the Integrated Stakeholder Consultation Workshop (ISCW) conducted in June 2017 in Manado, following the identification and prioritization of threats and issues, operational objectives, and indicators, workshop participants developed management measures for each (Table 26). To develop these management measures, stakeholders consulted the FMP for 716, which can be referenced in Annex III. This information was further validated during the February 2019 workshop at MMAF.

Management actions are the measures required to achieve an objective. In a situation where there are one or more management measures, they are referred to collectively as a 'strategy'—a group of measures required to reduce threats or address issue. For each objective, a list of all possible management measures is prepared, reviewed and selected with particular attention given to their ease of application, likelihood of success, feasibility, and cost. Often, one management measure can be used to address several objectives (e.g., fisheries conservation zone).

As there are indications of overfishing of big eye tuna, in order to realize sustainable management, management actions include implementation of catch limits for long lines based on WCPFC commitments and a regular stock assessment to monitor BET catch. With regard to the high proportion of juvenile yellowfin tuna caught, the Government must strictly control and implement harvest control measures to reduce the juvenile tuna catch. Skipjack tuna fisheries require management measures to implement catch limits and control the fishing capacity. Pole and line fisheries report that they are currently operating at a lower level of capacity due to the decreased availability of live bait fish. One of the reasons for the shortages of live bait fish is the increasing demand for human consumption of anchovy dry salted fish and other types of processed products. A live bait fish stock assessment and a study on alternative sources of bait fish are proposed.

To obtain additional data on all tuna species, which is now limited, fisheries business actors and fishing companies may be required to submit data as regulated on a regular basis and to develop a CDTS, complemented with other information as needed for fisheries management.

Controlling fishing effort will also directly achieve operational objectives of FAD management control in FMA 716. To achieve this operational objective, technical measures must be taken to control the number and position of FADs in accordance with MMAF Min.Reg.: No.26 of 2014 concerning FAD management.

Table 26. Results of Group Discussions: Ecological Well-Being Priority Issues, Operational Objectives, Indicators, and Management Measures

No	Target species			Issue	Operational Objectives	Indicator	Management Measures
1.	Tuna	Big Eye Tuna (BET)	1	Catch limit of about 5889 tons / year by longliners	To realize BET management and its ecosystem sustainability (link to NPOA Objective, p/ 26)	BET catch, CPUE	Develop harvest strategies* Implementation of catch limit for BET for longline based on WPCFC provisions (link to NPOA target) Conduct of regular stock assessment studies to monitor level of BET catch in FMA 716 Establish catch limit for BET in FMA 716* Study of catch limit for purseiners and optimum limit for pole and line* Promote the long line to utilize the quota* Implementation of study on use branch nylon for long line (link to NPOA target) (See page 161, NTMP)
			4	Limited data on production and effort	Improving availability of BET fishery data	Proportion of BET capture business actors submitting data as required by regulation (compliance to catch reporting) and using electronic logbooks	Requiring BET business actors to submit data using e-log book Developing and implementation of a catch documentation system (CDTS), complemented with other information as needed for fisheries management
		Yellowfin tuna	6	Baby tuna caught, increased	Control of fishing for juvenile tuna	Proportion of captured juvenile tuna	Implementation of study on composition of purse seine catch in FAD (link to NPOA target) (See page 162 of NTMP) Revise regulations based on the results of the study and develop management strategies* Initiation of control for juvenile tuna catch

No	Target species			Issue	Operational Objectives	Indicator	Management Measures
			7	Limited availability of production data and fishing effort YFT	Improving availability of fishery data YFT	proportion of YFT capture business actors submitting data as required by regulation (compliance to catch reporting)	Requirements for YFT fishing companies to submit data using e-log book Conduct of regular stock assessment studies to monitor level of YFT catch in FMA 716
							Developing and implementing a catch documentation system, complemented with other information as needed for fisheries management (e.g. e-log book and STELINA) Study of catch composition of purseiners and FADs* Document/study of the level of effort (no. of fishing vessels, purseiners)*
		Skipjack	9	Fleet development opportunities	Management of skipjack fishing capacity and mini-purse seiners	Capacity for skipjack fishing	Capacity control for skipjack fishing
			10	Limitations of anchovy supplies for live bait in Pole and line fishery	Initiation of live bait fish control for skipjack pole & line	Live bait fish	Conduct a live bait fish stock assessment (Risk-based assessment)
							Diversification of bait types (culture fish)
							Sustainable live bait utilization
			11	Limited data of production and fishing effort of SKJ	Improving availability of SKJ fishery data and improved reporting mechanisms	Proportion of SKJ fishing business actors submitting data as required by regulation (compliance to catch reporting) and electronic logbooks	Requiring for business catcher SKJ submits data using e-log book Conduct of regular stock assessment studies to monitor level of SKJ catch in FMA 716
							Developing a catch documentation system, complemented with other information as needed for fisheries management.

No	Target species			Issue	Operational Objectives	Indicator	Management Measures
2.	General ecosystems	Biodiversity - FAD	23	Excessive number of FAD and Blocking fish migration	FAD Control in FMA 716	Number and position of FAD; Number of conservation and management measures	Inventory amount and position of FAD Implementing Risk-based Assessment on negative impacts of tuna fishery on the ecosystem (link to NPOA target) (See page 162 of NTMP) Manage FAD according to MMAF Min.Reg.: No.26 of 2014 Regulation on density FAD in terms of depth and distance Establish management measures to protect identified spawning and breeding grounds
		Habitat	28	Destructive fishing using explosives materials	Combat illegal fishing practices with explosives	Number of fishing offenses with explosives	Increase supervision Improve law enforcement

**Additional inputs during the SFMP Review and Finalization Workshop (26-27 February 2019)*

In order to maintain fish abundance and improve income of fishers, there is a need to control fishing effort in all tuna fisheries. Improved quality of fishery products and price of fish can be achieved through better post-harvest measures and landing facilities. This will require capacity building of fishers on post-harvest measures. A study should be undertaken to develop a program on fisher cooperatives.

Table 27. Results of Group Discussions: Human Well-Being Priority Issues, Operational Objectives, and Management Measures

No	Issue	Operational Objectives	Indicator	Management Measures
1	Fishing ground further/increased operational costs	Maintain sustainable production rate	CPUE	Control of fishing effort
2	Decrease in income from tuna fisheries	Maintain sustainable production rate	CPUE	Control of fishing effort

No	Issue	Operational Objectives	Indicator	Management Measures
		Maintain sustainable production rate	Production	Control of fishing effort
		Increase net income of tuna fishery	Fisher Income	Capacity building and technical assistance on processing, marketing and alternative livelihoods
3	Decrease in income from skipjack fishery	Maintain sustainable production rate	CPUE	Control of fishing effort
		Maintain sustainable production rate	Production	Fish effort control
		Promote sustainable skipjack fishery income	Fishermen profit	Capacity building and technical assistance on processing, marketing and alternative livelihoods
4	Low selling price due to poor quality	Improving the quality of the catch on board Improve post-harvest quality* Improve cost structure+	Proportion of good quality fish landed	Quality control policy on the catch on board
5	Low quality of fish raw materials for processing	Maintaining quality of fish in transport to processing unit	Proportion of good quality raw material in processing unit	Quality control policy of raw material processing
6	Decrease in revenues due to lack of raw materials for proces-sing smoked fish	Maintain sustainable production rate	Production	Control of fishing effort
			CPUE	Control of fishing effort
		Maintaining sustainable supplies of raw materials from other regions	Supply volume from other regions	Optimization of national logistics distribution
7	Fisheries contribution to regional economy decrease	Maintaining sustainable contribution from fishing	Fish Production	Control of fishing effort
			CPUE	Control of fishing effort
		Improving the quality of fishery products from fish processing	Production processed	Optimization of raw material supply
		Revenue (PAD) from fisheries	PAD from fishery	Improvement of government services

No	Issue	Operational Objectives	Indicator	Management Measures
8	Decrease of foreign earnings from export of fish processing	Increase export of processed fishery product	Volume and value of export of processed fish	Meet the requirements of importing country (i.e: provision of traceability)
				Fish Processed quality control and improving post-harvest handling
				Maintaining the stability of fish processed production
				Penetration of new markets and increased refined production
9	Household income decreases due to the fish marketing and processing	Improved marketing and fish processing business activities	Access to more markets	Optimization of raw material supply Capacity building and technical assistance on processing, marketing
			The amount of labor in the fish processing	Optimization of employment opportunities for the surrounding community
11	Safety and human rights concerns for fishers	Improved safety at sea and human and rights for fishers	Fewer fisher safety incidents Better working conditions and rights for fishers	Incorporate insurance in fish licensing* Empowering the local enforcement to improve fishers' safety at sea*
12	Resilience and food safety of protein source (volume and low quality of catch)	Maintain sustainable production rate	Fish production	Control of fishing effort
		Sustaining fish resources	CPUE	Control of fishing effort
		Improvement in post-harvest practices	Proportion of catch fish in landing with good quality	Quality control policy of catch
13	Roles of fishers' cooperatives not yet optimal due to lack of capital	Improving the role of cooperatives in supporting the business of fishers and fish processors	Improved services provided by cooperatives	Government policy supporting coopeartives
14	Lack of knowledge about post-capture fish handling resulting in low quality	Increase knowledge and skills in fish handling of post-harvest technology	Improved safety and quality of fish	Training in post harvest technology

No	Issue	Operational Objectives	Indicator	Management Measures
15	Low local fisher working skills	Improve the working skills of local fishers	Skills training provided	Training in working ethics awareness
16	Lack of alternative livelihoods for fisher households	Increase availability of alternative livelihoods	Fisher households with alternative livelihoods	Conduct of alternative livelihood studies*
17	Lack of information on socio-economic of fishers	Improve information on socio-economic of fishers	Data on socio-economic of fishers	Conduct of studies related to socio-economic data of fishers*

**Additional inputs during the SFMP Review and Finalization Workshop (26-27 February 2019)*

Improvements in the governance of the fisheries can be achieved through better coordination among different levels of government (national and provincial), establishment of an FMA institutional structure, increased involvement of stakeholders in management, integration of local knowledge in management, and development of a collaborative framework among provinces on fisheries management and control of migrant fishers in FMA 716.

Table 28. Results of Group Discussions: Ability to Achieve Good Governance Priority Issues, Operational Objectives, Indicators, and Management Measures

			Issue	Operational objectives	Indicator	Management measures
Regional		6	The number of tuna fishing vessels not yet registered at WCPFC	Raise awareness of business actors related to ship registration mechanism at WCPFC	Number of vessels registered at WCPFC	Socialization related to vessel registration in WCPFC
						Facilitate ship registration at WCPFC
		18	Requirements for data on the dynamics of tuna and skipjack fisheries for management in the WCPFC area	Collecting fishery data as required on a regular basis and reporting to WCPFC	The proportion of fishing business actors submitting data as required by regulation using electronic logbooks	Obliging fishing entrepreneurs to submit data on regular basis;
						Developing a catch documentation system, complemented with other information as needed for fisheries management
National	Governance	1	There is no derivative rules on the authority of the central and regional governments under Law no. 23/2014	Clear-cut the authority sharing in fisheries management and harmonization of legislation	The publication of NSPK (Norms, Standards, Procedures, and Criteria) and its derivative regulations	The central government create NSPK and regional governments make derivative regulations

			Issue	Operational objectives	Indicator	Management measures
			Lack of capacity to implement the Law No. 23/2014 (Provincial and District)		and harmonized legislations	
		2	Lack of government intensity to communicate /disseminate regulations, government direct assistance.	Increases government intensity in disseminating regulations and direct government assistance	Frequency of socialization, communication media, and involvement of stakeholders	Strengthening of involvement of stakeholders in the socialization process and through communication media related to regulation and direct government assistance Conduct regular coordination forum on management and utilization of fisheries resources in FMA 716 (link to NPOA)
	Management	3	Limited implementation Min. Dec. 83/2016 on RPP FMA 716	Implement Min. Decree 83/2016 on RPP FMA 716	Realization of action plan RPP FMA 716	Implementation action plan RPP FMA 716
				Implement fishery management plan	The proportion of licensed fishing vessels and/or registered	Fishery controls with reference points & harvest strategy
					There is a reference point for fishing control	Fisheries control with reference point & harvest strategy
					There are control rules	Fishery control with reference point & harvest strategy
				Establishing or strengthening institutions to manage FMA 716	Establishment of FMA 716 management institution	The establishment of institutional structure and budgeting Create terms of reference Appoint FMA management personnel
		4	Limited integrated mechanisms on local wisdom in the field of capture fisheries on local and national regulations	Review and accommodate local wisdom on local as well as central regulations	Study on local wisdom and rights	Conduct studies of local wisdom
					List of local wisdom that needs to be accommodated	Making local regulations that accommodate local wisdom

			Issue	Operational objectives	Indicator	Management measures
		5	Lack of cross provincial coordination systems in FMA 716	Empower FMC to promote inter-provincial MOU with FMA 716	MOU migrant fishers	Strengthen FMC coordination with provincial government Establish territorial user rights for fishing Capacity building to enforce the regulation
		7	Lack of facilities, human resources and budget for management of FMA 716	Improved resources (facilities, capacity of human resources, budget) for management of FMA 716	Budget allocation and staff	Conduct assessment of needs and optimal budget Increased budget
		19	Limited data on production and capacity for tuna fishing	Improving the availability of tuna fishery data	The proportion of fishing entrepreneurs submitting data according to regulations using electronic logbooks	Obliging fishing entrepreneurs to submit data in accordance with the provisions on a regular basis
						Developing a catch documentation system, complemented with other information as needed for fisheries management
		20	Limited availability of production data and skipjack fishing capacity	Improving availability of skipjack fishery data	Proportion of fishing business actor submitting data as required by regulation using electronic logbooks	Obliging fishing business actors to submit data in accordance with regulation on a regular basis
						Developing a catch documentation system, complemented with other information as needed for fisheries management
			Conflict and intrusion into nearshore waters from other fishers	Tenure rights supported for nearshore fishers	Less conflict over fishing areas in nearshore waters	MCS for local marine patrol*
			Lack of capacity for MCS	Improve MCS activities	More patrols and higher compliance	MCS for local marine patrol* Increase budget for MCS activities*
			IUU fishing	Control IUU fishing	Develop an electronic catch documentation traceability scheme	Development of catch documentation system*

*Additional inputs during the SFMP Review and Finalization Workshop (26-27 February 2019)

CHAPTER 7: GOVERNANCE AND COORDINATION

The Fisheries Management Plan for FMA 716 is guided by Regulation of the Director General of Capture Fisheries Number 15/PER-DJPT/2017 concerning Technical Guidelines for the Operationalization of Fisheries Management Area Regional Secretariats in 11 Fisheries Management Areas of the Republic of Indonesia. The purpose of the enactment of the Operationalization of the Fisheries Management Regional Secretariats in the 11 FMAs is as guidelines for all stakeholders in the implementation of fisheries management institutions in the FMAs. The governance structure of the FMAs is as shown in Figure 7.

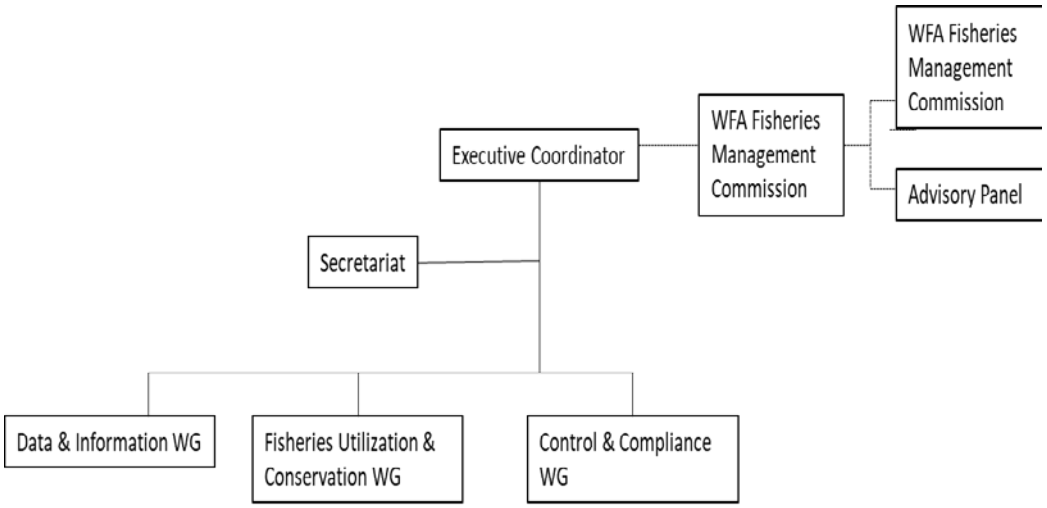


Figure 7. Governance Structure of FMA

An Executive Coordinator serves as the daily executive for fisheries management and plays a role in the implementation of fisheries management institutions at the FMA level and ensures the realization of sustainable fisheries management, through the preparation, implementation, and evaluation of Fisheries Management Plans in the FMA. In carrying out its duties, the Executive Coordinator will be assisted by three working groups: the data and information working group (WG), fisheries utilization and conservation WG, as well as control and compliance WG. In the formulation of the proposed recommendations, the Executive Coordinator will coordinate with the FMA's FMC which receives input from the Scientific Panel and Advisory Panel. The results of the recommendations from the FMA's FMC will be reported by the Executive Coordinator to the FMA's Head of Fisheries Management through the national secretariat. The Secretariat at the FMA level is a service unit supporting the implementation of fisheries management in each FMA, especially in terms of technical and administrative services in the fisheries management environment. The secretariat is coordinated by an Executive Coordinator.

Technically, in carrying out its duties, the Executive Coordinator is supported by three WGs.

1. **Data and Information WG:**
   - Compiles and analyze fisheries data and information at the FMA;
   - Recommends the required research and data for fisheries management policies;
   - Carries out tasks assigned by the Executive Coordinator; and
   - If necessary, proposes to the Executive Coordinator to establish a special task force.

2. **Fisheries Utilization and Conservation WG:**
   - Recommends actions for fisheries utilization and conservation in the FMA;
   - Coordinates the implementation of fisheries utilization and conservation management actions;
   - Carries out tasks assigned by the Executive Coordinator; and
   - If necessary, proposes to the Executive Coordinator to establish a special task force.
3. **Control and Compliance WG:**
   - Recommends control and compliance measures in the FMA;
   - Coordinates control of utilization and supervision of the implementation of management actions recommended to be implemented in the FMA;
   - Carries out tasks assigned by the Executive Coordinator; and
   - If necessary, proposes to the Executive Coordinator to establish a special task force.

In carrying out its duties, all elements of the WG are required to apply the principles of coordination, integration and synchronization both within their respective institution and between WGs and the Secretariat and Executive Coordinator. Each WG is led by a WG Coordinator who is responsible for leading and coordinating each of its members and implementing the collaboration between WG and the Secretariat and providing supervision and guidance for the implementation of the duties of its members. The WG results are submitted to the Secretariat for submission to the Executive Coordinator.

Based on the urgency of strategic issues and problems that may develop in the FMA, the Executive Coordinator through the FMA Fisheries Management Commission may establish a special task force responsible to the Executive Coordinator. Therefore, the existence of a special task force in each FMA can be different according to the needs in each FMA.

In addition to the fisheries management organization of each FMA, the following groups should also be established:

1) FMA fisheries management commission;
2) scientific panel; and
3) advisory panel.

Fisheries Management Commission – Each FMA's FMC will have one main coordinator who is a Head of the Provincial Marine and Fisheries Office. Members of the FMC will include members of MMAF Echelon II related to fisheries management, Head of the Provincial Marine and Fisheries Office, Head of Fisheries Port, and Executive Coordinator. The Coordinator's assignment period is two years and then the coordinator will be elected alternately.

The change in membership of the FMC will be carried out based on proposals from relevant agencies and or decisions of FMC meetings. Conditions for termination of membership from the FMC include: (a) death; (b) no longer occupying positions and being replaced by new officials for members appointed as members because of their positions; (c) dismissed for some other reasons; and (d) FMC resignation.

Advisory Panel – The Advisory Panel also consists of one Coordinator and its members. Members of the Advisory Panel consist of Non-Capture Fisheries Center Unit, Fishing Associations, Fisheries Product Processing Associations, Customary Institutions, and NGOs. In accordance with their main duties and functions, the Advisory Panel expresses its aspiration to the

FMC in preparing fisheries management recommendations. NGOs that are members of the Advisory Panel are those that have been officially registered and are working in fisheries sector.

Scientific Panel – Membership of the Scientific Panel consists of one Coordinator and members. Members of the Scientific Panel consist of representatives from Research Institutes in the field of marine affairs and fisheries, universities, and scientific groups of fisheries managements in each FMA and experts in fisheries and marine. In accordance with its main tasks and functions, the scientific panel will provide data, information, and scientific recommendations to the FMC related to fisheries management.

In carrying out their duties, if there are specific and urgent issues to be handled, the FMA Fisheries Management Commission can establish a Special Task Force, which is established by the FMA Fisheries Management Commission in accordance with their respective fields.

CHAPTER 8: FINANCING

Sufficient, timely, and sustained financial resources to support the SFMP are critical to achieve long-term sustainability of food security, livelihoods, and conservation in FMA 716. Funds need to be available to support planning, implementation, coordination, monitoring and enforcement, among other activities. Upon adoption of the plan by the MMAF, a financial strategy and/or roadmap will need to be developed including list of potential sources of funding. Potential sources of funding, include: National government; Provincial/local governments; International programs; a Public-Private Partnership scheme; and others (Philanthropic, Donors, NGOs).

The plan activities will need to be integrated into the workplans and budgeting of the relevant MMAF and Provincial Governments bordering FMA 716. The SFMP will also need to be mainstreamed into the national government agenda i.e., updated Fisheries Management Plan for FMA 716 and the National Tuna Management Plan.

CHAPTER 9: MONITORING AND EVALUATION

Managing fisheries resources is a continuous, adaptive, and participatory process comprised of a set of related tasks that must be carried out to achieve a desired set of objectives. Plans must be monitored if they are to be kept on track and evaluated if there is to be learning from successes and failures. Monitoring and Evaluation (M&E) is meant to gauge if the management actions are getting fisheries managers closer to achieving specified objectives and goals. Monitoring refers to the collection of data that are focused on the indicators that in turn are linked to the plan's objectives. Indicators are used to track the key outcomes identified by the plan's operational objectives and provide a measure of how well management actions are performing. Evaluation consists of reviewing the results of actions taken and assessing whether these actions have produced the desired outcomes. Evaluation helps managers to adapt and improve by learning. The plan's M&E system provides critical information for adaptive management, which is to learn by doing.

M&E can help to answer critical questions such as: Are the activities working or not? If not, what actions are needed to make them work? Monitoring answers the question: How are we doing? Evaluation answers the question: How did we do? If the plan has measurable objectives and indicators for evaluation, ongoing monitoring can provide the information required to evaluate the plan's effectiveness and performance. The M&E plan provides an outline of the steps that should be undertaken to ensure that the program is on track.

Effective plan assessment and evaluation involves several steps: (i) preliminary appraisal, (ii) baseline assessment, (iii) monitoring, and (iv) evaluation. Information for each of these steps is essential to maximize chances that the plan will be effective for the adaptive management process and to acquire lessons learned. A SFMP's M&E system may include a reporting system, documentation processes, evaluation/performance indicators, implementation mechanisms, and baseline data/information. The M&E system shall track progress in achieving the goal and objectives of the SFMP through time. In this way, accurate and timely feedback may be provided to the implementing units/organizations.

The SFMP will be evaluated annually and reviewed five years after implementation. The evaluation and review process will be coordinated with the Director General of Capture Fisheries based on updated scientific data, national policy and legislation, management objectives and management measures, and other factors affecting the tuna and neritic tuna fishing activity. The monitoring and evaluation process will be participatory involving a range of stakeholders.

The implementation of the SFMP for FMA 716 will be primarily evaluated based on achieving the overarching goal for ecological, human well-being, and governance of this plan. As agreed during the SFMP Review and Finalization Workshop in February 2019, MMAF proposed that the targets, indicators, and benchmarks for each goal are adopted from Fisheries Management Plan for FMA 716 based on the Ministerial Decree No. 83/KEPMEN–KP/2016 (Tables 29-31).

Table 29. Target, Indicators, and Benchmark for SFMP Goals

Goal	Target	Indicator	Benchmark
1. Realized management of fisheries resources and their habitats	Availability of capture fisheries data that can meet the interests of fish resource management within five years	Capture fisheries data that can meet the interests of fish resource management	Capture fisheries data cannot meet the interests of fish resource management
	The realization of the use of legal fishing gears/methods of more than 50% within five years	The number of ships using illegal fishing gears	More than 50% of ships use illegal fishing gears
2. Increase economic and social benefits of sustainable fisheries for the human being welfare	Minimize conflicts between Andon (moving/migrate) fishermen and Andon site destination's fishermen within five years	Frequency of conflicts between Andon (moving/migrate) fishermen and Andon site destination's fishermen	Conflict often occur
	As many as 5% of fishermen are able to implement good handling methods within five years	The number of fishermen who take part in training on good handling method	There are still few fishermen who take part in training on good handling method

3. Active participation of stakeholders and compliance to fisheries management	Optimal management of FADs in accordance with statutory provisions within five years	The number of FADs managed optimally in accordance with the provisions of the legislation	Most FADs are not managed optimally in accordance with the provisions of the legislation

REFERENCES

Allain,V., S.Nicol, J.Polovina, M.Coll, R.Olson, S.Griffiths, J.Dambacher, J.Young, J.J.Molina, S.Hoyle, T.Lawson, J.Bell., 2011. Report of the International Workshop on Opportunity for Ecosystem Approaches to Fisheries Management in the Pacific Ocean Tuna Fisheries. Scientific Committee 7th Regular Session. 9-17 August 2011. Pohnpei, Fed. States of Micronesia. WCPFC-SC7-2011/EB-IP-04.

Andrew, N., L. Evans. Approaches and frameworks for management and research in small-scale fisheries, in: Small-scale Fisheries Management: Frameworks and Approaches for the Developing World, CABI, Oxfordshire, UK, 2011, pp. 16–34.

Anonymous. 2016. Estimates of Annual Catches in the WCPFC Statistical Area. Scientific Committee 12th Regular Session. WCPFC-SC12-2016/ST-IP-01. Bali, Indonesia. 3–11 August 2016. 34p.

Anonymous. 2001. Fish stock assessment in the Indonesian waters. RCCF/MMAF-RDCO. Jakarta.125p.

Anderson. L.G. & J.C. Seijo. 2010. Bioeconomics of Fisheries Management. Wiley – Blackwell, Ames. 305p.

Atmaja, S.B. and D.Nugroho. 2005. Application of Beverton and Holt model to the roundscads fishery in the adjacent sea of Natuna. JPPI. Vol.11 No.6 : 10-17 (In Indonesian)

Bailey, M., and U.R.Sumaila. 2017 (Draft/in press). The cost of juvenile fishing: FADs management in the Western and Central Pacific Ocean tuna fishery. Fisheries Economics Research Unit. UBC, Vancouver, Canada. 16p.

BPS. 2014. Statistics of Marine and Coastal Resources - Central Agency for Indonesian Statistics. 254p.

Christie, P., D.L. Fluharty, A.T. White, L. Eisma-Osiorio, W. Jatulan. Assessing the feasibility of ecosystem-based fisheries management in tropical context, Mar. Policy 31 (2007) 239–250.

Chodriyah, U. 2015. Fisheries biological characteristics, habitat, and production potential of fish resources in FMA 716 (Sulawesi Sea). Final Report. Research Ins.for Mar.Fish. MMAF. 157p. (Unpublished).

Clark, C.W. 2006. The Worldwide Crisis in Fisheries: Economic Model and Human Behavior. Cambridge University Press, Cambridge. 263p.

Clarke,S. 2014. Bycatch in Longline Fisheries for tuna and tuna-like species: A Global Review of Status and Mitigation Measures. FAO Fish.Tech. Pap. 588. 200p.

Cochrane, K.L. 1999. Complexity in fisheries and limitations in the increasing complexity of fisheries management. ICES Journal of Marine Science 56(6): 917-926.

Cochrane, K.L., C.J. Augustyn, A.C. Cockcroft , J.H.M.David, M.H.Griffiths, J.C. Groeneveld, M.R. Lipińnski, M.J.Smale, C.D.Smith and R.J.Q.Tarr., 2004. An ecosystem approach to fisheries in the southern Benguela context. African Journal of Marine Science, 26: 9-35.

Cochrane, K.L., C.J. Augustyn, G. Bianchi, P. de Barros, T. Fairweather, J. Iitembu, D. Japp, A. Kanandjembo, K. Kilongo, N. Moroff, D. Nel, J.-P. Roux, L.J. Shannon, B. van Zyl, & F. Vaz Velho. 2007. Results and conclusions of the project "Ecosystem approaches for fisheries management in the Benguela Current Large Marine Ecosystem". FAO Fisheries Circular. No. 1026. Rome, FAO. 167p.

Coffey, C. 2005. What role for public participation in fisheries governance? Reviews: Methods and Technologies in Fish Biology and Fisheries . 4: 27-44.

Davies, N., S.Harley, J.Hampton, and S.McKechnie. 2014. Stock Assessment of Yellowfin tuna in the Western and Central Pacific Ocean. WCPFC-SC10-2014/SA- WP-04. 119p
DGCF., 2015. Statistics of Marine Capture Fisheries by Fisheries Management Area (FMA), 2005-2014. Directorate General of Capture Fisheries. 517p.

DGCF. 2005-2015. Statistics of Marine Capture Fisheries. Directorate General of Capture Fisheries.

FAO. 2005. Discards in the World's Marine Fisheries: An Update. FAO Fish. Tech. Paper No. 470. 131p.

FAO. 1995. Code of Conduct for Responsible Fisheries. Rome; FAO: 41 p.

FAO. 1997. FAO Technical Guidelines for Responsible Fisheries. 4. Fisheries Management. Rome 82p.

FAO. Technical Guidelines for Responsible Fisheries, FAO, Rome, 2003.
R. Pomeroy, R. Brainard, M. Moews, A. Heenan, J. Shackeroff, N. Armada, Coral Triangle Regional Ecosystem Approach to Fisheries Management (EAFM) Guidelines, The USAID Coral Triangle Support Partnership, Honolulu, Hawaii, 2013.

FAO. 2001 — Report of the Reykjavík Conference on Responsible Fisheries in the Marine Ecosystem. Reykjavík, Iceland, October 2001. Fish. Rep. 658: 135 p.

FAO. 2003 — Fisheries Management 2. The Ecosystem Approach to Fisheries. FAO Technical Guidelines for Responsible Fisheries. 4(Suppl. 2): 112 p.

FAO. 2005. Putting into Practice the Ecosystem Approach to Fisheries. Rome, FAO. 76p

FAO. 2016. Handbook of the EAF-Nansen project training course on the ecosystem approach to fisheries: Preparation and implementation of an EAF management plan. Rome, FAO. 71p.

Fine, R.A., R. Lukas, F.M. Bingham, M.J. Warner and R.H. Gammon. 1994. The Western equatorial Pacific: A water mass crossroads. J. Geophys. Res.: Oceans, 99: 25063-2508

Fletcher, R., Chesson, J., Fisher, M., Sainsbury, K., Hundloe, T., Smith, T. and B.Whitworth. 2002. National ESD reporting framework for Australian Fisheries: the 'how to" guide for wild capture fisheries., Canberra, Australia. FRDC Project 2000/145: 120 pp.

Fletcher, W.J. 2008. A Guide to implementing an ecosystem approach to fisheries management (EAFM) for the tuna fisheries of the Western and Central Pacific Region. FFA, Honiara, Solomon Islands. (Vers 5 March 2008). 70p.

Fletcher, W.J. 2010. Planning processes for the management of the tuna fisheries of the Western and Central Pacific Region using an Ecosystem Approach. Forum Fisheries Agency, Honiara, Solomon Islands. Facilitator's Version 6.1 January 2010. 61p.

Garcia, S.M. A. Zerbi, C. Aliaume, T. Do Chi, G. Lasserre., 2003. The ecosystem approach to fisheries. Issues, terminology, principles, institutional foundations, implementations and outlook. FAO Fish.Tech. Pap. 443. 71p.

Gillett, R. 2012. Tuna for to morrow. SmartFish – IOC-COMESA, EAC, -IGAD-SADC.-FAO. 88p.

Gillett, R. 2011. Bycatch in small-scale tuna fisheries. A global study. FAO Fish.& Aquaculture Tech. Pap. 560. 116p.

Gilman, E.L, and C.G.Lundin. 2008. Minimizing Bycatch of Sensitive Species Groups in Marine Capture Fisheries: Lessons from Tuna Fisheries. IUCN 23p.

Glazier, E. 2011. Ecosystem Based Fisheries Management in the Western Pacific. John Wiley & Sons, 400p

Grant, S. 2008. Scientific basis for ecosystem-based management in the Lesser Antilles including interactions with marine mammals and other top predators: Assessment of fisheries management issues in the Lesser Antilles and the ecosystem approach to fisheries management by, FAO, Barbados. 254p.

Gordon, H.S. 1954. The economic theory of the common property resource: the fishery. Journal of Political Economy, 62: 124 – 42.

Gulland. J.A. 1983. Fish stock assessment. A manual of basic methods. John Wiley & Sons. 223 p.

Gulland, J.A. Fish population dynamics. The implications for management. John Wiley & Sons. 442p.

Harley,S., N.Davies, J. Hampton, and S.McKechnie. 2014. Stock Assessment of Bigeye Tuna in the Western and Central Pacific Ocean. WCPFC-SC10-2014/SA-WP-01. 115p.

Harley, S. J., P.Williams, S.Nicol, J.Hampton and S.Brouwer. 2015. The western and central Pacific tuna fishery: 2014 overview and status of stocks. Oceanic Fisheries Programme. Tuna Fisheries Assessment Report No. 15. Secretariat of the Pacific Community. Oce. fish. Programme. New Caledonia. 39p.

Harsono, G., A.S. Atmadipoera, F. Syamsudin, D. Manurung and S.B. Mulyono. 2014. Halmahera Eddy Features Observed from Multisensor Satellite Oceanography. Asian Journal of Scientific Research, 7: 571-580.

Johannessson, K.A. 1983. Report of acoustic survey cruises in the Sangihe and Talaud Archipelagos of the North Sulawesi Province. FAO/CIDA/INFIDEP. 85p (Unpublished).

Jones, R. 1982. Ecosystems, food chains and fish yields. In Pauly, D. and G.I.Murphy (eds). Theory and management of tropical fisheries. Proc. of the ICLARM/CSIRO Workshop on the theory and management of tropical multispecies stocks. 12-21 January 1981. Cronulla Australia. ICLARM-CSIRO.

Jueldy, S.Muhammad, D.Koestiono, G.Mamuaya. 2014. Fishermen's Household characteristics in Bunaken National Park Area, North Sulawesi Province. IOSR Journal of Agriculture and Veterinary Science . Vol.7, (1): Pp. 56-62

Kashino, Y. A. Atmadipoera and Y. Kuroda, 2013. Observed features of the Halmahera and Mindanao Eddies. J. Geophys. Res.: Oceans, 118: 6543-6560.

Langenheim, J. 2015. Controversial mine threatens Indonesian dive mecca. The Guardian.

MacInnes., M. 1989 The Baitfishery in Kiribati and Its Impact on the Tuna Industry. In Blaber, S.J.M. and J.W. Copland (Eds). Tuna Baitfish in the Indo-Pacific Region. Proceedings of a workshop, Honiara, Solomon Islands, 11-13 December, 1989: 52-55.

Maniku,H., R.E. Anderson and A. Hafiz. 1989. Tuna Baitfishing in Maldives. In Blaber, S.J.M. and J.W. Copland (Eds). Tuna Baitfish in the Indo-Pacific Region. Proceedings of a workshop, Honiara, Solomon Islands, Dec.1989: 22-29.

McKechnie, S., J. Hampton, G. M. Pilling, N. Davies. 2016. Stock assessment of skipjack tuna in the western and central Pacific Ocean. WCPFC-SC12-2016/SA-WP-04. 120p

Mantjoro, E., and C.Kataoka. 1991. Socio-economic Characteristics of the Skipjack Fishery in Indonesia. South Pacific Study Vol. 11, No. 2, 1991: 105-122

Morgan, A.C. 2011. Fish Aggregating Devices and Tuna: Impacts and Management Options. Ocean Science Division, Pew Environment Group, Washington, DC. 18p.

Myers, R. A. & Worm, B. 2003 Rapid worldwide depletion of predatory fish communities. Nature 423, 280–283.

Pauly, D., and P.Martosubroto. 1996 (Eds). Baseline Studies of Biodiversity: The fish resources in Western Indonesia. ICLARM Study Review. 23, 321 p.

Plagányi, É.E. 2007. Models for an ecosystem approach to fisheries. FAO Fisheries Technical Paper. No. 477. 108p.

Pomeroy, R., K.H.W. Phang, K. Ramdass, J.M. Saad, P. Lokani, G. Mayo-Anda, E. Lorenzo, G. Manero, Z. Maguad, M.D. Pido, G. Goby. Moving towards an ecosystem approach to fisheries management in the Coral Triangle Region, Mar. Policy 51 (51) (2015) 211–219.

Pomeroy, R., R. Brainard, M. Moews, A. Heenan, J. Shackeroff, N. Armada. Coral Triangle Regional Ecosystem Approach to Fisheries Management (EAFM) Guidelines, The USAID Coral Triangle Support Partnership, Honolulu, Hawaii, 2013.

Ruckelshaus, M., T. Klinger, N. Knowlton, D. DeMaster. Marine ecosystem-based management in practice: scientific and governance challenges, BioScience 58 (2008) 53–63.

Sadhotomo,B., A.S.Panggabean, Awwaluddin, A.Priatna and R.Lasniroha. 2009. Research on the assessment of pelagic fish resources in the waters of Sulawesi Sea. Annual Report 2009. RIMF. 44p.

Schaefer, M.B. 1957. Some considerations of population dynamics and economics in relation to the management of marine fisheries. Journal of the Fisheries Research Board of Canada, 14: 669 – 81.

Sharma, S.P. and T.J.H. Adams. 1989. The Fiji Tuna Baitfishery. In Blaber, S.J.M. and J.W. Copland (Eds). Tuna Baitfish in the Indo-Pacific Region. Proceedings of a workshop, Honiara, Solomon Islands, 11-13 Dec. 1989: 45-51.

Shomura, R.S., J.Majkowski and R.F. Harman. 1995 (Eds). Status of Interactions of Pacific Tuna Fisheries in 1995. Proc. the Second FAO Expert Consultation on Interactions of Pacific Tuna Fisheries, Shimizu, Japan 23-31 Jan.1995.

Skirtun, M., and C. Reid. 2016. Analyses and projections of economic conditions in WCPO fisheries. Scientific Committee 12th Regular Session. WCPFC-SC12-2016/ST-WP-04. Bali, Indonesia. 3–11 August 2016. 33p.

Turak, E., and L.DeVantier. 2003. Final Report to the International Ocean Institute Regional Centre for Australia & the Western Pacific. Sponsored by the TOTAL Foundation (France), the International Ocean

Institute - Regional Centre for Australia & the Western Pacific, Marine Conservation Action Fund (Boston, Massachussetts) and the University of Sam Ratulangi (Manado, North Sulawesi, Indonesia). 65p.

Wagey, T., and Z.Arifin (Eds). 2008. Marine Biodiversity Review of the Arafura and the Timor Seas. MMAF-LIPI-UNDP-Cencus of Marine Life. 136p

Wirtky, K. 1961. Physical Oceanography of the Southeast AsianWaters. Naga Report. Volume 2. Scientific Results of Marine Investigations of the South China Sea and the Gulf of Thailand 1959-1961. The University of California. Scripps Institution of Oceanography. La Jolla, California. 195p.

WorldFish Centre, Implementing Ecosystem Approach to Fisheries Management in Small Scale Fisheries – EAFM Plan Report, EU, WFC, PKSPL-IPB, RCMFSE, MMAF. 2013.

Wudianto. 2001. Analysis of the distribution and abundance of Bali sardine (*Sardinella lemuru* Bleeker 1853) in relation with fishing optimisation. Dr. Dissertation. (Unpublished). Post Graduate Program. Bogor Agriculture University. Bogor. 215p (In Indonesian)

ANNEX I: SMALL PELAGIC RESOURCES AND MANAGEMENT CONSIDERATIONS

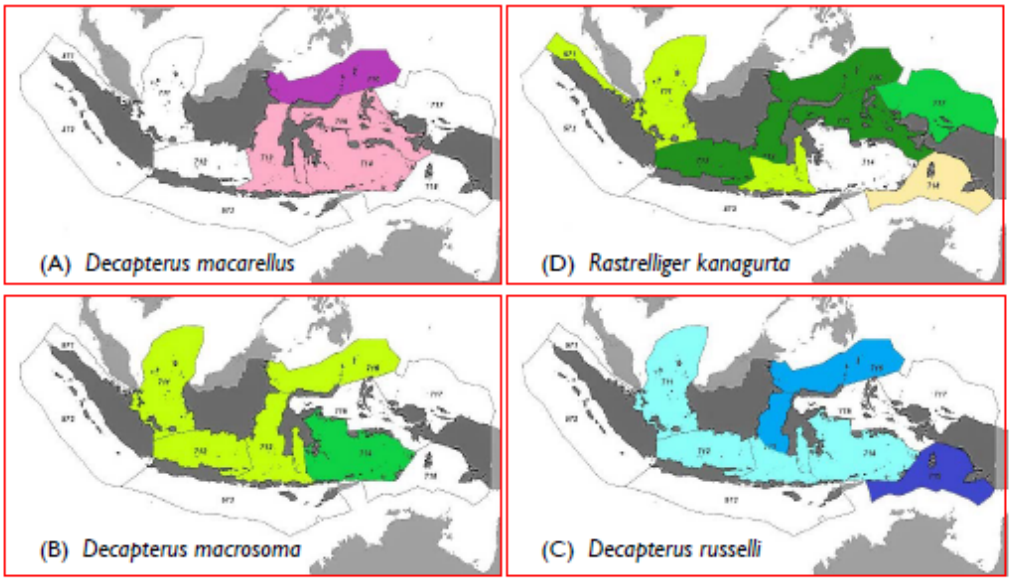
Small pelagic fishing grounds are currently contained along the coast line of the southern part of the Sulawesi Sea and around the waters of the small islands of the districts of Sangihe and Talaud. Fishing activities are confined and mostly carried out in the shallower waters, however, there is a potential for the extension of small pelagic fishing activities into deeper waters in the areas where fish aggregating devices (FADs) have been deployed.

Based on the capture fisheries statistical data (DGCF, 2015), the predominant small pelagic species in Indonesia are mackerels, scads, and trevallies, contributing 26%, 27% and 14% of the total production of 17 small pelagic fish species groups. Similarly, the catch of small pelagics from FMA 716 was also predominated by mackerels, scads, and trevallies, contributing 10%, 60% and 18% of the total production of the 17 species groups. The genetic information on stock units were only available for some species of mackerels and scads. Therefore, the delineation of the management unit of small pelagic fishery in FMA 716 was undertaken based on the management unit of mackerels and scads.

Stock Distribution and Genetic Connectivity –

The main species of scads in FMA 716 was scads or *malalugis* (*Decapterus macarellus*), contributing 58% of the total production of 17 small pelagic fish species groups from fishing in FMA 716 (DGCF, 2016). Zamroni et al. (2014) reported that *Decapterus macarellus* in FMA 716 (Sulawesi Sea) is genetically different from that in adjacent FMAs, i.e. in FMA 713 (Bone Bay, Flores Sea and Makassar Strait) and 715 (Maluku Sea and Tomini Bay). It is clear that in term of *D. macarellus* the small pelagic fishery in FMA 716 can be managed separately from other FMAs. Unfortunately, other species in FMA 716, e.g. banyar (*Rastrelliger kanagurta*), layang deles (*Decapterus macrosoma*) and layang benggol (*Decapterus russelli*), are genetically not different from those in adjacent FMAs.

Rastrelliger kanagurta in FMA 716 (Manado) is genetically not different from that in FMA 712 Karimunjawa), FMA 713 (Makassar), and FMA 715 (Halmahera and Raja Ampat) (Jackson *et al.*, 2014). Similarly, *D. macrosoma* in FMA 716 (Sulawesi Sea) is genetically not different from that in FMA 711, FMA 712 and FMA 713 (Makassar Strait) (Arnaud *et al.*, 1999; Borsa, 2003; Rohfritsch & Borsa, 2005). *D. russelli* in FMA 716 (Sulawesi Sea) is also genetically not different from that in FMA 711, 712, 713 (Flores Sea), and 714 (Arnaud *et al.*, 1999; Perrin & Borsa, 2001; Borsa, 2003; Rohfritsch & Borsa, 2005; Suwarso, & Zamroni, 2013). Indicative maps of stock distribution of those species are presented in Figure 1.



Source(s): (A) Arnaud et al. (1999), and Zamroni et al. (2014); (B) Arnaud et al. (1999), Borsa (2003), and Suwarso & Zamroni (2013); (C) Perrin & Borsa (2001), Rohfritsch & Borsa (2005), and Suwarso & Zamroni (2013); (D) Anonymous (2014), Jackson et al. (2014), Zamroni et al. (2016), and Zamroni et al. (MS).[38,39,40]

Figure 1. Indicative maps of stock distribution, delineated on the basis of published information on population genetic structure of: (A) Decapterus macarellus, (B) Decapterus macrosoma, (C) Decapaterus russelli, (D) Rastrelliger kanagurta

Decapterus macarellus, Decapterus macrosoma, Decapterus russelli, and *Rastrelliger kanagurta* contributed 61% of the total catch of 17 species groups of small pelagic fishes in FMA 716, while 39% consisted of more than 13 species groups of small pelagic fishes (DGCF, 2016). However, the catch of *Rastrelliger kanagurta* from fishing in FMA 716 was only 5.1% of the total catch from utilizing the stock distributing in FMA 712, 713, 715, and 716. The catch of *Decapterus macrosoma* from FMA 716 was only 0.5% of the total catch from utilizing the stock distribution in FMA 711, 712, 713, and 716. Meanwhile, the catch of *Decapterus russelli* was only 1.7% of the total catch from utilizing the stock distributing in FMA 713 and 716 (Table 1). These figures indicate a small contribution of FMA 716's small pelagic fishery to the fishing mortality of fishing *Rastrelliger kanagurta*, *Decapterus macrosoma,* and *Decapterus russelli*, which in turn result in small impact to the population or stock abundance of those species.

Table 1. Proportion of Decapterus macarellus, Decapterus macrosoma, Decapterus russelli and Rastrelliger kanagurta caught, according to FMA

Species	Total production of one population unit	FMA 711	FMA 712	FMA 713	FMA 715	FMA 716
Indian mackerel (Rastrelliger kanaguta)	100%		34.2%	30.9%	29.8%	5.1%
Layang scad. Round scad (Decapterus macrosoma)	100%	0.6%	89.2%	9.7%		0.5%
Indian scad. Russel scad (Decapterus russelli	100%			98.3%		1.7%
Mackerel scad (Decapterus macarellus)	100%					100%

The high proportion of *Decapterus macarellus, Decapterus macrosoma, Decapterus russelli,* and *Rastrelliger kanagurta* in the FMA 716's small pelagic fishery production, and the small impact of catching those four species in FMA 716 on overall population of those species, indicated possible separation of the small pelagic fish stock and fisheries in FMA 716 from other FMAs as a management unit to manage and conserve small pelagic fishery in FMA 716. Separating FMA 716 as the management unit for the small pelagic fishery, the biomass of small pelagic fishes in FMA 716 is treated as the stock unit in the management of small pelagic fishery in FMA 716.

Catch, Fishing Effort, and Catch per Unit Effort Values –

Statistical data of capture fisheries, published by DGCF (2016), reported that the small pelagic fishery in the FMA-716 contributed 29.3% of the area's total production of marine capture fisheries during 2005-2015. The small pelagics landed by purse-seiners from FMA 716 consisted of at least 17 groups of species and contributed 87.1% of the total production of small pelagic fishery during that period. 69.2 % of the total small pelagic fishery production consisted of round-scads (56.6%) and trevallies (12.6%). Given the sufficient amount of data available on these 17 groups of species and their consistent catch by purse seine vessels, USAID Oceans focused their studies to this group which henceforth is mentioned as "small pelagic species."

During 2005-2015, small pelagic fishery production increased, while fishing effort declined. The fishing effort was standardized to the number of the 20 meter length overall (LOA) vessels operating purse seine gears. The average tonnage of the 20 meter LOA vessels was about 35 GT, categorized as a medium scale purse-seiner. Following, the catches per unit of fishing effort (CPUE) was established, resulting from observation and estimations for the period of 2005-2015. The CPUE in that period tends to increase. In 2015, the production of the small pelagic fish species was about 71 thousand tons and the CPUE of the medium scale purse seine fishery was about 165 ton/vessels. Meanwhile, the CPUE of the small-scale purse seine fishery was about 30.4 ton/vessels, with an average of 12 meter LOA.

Estimate of small pelagic fish biomass from survey data –

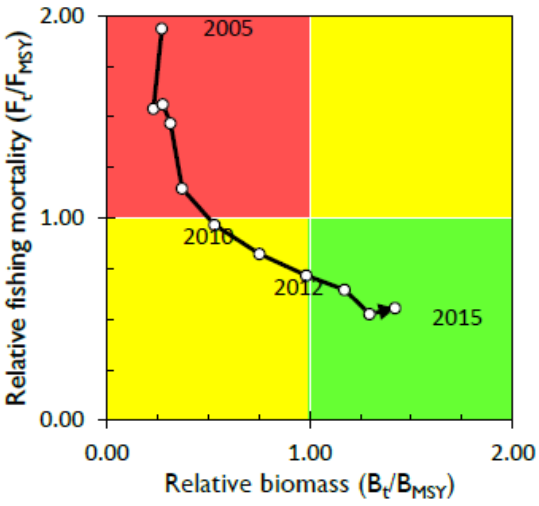
An estimation of the biomass abundance of small pelagic fish in the waters of Sulawesi Sea has been attempted based on the distribution of the target strength. Acoustic surveys were carried out in September 1982 and May 1983 under the FAO/CIDA Indonesian Fisheries Development Project (FAO, 1983), in August-September 2001 (Anonymous, 2001), and in May 2009 under research cooperation with the Southeast Asian Fisheries Development Center (SEAFDEC) (Sadhotomo et al., 2009).

As pelagic fish migrate from one place to another in search of suitable conditions for feeding and spawning, this abundance estimation provides a picture of fish biomass during the survey period of May 2009. It is likely that temporal variation in the pelagic biomass occurs in accordance with the changes in oceanographic conditions at each depth level. Based on this table, it can be interpreted that the pelagic fish biomass tends to form a school in the depth range from the surface to 50 m, while larger pelagic fish group in deeper waters (100-150 m).

The results of USAID Oceans' study, which analyzed data from 2005 to 2015, show that fishing pressure from the small pelagic fishery has been at a safe level since 2010. The small pelagic group is dominated by round scads (50%), of which the 'malalugis' (Decapterus macarellus) makes up the majority (76%). Other dominant small pelagic species groups are anchovies and trevallies, 13.7% and 10.5% respectively. Mackerels, sardines, garfish, flying fish and mullets make up the remaining less than 5% of small pelagic catch. The stock of small pelagics was shown to be in healthy

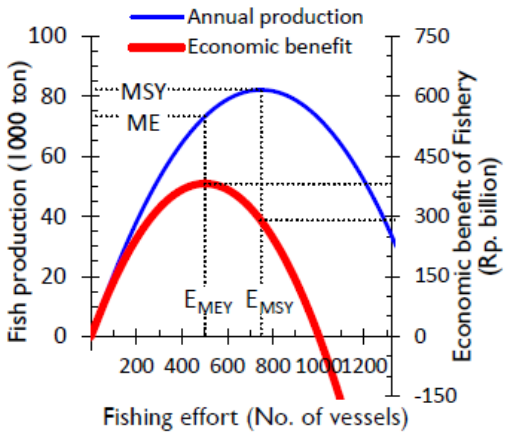
condition, recovering from its overexploitation in 2005 through 2012. Fishing mortality (F) and biomass (B) were estimated to be lower than F at MSY (F_{MSY}) and larger than B at MSY (B_{MSY}), respectively (Figure 2). Therefore, there is an opportunity to increase fishing activities that target small pelagic species to optimize economic profit and fish production.

Figure 2. Kobe plot of the status of small pelagic fish stock



The study also found that, since the profit and production curves are bell-shaped, the optimum levels of profit and production (MSY) are achieved when the levels of fishing effort are equal to 501 units and 747 units, respectively (Figure 3). (Note: one unit is equal to a unit of 20 m length vessel operating purse seine).

Figure 3. Production and economic profit according to level of fishing effort



Interaction between small pelagic and tuna –

The use of small pelagic fish for baitfish, such as roundscad, *D. macarellus*, bigeye scad *Selar crumenopthalmus*, spotted sardine (*Sardinella sirm*), with a small percentage of blue sardine (*S. clupeoides*), mackerels (*Rastrelliger kanagurta*) predominates, with the more estuarine *R. brachysoma* contributing in some areas *R. faughni*, mostly in skipjack pole and line fisheries and long line, have been reported by several authors (Sharma and Adams., 1989, MacInnes., 1989; Maniku et al., 1989). With this phenomena, it is likely small pelagic fish and tuna have a predator-prey relationship. Ecopath is onefish stock assessment model that is designed to obtain the long-term optimal and sustainable yields, based on the study of species interactions. In order to understand the effects of fishing, some management options could be tested. As reported by Jones (1982) in a study on the aspects of food and feeding habits, it can be predicted that in the development and growth of fish in general, an individual fish will need to feed in the form of other fish around 25% of its body weight. Thus, for the annual production of 1,000 tons tuna, approximately 250 tons of other fish—mostly small pelagics—must be consumed.

Table 2. Small pelagic fish production (tons) in FMA 716

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Average	%
Roundscads	29,133	23,604	26,069	31,984	28,479	34,647	36,052	38,094	39,302	34,376	32,174	49.6
Trevallies	5,294	3,979	5,076	4,140	5,775	6,967	7,821	8,033	9,037	11,872	6,799	10.5
Sardines	1,657	1,342	1,431	1,974	3,286	3,240	4,749	5,011	4,510	4,001	3,120	4.8
Chub Mackerel	2,349	1,746	2,376	1,965	5,005	5,130	5,628	2,616	1,873	4,380	3,307	5.1
Mullet	622	673	1,001	870	861	808	1,197	1,343	1,095	943	941	1.5
Anchovies	3,297	5,168	9,623	9,065	7,018	8,088	8,077	14,401	15,258	8,782	8,878	13.7
Torpedo-scad	118	122	143	114	170	114	125	132	298	151	149	0.2
Bigeye scad	21	29	184	159	404	411	389	185	403	757	294	0.5
Garfish	1,709	1,297	1,899	1,324	962	1,231	1,130	1,383	1,301	1,835	1,407	2.2
Flying fish	285	468	777	586	405	970	1,096	1,074	1,292	1,292	825	1.3
Indian mackerel	-	-	-	-	540	519	634	4,496	5,060	1,911	1,316	2.0
Others	6,102	13,746	4,679	5,816	3,830	7,015	5,692	4,942	1,403	2,759	5,598	8.6
Total	50,587	52,174	53,258	57,997	56,735	69,140	72,590	81,710	80,832	73,059	64,808	100.0

Source: DGCF, 2015

Composition of fish stocks –

SEAFDEC conducted a hydro-acoustic survey in the Sulawesi Sea in December 2014 aboard the M/V SEAFDEC 2, equipped with scientific echosounder Furuno FQ-80, and performed a large-scale acoustic survey of the western Sulawesi Sea and a small-scale survey in the form of the acoustic observations around FADs. The hydroacoustic survey started from the tip of Northeast Sulawesi (Manado) to the western part of FMA 716, close to the mouth of the Makassar straits. Higher fish densities were found from zero to 25 meters, with an abundance of 50 to 300 fish per 1,000 cubic meters. In general, the fish density found during this survey was relatively low (Table 3).

The acoustic observations around FADs, based on the observed target strength (TS), showed that small pelagic fish echo traces were detected from the surface down to 40m depth, dominated by fish <20cm length. Some large pelagic fish echoes were detected in water columns of 40-70m, with the size of fish ranging from 30-50cm length. The fish species were likely comprised of neritic, skipjack, and some large baby tuna that usually form a mixed school with skipjacks. This assessment was later confirmed with the fishers based in the Tumumpa Fish landing site of Manado, who reported that one week before the observation, the fishers caught approximately five tons of skipjack tuna in one trip fishing around this FAD.

Table 3. Estimated density of fish and standing stock size (biomass) of pelagic fish in the survey area in each depth stratum (Sadhotomo et al., 2009)

Strata (meter)	Density (fish/ 1000m^3)	Stock density (tons/km^2)		Biomass (tons)	
		Small pelagic	Large pelagic	Small pelagic	Large pelagic
0-50	30	1.6	2.1	48,159	64,721
51-100	3	0.2	0.7	6,296	21,427
101-150	13	1.0	1.1	29,954	32,526
Total	46	2.8	3.9	83,409	118,674
Mean	15	0.9	1.3		

In April 2015, SEAFDEC surveyed 30 kg of catch from handline fishers operating in a FAD-use area. The catch composition was 22% yellowfin tuna (*Thunnus albacares*), 61% skipjack (*Katsuwonus pelamis*), 16% *tongkol krai*/frigate tuna (*Auxis thazard*), and 1% of kawa-kawa (*Euthynnus affinis*). The size of fish caught ranged from 21-37 cm length.

Management Considerations –

Sustainable management of small pelagic fisheries is to obtained by controlling the fishing effort through limiting the number of units of medium-scale purse-seiners. The small pelagic fishing activity should be closed for one year when relative fishing mortality goes beyond safe stock abundance levels. Tables 4 and 5 provides the list of priority issues, operational objectives, and indicators. Tables 6 and 7 provide the proposed management actions/interventions.

Table 4. Results of Group Discussions: Ecological Well-Being Priority Issues, Operational Objectives, and Indicators

	Target Species			Issues	Operational Objectives	Indicator
1	Small pelagics	Scads (*Layang*)	13	Potential overfishing and illegal fishing in North Kalimantan by outside fishers	Managing the catch of local fishermen to address overfishing	Production control fishery
						CPUE
			15	Limited data on production and fishing effort	Improving availability of small pelagic fishery data	Proportion of fishing business actors submitting data as required by regulation (compliance to catch reporting)
2	Other fish stock	Anchovy	16	High demand but limited stock;	Initiation of anchovy fishery management	Anchovy catches
			17	Limited availability of production data and fishing effort	Increasing availability of pelagic anchovy fishery data of	Proportion of fishing business actors submitting data as required by regulation

Table 5. Results of Group Discussions: Ability to Achieve Governance Priority Issues, Operational Objectives, and Indicators

	Issues	Operational Objectives	Indicators
1	Limited availability of production data and small pelagic fishing	Increasing availability of small pelagic fishery data	Proportion of fishing business actors Submitting data as required using electronic logbooks
2	Limited availability of production data and anchovy fishing capacity	Increasing the availability of an anchovy fishery data	Proportion of fishing business actors submitting data as required using electronic logbooks

Table 6. Results of Group Discussions: Ecological Well-Being Priority Issues, Operational Objectives, Indicators, and Management Measures for Small Pelagics and Other Fish Stocks

No.	Target Species			Issues	Operational Objectives	Indicators	Management Measures
1	Small pelagics	Scads (*Layang*)	13	High demand for consumption and fish requirements so that potentially overfishing	Optimizing the catch of local fishermen	Production control fishery	Development and implement harvest control measure
						CPUE	Control of fishing effort
			15	Limited data on production and fishing effort	Improving availability of small pelagic fishery data	proportion of fishing business actors submitting data as required by regulation (compliance to catch reporting)	Requiring fishing business actors to submit data in accordance with the provisions on a regular basis
							Developing a catch documentation system documentation, complemented with other information as needed for fisheries management
2	Other fish stock	Anchovy	16	High demand but limited stock;	Initiation of anchovy fishery management	anchovy catches	Development and implementation of fishery management step
			17	Limited availability of production data and fishing effort	Increasing availability of pelagic anchovy fishery data of	proportion of fishing business actors submitting data as required by regulation	Requiring fishing business actors to submit data in accordance with provisions on a regular basis
							Developing a catch documentation systems, complemented with other information as needed for fisheries management

Table 7. Results of Group Discussions: Ability to Achieve Good Governance Priority Issues, Operational Objectives, Indicators, and Management Measures

Issue	Operational objectives	Indicator	Management measures
Limited availability of production data and small pelagic fishing	Increasing availability of small pelagic fishery data	Proportion of fishing business actors Submitting data as required using electronic logbooks	Obliging fishing business actors to submit data in accordance with regulation on a regular basis
			Developing a catch documentation system, complemented with other information as needed for fisheries management
Limited availability of production data and anchovy fishing capacity	Increasing the availability of an anchovy fishery data	Proportion of fishing business actors submitting data as required using electronic logbooks	Obliging fishing business actors to submit data in accordance with regulation on a regular basis
			Developing a catch documentation system, complemented with other information as needed for fisheries management

ANNEX II. LIST OF WORKSHOP PARTICIPANTS

List of participants to the June 21-23, 2017, Integrated Stakeholders Consultation Workshop, Manado Indonesia:

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ANNEX III. FMP716 INDICATORS AND BENCHMARKS

Ministerial Decree No.83/2016 on the FMP of FMA 716

INDICATORS AND BENCHMARKS

To ensure the success of achieving the above targets, indicators and benchmarks for small pelagic fish and demersal fish are established. Indicator is a measurable variable that can be monitored in determining the status of a fishery system at a certain time (FAO, 2003).

Indicators and benchmarks for achieving Goal 1: "realizing sustainable management of fish and habitat resources"

Table 12. Indicator and Benchmark of Goal 1

Target	Indicator	Benchmark
Availability of capture fisheries data that can meet the interests of fish resource management within five years	Capture fisheries data that can meet the interests of fish resource management	Capture fisheries data cannot meet the interests of fish resource management
The realization of the use of legal fishing gears/methods of more than 50% within five years	The number of ships using illegal fishing gears	More than 50% of ships use illegal fishing gears

Indicators and benchmarks for achieving goal 2: "increasing the economic and social benefits of sustainable fisheries for the welfare of the community"

Table 13. Indicator and Benchmark of Goal 2

Target	Indicator	Benchmark
Minimize conflicts between Andon (moving/migrate) fishermen and Andon site destination's fishermen within five years	Frequency of conflicts between Andon (moving/migrate) fishermen and Andon site destination's fishermen	Conflict often occur
As many as 5% of fishermen are able to implement good handling methods within five years	The number of fishermen who take part in training on good handling method	There are still few fishermen who take part in training on good handling method

Indicators and benchmarks for achieving goal 3: "active participation and stakeholder compliance in fisheries management"

Table 14. Indicator and Benchmark of Goal 3

Target	Indicator	Benchmark
Optimal management of FADs in accordance with statutory provisions within five years	The number of FADs managed optimally in accordance with the provisions of the legislation	Most FADs are not managed optimally in accordance with the provisions of the legislation

Table 15. Action Plan for Objective 1: "Resource Management Actualization of Sustainable Fish and Their Habitat"

No	Target	Action Plan	PIC	Time Plan
1.	The availability of capture fisheries data that can meet the interests of fish resource management within 5 (five) years	1. To improve facilities and infrastructures for collecting of capture fisheries data and fishing logbook	Directorate General of Capture Fisheries (DGCF) and local government	2016-2019
		2. To carry out technical guidance for collecting and processing of capture fisheries data	DGCF, Agency for Research of Human Resources Marine and Fisheries (ARHRMF /BPSDMKP) and local government	2016-2020
		3. To carry out technical guidance on filling the fishing logbook	DGCF, ARHRMF /BPSDMKP and local government	2016-2020
		4. To coordinate and validate capture fisheries statistics and fishing logbook	DGCF and local government	2016-2020
		5. To increase the number of data collection officers (enumerators) and fishing logbook officers	DGCF and local government	2016-2020
		6. To improve the data collection methodology according to fish resource management needs	DGCF and local government	2016-2020
		7. To carry out cooperation with related parties to provide capture fisheries data in accordance with fish resource management needs	DGCF and local government	2016-2020
2.	The realization of the use of legal fishing gears/ methods of more than 50% within 5 (five) years	1. To inventory of the use of fishing gear that is not in accordance with the laws and regulations	DGCF and local government	2016-2020
		2. To analyse of environmentally friendly fishing gear	Agency for Research and Development of Marine and Fisheries (ARDMF) and DGCF	2017-2020
		3. To carry out surveillance operations on activities that use fishing gears/ methods that are not in accordance	DG of Marine and Fisheries Resources Surveillance (DGMFRS /PSDKP) and local government	2016-2020

		with the laws and regulations		
		4. To evaluate the use of fishing gears/ methods	DGCF, PSDKP and local government	2016-2020
		5. To carry out a campaign on the use of legal fishing gears/ methods	DGCF, BPSDMKP and local government	2016-2020

Table 16. Action Plan for Objective 2: "Increased of economic and social benefits of sustainable fisheries for the community welfare"

No	Target	Action Plan	PIC	Time Plan
1.	Minimization of conflicts between Andon fishermen and Andon destination fishermen within 5 (five) years	1. Monitoring, evaluation, surveillance, and coaching of Andon fishermen	DGCF, DG of Marine and Fisheries Resources Surveillance (DGMFRS /DJPSDKP), and Local Government	2017-2020
		2. Revision of Regulation of Minister of Marine Affairs and Fisheries Number 36/PERMEN- KP/2014 on Andon Fishing	DGCF and Secretariat General (SG)	2016-2017
		3. Socialization of Regulation of Minister of Marine Affairs and Fisheries on Andon Fishing	DGCF and SG	2017-2020
		4. Implementation of Regulation of Minister of Marine Affairs and Fisheries on Andon Fishing	DGCF and Local Government	2017-2020
		5. Analysis of factors that cause the conflict of Andon fishermen and Andon destination fishermen	Agency for Research and Development of Marine and Fisheries (ARDMF), DGCF, and Local Government	2016-2017
2.	5% of fishermen are able to apply best practices of fish handling methods within 5 (five) years	1. Conduct training on best practices of fish handling for fishermen	DGCF, Agency for Research of Human Resources Marine and Fisheries (ARHRMF /BPSDMKP), and Local Government	2016-2020
		2. Socialization and coaching fishermen and officer at fish landing site for better practices of fish handling	DGCF, BPSDMPKP, DJPDSPKP, and Local Government	2016-2020
		3. Certification of fishing crew and carrier fish crew	DGCF and BPSDMPKP	2016-2020

Table 17. Action Plan for Objective 3: "Active participation and stakeholder compliance in fisheries management"

No	Target	Action Plan	PIC	Time Plan
1.	Optimal FADs management in accordance with the provisions of the Laws and Regulations within 5 (five) years	1. Revision of Regulation of Minister of Marine Affairs and Fisheries Number 26/PERMEN-KP/2014 on FADs	DGCF and Secretariat General (SG)	2016-2017
		2. Socialization of legislation on FADs	DGCF, SG, and Local Government	2017-2020
		3. Data collection and evaluation of status and distribution of FADs	DGCF, Agency for Research and Development of Marine and Fisheries (ARDMF) and Local Government	2016-2020
		4. FADs licensing (new and renewal) in accordance with evaluation results and provisions of the legislation	DGCF and Local Government	2017-2020
		5. Surveillance and law enforcement against private sectors that do not implement FADs regulation	DG of Marine and Fisheries Resources Surveillance (DGMFRS /DJPSDKP) and Local Government	2016-2020
		6. Encouraging the active role of Monitoring Community Group (POKMASWAS) in providing information regarding violation	DJPSDKP and Local Government	2016-2020