WEST PACIFIC EAST ASIA
OCEANIC FISHERIES MANAGEMENT

WPEA OFM

NATIONAL TUNA FISHERY PROFILE

On the CELEBES SEA (FMA -716) and PACIFIC OCEAN (FMA 717)

INDONESIA

NOVEMBER 2012

MINISTRY OF MARINE AFFAIRS AND FISHERIES
DIRECTORATE GENERAL FOR CAPTURE FISHERIES
JAKARTA
AND
WESTERN AND CENTRAL PACIFIC FISHERIES COMMISSION

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NATIONAL TUNA FISHERY PROFILE
FMA No. 716 and No. 717

DIRECTORATE OF FISHERIES RESOURCES
DIRECTORATE GENERAL OF
CAPTURE FISHERIES
MINISTRY OF MARINE AFFAIRS AND FISHERIES
2012

GLOSSARY

Fish resources	Renewable resources that include all types and species of finfish and other aquatic biota.
Fisher or fisherman	Someone who captures fish and/or other aquatic biota from a body of water, or gathers shellfish as a livelihood.
Fisheries Business License (SIUP)	A license authorizing a company (as the bearer) to conduct fisheries business using production facilities specified in the license.
Fisheries Management Area (FMA)	A defined area that is harmonized with administrative boundaries and designated for the management of select fisheries activities.
Fishing base	A base point (usually a fishing port or fish landing base) for fishing vessels to dock and land their catches.
Fishing fleet	An aggregate of commercial fishing vessels. The term may be used for all vessels operating out of a particular port, all vessels engaged in a particular type of fishing (e.g., tuna fishing fleet), all vessels engaged in a particular type of gear (e.g., sardine purse seine fleet), or all fishing vessels of a country or region (modified from *Wikipedia*).
Fishing gear productivity	The effectiveness of fishing gear measured as a ratio between the amount of catch (by the gear) and the number of fishing trips completed to obtain that amount of catch.
Fishing ground	An area in a body of water where fishes congregate and fishing is usually good; prompting fishers to operate and catch fish here (modified from *Merriam- Webster Dictionary*).
Fishing license (SIPI)	A license authorizing a fishing vessel (as the bearer) to fish. SIPI license is compulsory and is an integral part of the Fisheries Business License (SIUP).
Fishing port or Fish Landing Centre	A port or harbour for landing and distributing fish and is a base that provides various services for fishing activities.
Fishing trip	A measure of activity of a fishing fleet (or a fishing vessel, whichever is applicable) that starts off from a fishing base and then back to the fishing base.
Fishing vessel	A boat or ship used to catch fish in the sea, on a lake or river; as well as to support ancillary fisheries activities.
Full-time fishers	Fishers who spend all of their working time for fishing.
High seas	All parts of the sea that are not included in the territorial sea or in the internal waters of a State (UN Convention on the High Seas, 1958). In the case of Indonesia, these are parts of the sea that are not included in Indonesia's Economic Exclusive Zone (IEEZ), Indonesia's territorial seas, Indonesia's archipelagic waters and inland waters of Indonesia.
Length-at-first-maturity	Mean length at which fish of a given population develop ripe gonads for the first time (*FishBase*).
Little Tuna or Small Tunas	Refers to *Euthynnus affinis*.
Low season	The period of time when the amount of fish landed is very low.
Part-time (major) fishers	Fishers who spend a majority of their working time for fishing.
Part-time (minor) fishers	Fishers who spend a minor part of their working time for fishing.

Peak season	The period of time when the amount of fish landed is at the highest point (i.e., glut).
Production volume	Also known as ‘landed catch’, is the amount of catches landed expressed in units of weight. Usually, this only includes reported landed catch.
Production values	Also known as ‘landed values’, are the values of reported landed catch expressed in Indonesian Rupiah.
Ship visits	The frequency of ship visits to land catches at a fishing port or fish landing centre.
Size of vessel	Dimension of a vessel which is expressed in gross tonnage (GT) unit.
Tuna or Main Tuna	Fishes of the Family Scombridae, Order Perciformes (perch-likes); in this report it refers to Yellowfin Tuna (*Thunnus albacares*), Bigeye Tuna (*Thunnus obesus*), and Albacore Tuna (*Thunnus alalunga*).

Summary

Introduction

Tuna fisheries are major contributors of foreign exchange earnings in Indonesia. They are considered as the mainstay of Indonesia's fisheries export, after shrimps and seaweed. In Indonesia Fisheries Book 2009, stated that Indonesia marine capture fisheries production was about 4.73 million tonnes, with production value reaches Rp 39,807,632,713.000. In which the biggest production number were Eastern little tuna (0.400 million tonnes), Skipjack tuna (0.302 million tonnes) and other tunas (0.192 million tonnes), or 11.77% from total national marine capture fisheries production,

Indonesia is one of the countries that have interest in the Western and Central Pacific Fisheries Commission (WCPFC) membership. Although Indonesia's involvement at WCPFC has only been as cooperating non-member (CNN), it is considered important for Indonesia to do periodic reviews on the tuna fisheries in areas that are associated with the WCPFC convention areas. These periodic reviews are needed to provide accurate picture on the tuna fisheries and tuna stock status that are managed by WCPFC, as well as providing insights on the impact of these fisheries on the other species, particularly on the protected species (e.g., sharks, rays and turtles), and the ecologically-related species (ERS). Indonesia's marine region that is associated with the WCPFC convention areas falls into two (2) Fisheries Management Areas (FMA): FMA 716 and FMA 717.

The objectives of this report are threefold: (1) to provide comprehensive information about tuna fisheries in FMA 716 and FMA 717; (2) to update tuna fisheries data in areas associated with the WCPFC convention areas; and (3) as a baseline data for the preparation of Annual Tuna Fisheries Report to WCPFC.

General Information

There are five provinces included in these two FMAs: North Sulawesi, Gorontalo, North Maluku, Papua and West Papua. All of these provinces are located in eastern Indonesia and together they form the largest center of tuna fisheries industry in the country. Tuna production volume from these five provinces amounted to 323,969 tonnes, or equivalent to 59.85% of the total national tuna production (processed from Capture Fisheries Statistics Data of Indonesia, 2009).

Tuna Fisheries Activities

The numbers of fishing fleets that operate in the provinces adjacent to WCPFC convention areas during 2000 – 2009 tend to increase. The highest increase occurred during 2001-2002 in almost all of sizes of vessel, from 30 GT up to 300 GT, with the majority of fishing vessels were from the size category of less than 100 GT (74.74%).

There are numerous types of primary fishing gear that are used to catch tunas, and these vary depend on the region. In North Sulawesi, the primary fishing gear for tuna and skipjack tuna are purse seine, pole and line, hand line and troll line. In Maluku, they are pole and line, long line, and troll line. Meanwhile, in Sorong (West Papua Province), troll line, purse seine, hand line, and gill net are used to catch tuna, skipjack, and little tuna. Based on the number of fishing gear used during the period of 2000 - 2009, troll line always dominate every year. From 2004 - 2009, pole and line, and troll line have decreased in numbers, while other fishing gear (purse seine and long line) have increased in numbers. During this period, fishing trips were dominated by troll line and pole and line. This is because these two types of fishing gear have shorter fishing days compared to other fishing gear. Generally speaking, the

number of fishing trips during 2004 – 2009 tends to increase. The highest increases in fishing trips were from purse seine and long line.

Tuna fisheries activities in Indonesia occur throughout the year, however there are different fishing seasons, and they depend on the fishing grounds. Until 1990, skipjack fishing grounds frequented by fishers in North Sulawesi were still below 30 miles from the coast line; however, since 1991 the fishing grounds have expanded and gone further afield. Fishing grounds for pole and line vessels who are based in PPS (*Pelabuhan Perikanan Samudera*, or Oceanic Fishing Port) Bitung in North Sulawesi operate around Halmahera Sea (in North Maluku) and in Sulawesi Sea.

Annual tuna catch during the period of 2000 - 2009 were dominated by skipjack. In total, total catch of all tuna tend to increase. When we see each species of tuna that were caught in the last three years (2007 – 2009), the highest increase occurred in Bigeye tuna (from 4,081 tonnes [2007], to 8,157 tonnes [2009], an increase of 99.88%). Next is Yellowfin tuna (from 27,712 tonnes [2007] to 39,299 tonnes [2009], or an increase of 41.81%) and Skipjack (from 68,118 tonnes [2007] to 75,381 tonnes [2009], or an increase of 10.66%).

Catch composition by category or groups and types of fish for the last ten years shows that total catch of main tuna - in this report refers to Yellowfin Tuna (*Thunnus albacares*), Bigeye Tuna (*Thunnus obesus*), and Albacore Tuna (*Thunnus alalunga*) - tend to have a reduction in proportion, while proportion of small tuna (Refers to *Euthynnus affinis*) tend to increase in the catch composition. Proportion of Seerfish group and others group in FMA 716 are relatively stable in catch composition; meanwhile, in FMA 717 they tend to have small increase.

Based on catch composition by fishing gear type, yellowfin tuna dominated the catches of longline and handline. The composition of purse seine catch is similar with that of pole and line catch, and that is dominated by skipjack tuna. The overall catch composition trend tends to have two different patterns. Yellowfin tuna catch increased up to 2003, and then fluctuated, and returned to sharp increase in 2008. As for Bigeye tuna, it is a bit different. Highest catch increase for Bigeye tuna occurred in 2008, then in 2009 slightly declined. Of all four fishing gear, only purse seine that catches all species of tuna (skipjack, yellowfin tuna and bigeye tuna).

Fisheries Infrastructure

Indonesia's fishing ports are classified into four types, namely Oceanic Fishing Port (OFP, or *PPS, Pelabuhan Perikanan Samudera*), Archipelagic Fishing Port (AFP, or *PPN, Pelabuhan Perikanan Nusantara*), Coastal Fishing Port (CFP, or *PPP, Pelabuhan Perikanan Pantai*), and Fish Landing Centre (FLC, or *PPI, Pusat Pendaratan Ikan*). These ports are categorized based on the size of vessels that it can accommodate, the geographical range of fishing activities of those vessels, and the volume of fish landings that routinely occur at the respective ports. In the provinces that are adjacent to the Pacific Ocean, there are 1 OFP, 1 AFP, 5 CFP and more than 20 FLC which are distributed in five provinces.

Of the 14 fishing ports in North Sulawesi, the fishing base (port/centre) for the vessels that operate in and around the Pacific Ocean are in Bitung OFP and 4 FLCs (Tumumpa FLC, Kema FLC, Belang FLC, and Amurang FLC).

Market and Processing

In Gorontalo, North Maluku, Papua, West Papua, and North Sulawesi provinces, tuna are sold fresh and in processed form. According to results of *Susenas*[1] (2008) household absorption for tuna fish,

[1] *SUSENAS (Survei Sosial-Ekonomi Nasional)*, or the National Socioeconomic Survey is a series of large-scale multi-purpose socioeconomic surveys initiated in 1963-1964 and fielded every year or two since then. Since 1993, SUSENAS surveys cover a nationally representative sample typically composed of 200,000 households. Each

little tuna, and skipjack in these 5 provinces are in fresh form (76,731.20 tonnes), processed form (4,929.09 tonnes) and salted form (1,904.67 tonnes), respectively. Therefore, in total the household tuna absorption amounted to 86,564.96 tonnes. Of these 5 provinces, the biggest absorption for fresh and processed tuna comes from North Sulawesi, while for salted tuna comes from North Maluku. Nevertheless, despite being the largest center of tuna fisheries industry in the country, the absorption of tuna in each of these 5 provinces is very small compared to the tuna absorption of other provinces in Indonesia. The greatest absorption of tuna in Indonesia comes from East Java Province, which is 61,176 tonnes of fresh tunas; 89,057.23 tonnes of salted tunas, and 77,928.16 tonnes of processed tunas.

Among 5 provinces which face with Pacific Ocean, export marketing of tunas only done in North Sulawesi and Maluku. In North Sulawesi, export done in fresh, frozen, and processed form, while in Maluku only in frozen form. Species of tunas which marketed through those 2 provinces consist of yellowfin tuna, skipjack, and other tunas, whereas albacore isn't exported through those 2 provinces, but through Surabaya. Total export for those 2 provinces is 58,894.22 ton with 57,697 ton come from North Sulawesi and 1,196.26 ton come from Maluku. The contribution of those 2 provinces in national tuna export is quiet big, which is 44.77% from national total export.

Fisheries Socio-Economic Characters

The number of fishers in 2000 was recorded at 453,451 persons, and then increased to 536,296 persons in 2009, these consists of 174,787 persons of full-time fishers, 149,885 persons of major part-time fishers and 93,286 persons of minor part-time fishers. Compared with data in 2008, two categories of fishers have increased sharply: full-time fishers (43.07%), and major part-time fishers (32.67%). All in all, the increase of the number of fishers in the last two years (2008 – 2009) constituted the highest increase in the last 10 years.

The increase of tuna production for the period of 2000-2009 have resulted in the increased of production values for tuna. The lowest tuna production value occurred in 2000, while the highest production value occurred in 2006. Along with the decreasing of total tuna production, the total tuna production value in 2009 also experiencing a decrease compared to previous year.

The contribution of fisheries sub-sector towards the economy of Bitung City shows that the fisheries sub-sector had fulfilled the (fish) needs of the local economy, and even is able to export through Bitung City. The contribution of capture fisheries towards the exports in Bitung City for the period of 2000 – 2007 is also high, i.e., 34.26% from the total export value of Bitung City. Capture fisheries in Bitung City had proven to be useful in eliminating unemployment, as it contributed towards 15.68% of the workforce.

Fisheries Management

In regards to the management of high-sea fisheries, Indonesia have had a set of laws and institutions and have prepared a variety of regulations and policies to support the forming and strengthening of related institutions. These regulations and policies include Ministerial Regulation (*Permen*), Ministerial Decree (*Kepmen*), and other policies. These institutional strengthening are then followed-up by the forming of competent authorities by MMAF (Ministry of Marine Affairs and Fisheries) such as, the National Committee on Fish Resources Assessment (*Komisi Nasional Pengkajian*

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survey contains a core questionnaire which consists of a household roster listing the sex, age, marital status, and educational attainment of all household members, supplemented by modules covering about 60,000 households that are rotated over time to collection additional information such as health care and nutrition, household income and expenditure, and labor force experience (Source: http://www.rand.org/labor/bps/susenas.html).

Sumberdaya Ikan or KOMNAS KAJISKAN) and the Quality Assurance Authority (*Otoritas Penjaminan Mutu*). Besides government institutions, from private sector there is an association of fisheries entrepreneurs under the umbrella of GAPPINDO (*Gabungan Pengusaha Perikanan Indonesia*, or Indonesian Fishery Federation), in which one of their goals is to instill awareness to preserve nature.

Problems in Indonesian tuna fisheries can be categorized into two categories: capture issues, and trade issues. Under the category of capture issues in tuna fisheries, illegal fishing by fishers from other countries is rampant, whereas trade issues consist of problems surrounding import duty tariff, environmental issues and ecolabeling.

Rules on conservation and fish resources management in UNCLOS have been adopted by UNIA agreement. UNIA agreement has also been adopted in the Act No. 31/2004 pertaining to Fisheries. Regulations that have not been adopted should be considered in drafting the regulations on conservation and fisheries management in high sea waters, especially in WCPFC convention area. The rationale behind this is because management principles and actions adopted by WCPFC should be applied in national policies for the management of highly migratory fish stocks in the areas under the jurisdiction of archipelagic nation.

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1.1 Background

Tuna fisheries are major contributors of foreign exchange earnings in Indonesia. They are considered as the mainstay of Indonesia's fisheries export, after shrimps and seaweed. In Indonesia Fisheries Book 2009, stated that Indonesia marine capture fisheries production was about 4.73 million tonnes, with production value reaches Rp 39,807,632,713.000. In which the biggest production number were Eastern little tuna (0.400 million tonnes), Skipjack tuna (0.302 million tonnes) and other tunas (0.192 million tonnes), or 11.77% from total national marine capture fisheries production.

Tunas are widely but sparsely distributed throughout the Pacific Ocean, the Atlantic Ocean, and other oceans of the world. Their ability to have long-distance migration across several countries' maritime boundaries (*highly migratory species)* has put tuna in a situation where it needs to be managed collectively by these countries at regional scale. Collaboration to collectively manage tuna fisheries resources is needed because overfishing of tuna in one country may cause a problem or adverse effects onto the tuna stock in another country. This common interest amongst countries in tuna fisheries management encourages the forming of regional fisheries organization known as *Regional Fisheries Management Organization* (RFMO). RFMO as inter-countries fisheries managing body started to evolve in 1960s (Satria *et al*, 2009). The intention to collaborate emerged after there was awareness that fishery capture activities in one country will affect the status of fishery resources in other countries, thereby affecting the respective capture fisheries that utilize the same fish resources. If every country race to increase their fish production, either by increasing fishing effort or catch capacity, fish resources in general will be severely impacted and threatened, causing the sustainability of fisheries industry to be in danger.

1.2 Membership of Indonesia in Regional Fisheries Management Organization (RFMO)

Currently there are a numbers of RFMO. However, only five tuna RFMOs which have jurisdictional areas that are in direct contact with Indonesia's interest at the Indonesia's Economic Exclusive Zone (IEEZ), namely IOTC (*Indian Ocean Tuna Commission*), CCSBT *(Commission for the Conservation of Southern Bluefin Tuna*), WCPFC *(Western and Central Pacific Fisheries Commission*), IATTC (*Inter-America Tropical Tuna Commission*) and ICCAT (*International Commission for the Conservation of Atlantic Tuna*) (Fig 1.1). The geographical positions of the country members in an RFMO generally are not always in close proximity to the RFMO managed areas. These occur because the primary factor for RFMO membership is not the geographical location of the country in question, but rather, the location of fisheries capture activities carried out by the fishers from the RFMO country members. Rules in each RFMO demands consistency and commitment from their country members to obey the agreements or rules which have been made. The rules were properly made with many purposes. However, the main purposes are the sustainability of fisheries resources and consumers protection.

There are two important aspects about the authority of RFMO: rules, and determination of total allowable catch and quota allocation for each member of RFMO (Mc Dorman, 2005, *cited in* Satria, 2009). The rules are necessary to maintain orderliness in the management of tuna in the regions and to create harmony between regional and country-based rules.

In the central and western part of the Pacific Ocean which border directly with Indonesia, countries in this region have agreed to form *Western and Central Pacific Fisheries Commission* (*WCPFC*). *WCPFC* is a regional fisheries organization which was formed in the high seas part of the Western and Central Pacific Ocean, in regards to the fisheries management for highly migratory species.

In 2004, Indonesia officially became a WCPFC member with a Cooperating Non-Member (CNM) status up to 2006. The extension of this status continues annually from 2007 throughout 2010.

Therefore, by 2011, Indonesia remains to be a CNM in WCPFC. *This status has rendered Indonesia not to have a strong role in decision making processes during meetings conducted by WCPFC.* In the 2010 annual meeting in Honolulu, the Commission Council had hoped that in 2012, Indonesia would be willing to improve its status to *Member* (Fisheries Management Organization Regional Policy Analysis Report/RFMO WCPFC – Directorate of Fisheries Resources, 2010). As part of the international community, Indonesia tries to obey the prevailing international laws, including regulations on capture fisheries in open sea, such as the feasibility of fishing vessels and the compliance of those vessels to the prevailing management and conservation rules and regulations.

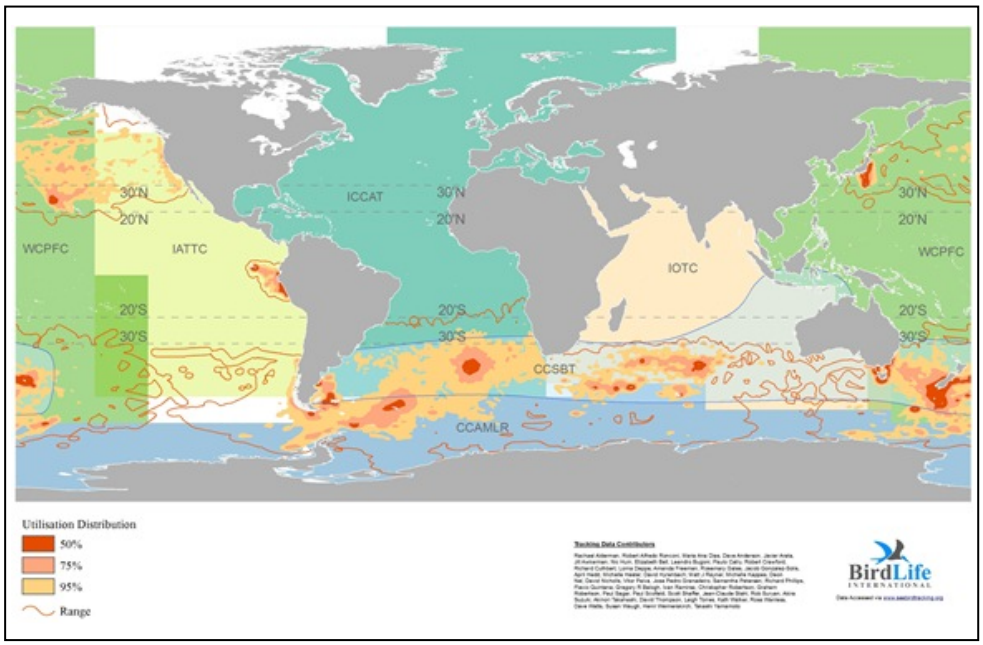


Fig. 1.1. Map of 13 RFMO authority areas in the world
(*Source: Bird Life International, 2008*)

Indonesia's membership status in RFMO is very important, especially to gain the benefits deriving from the Ratification of UNIA 1995, as seen on the Explanation of the Law Number 21, Year 2009 : (1) To get accurate fisheries data and information easily and on-time through data and information exchange mechanism amongst country members; (2) To get fish resources allocation for straddling fish stocks species and highly migratory stocks species through international quota establishment; (3) To get access rights and opportunities to participate in utilizing the fish potentials in high seas; (4) To get special treatments as a developing country, such as getting financial aids, technical helps, technology transfer supports, scientific research supports, surveillance aids, and law enforcement supports; (5) To strengthen Indonesia's position in international fisheries organization fora; (6) To reaffirm Indonesia's sovereignty rights related to fish resources management within Indonesia's Exclusive Economic Zone; and (7) To strengthen the implementation of regional agreements in fish resources management. All of those benefits are also benefits of being a member in the WCPFC.

One of the benefits that can be obtained by becoming a member in the WCPFC is the facilitation of getting accurate and precise information and data exchange amongst member states and the technology

transfer for developing countries in relation to the conservation of fish resources in central and western Pacific Ocean. In order to exchange information about fisheries data, regular observation and evaluation towards tuna fisheries in the areas related to WCPFC Convention Area is needed; and this is presented in the form of Report on the Tuna Fishery Profile in the convention area. The profile report is needed to get accurate picture of the capture fisheries activities and the stock status of the tuna fisheries resources managed by WCPFC and the effect of those fisheries resources utilization towards other fish species, particularly protected species (such as some shark species, rays and turtles), and fish species categorized under the Ecologically Related Species group.

According to the Ministerial Regulation (*PerMen*) No. 01/2009 of the Ministry of Marine Affairs and Fisheries (MMAF) of the Republic of Indonesia, the Fisheries Management Areas (FMAs) within Indonesia's seas are divided into 11 FMAs (Fig. 1.2). Of those 11 FMAs, there are 2 FMAs which are adjacent to the western and central part of the Pacific Ocean; these are FMA 716 (Sulawesi Sea and northern Halmahera Island) and FMA 717 (Cendrawasih Bay and the Pacific Ocean).

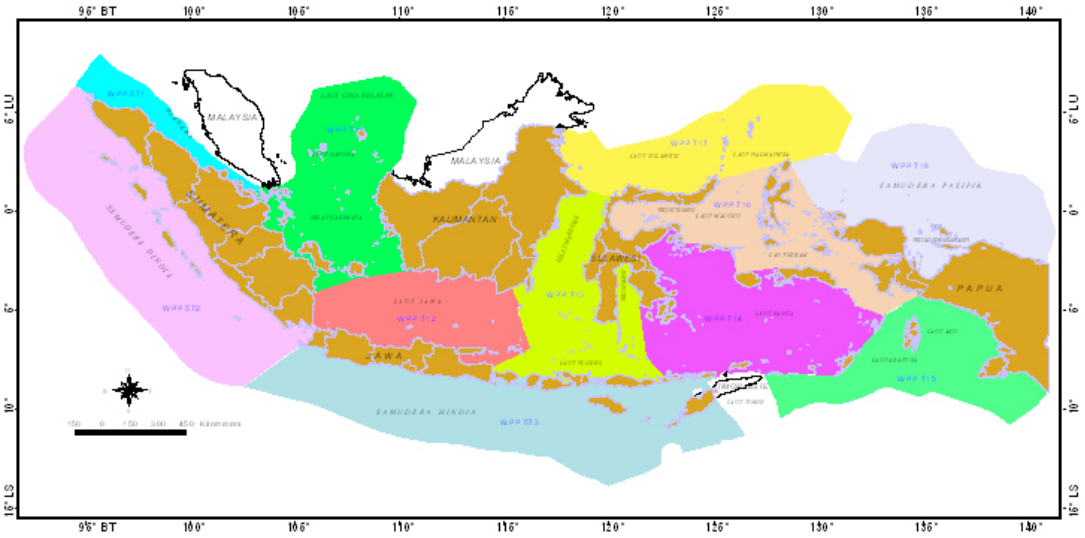


Figure 1.2. Map of Indonesia's Fisheries Management Areas
(Source: Ministerial Regulation (PerMen) No. 01/2009, Ministry of Marine Affairs and Fisheries (MMAF) of the Republic of Indonesia.

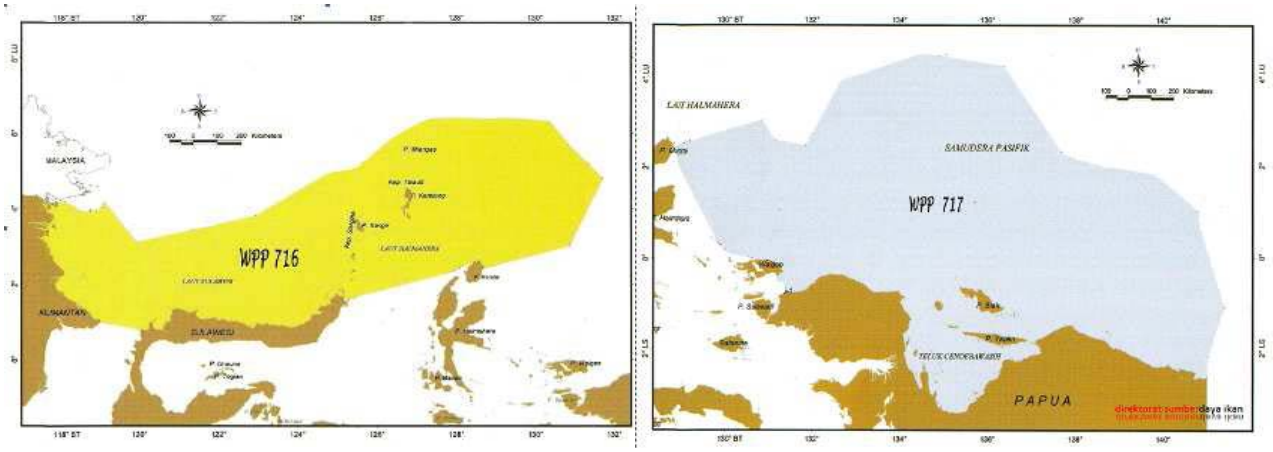
1.3 Objectives

The objectives of this report are as follows:

1. To provide comprehensive information about tuna fisheries in FMAs No. 716 and No. 717;
2. To update tuna fisheries data in the areas related to WCPFC Convention Area; and
3. As a baseline for the preparation of the Annual Tuna Fisheries Report to WCPFC.

II. GENERAL INFORMATION

Geographically speaking, the Pacific Ocean borders with several regions in Indonesia: North Sulawesi Province, Gorontalo (the Municipality of North Gorontalo), North Maluku Province (North Halmahera Regency), Papua Province (Biak Numfor), and West Papua Province. According to the Ministerial Regulation (*PerMen*) No. PER 01/2009, the Fisheries Management Areas (FMAs) within Indonesia's seas are divided into 11 FMAs. Several provinces that are adjacent to the central and western Pacific Ocean are included in two FMAs; these are FMA 716 (Sulawesi Sea and Northern Halmahera Island) and FMA 717 (Cendrawasih Bay and the Pacific Ocean) (Fig. 2.1). These waters lie within the boundaries of 0.7511 – 6.4211 North Latitude and 118.1222 – 131.3964 East Longitude coordinates (FMA 716) and 4.2575 North Latitude – 3.357 South Latitude and 128.6939 – 141.4 East Longitude coordinates (FMA 717). As a whole, the boundary limit of these two FMAs is 6.4211 North Latitude – 3.357 South Latitude and 118.1222 – 141.4 East Longitude. Therefore, as constrained by these geographical positions, the data which will be used in this report will concentrate from these two FMAs only, namely FMA 716 (that includes North Sulawesi Province, Gorontalo Province, and parts of North Maluku Province) and FMA 717 (that includes parts of North Maluku Province, Papua Province and West Papua Province)



A. FMA 716, includes 5 provinces:
East Kalimantan (5 regencies),
North Sulawesi (8 regencies),
Gorontalo (1 regency),
Central Sulawesi (2 regencies)
North Malukua (2 regencies)

B. FMA 717, includes 3 provinces:
North Maluku (2 regencies),
West Papua (5 regencies),
Papua (10 regencies)

Figure 2.1 Fisheries Management Area (FMA) No. 716 and No. 717 (*source: PER 01 MEN 2009*). *Note: the bold letters indicate provinces that are directly adjacent to the Pacific Ocean*

2.1 Natural Condition

The condition of the resources in the areas that are adjacent to the Pacific Ocean is herein described using the information of the resources condition in the Halmahera Sea. The water mass of the Halmahera Sea stems from the southern Pacific Ocean which moves to Halmahera Sea through the northern coastal waters of Papua Island in shallow layer (thermocline layer) which is indicated by its maximum salinity. Under the maximum salinity layer there is a water mass layer from the northern

Pacific which moves to southern direction and enters Sulawesi Sea into deep layer. According to this geographical fact, the character of this marine region is the character of oceanic origin which is presumed to come from various locations in the northern or western Pacific Ocean (Hadikusumah, 2010).

2.1.1 Temperature

The temperature of the surface layer varied between 29.0 – 30.1 ^{O}C, the seasonal and annual variation of the surface temperature is less than 1.5 ^{O}C (Qu *et al.*, 2005). This range of water temperature reflects the natural condition of tropical waters.

The vertical distribution of the temperature shows the existence of water mass stratification. The surface layer is well-mixed as indicated by warmer temperature that reaches as deep as 50m. Under the well-mixed surface layer, there is a thermocline layer where the temperature declines fast as the depth increases. The bottom limit of the thermocline layer lies at 250m in depth and temperature varies between 28.0 ^{O}C at the top limit to 13.0 ^{O}C at the bottom limit. The temperature would continue to decline up to 7 ^{O}C at 500m in depth. The horizontal distribution of temperature shows that the temperature varies between 29.0 – 30.1 ^{O}C (DGCF, 2001).

2.1.2 Salinity

Halmahera Sea water mass is highly-saline with 34.988 psu of maximum salinity. There are two different kinds of water mass that ranges from the surface all the way to approx. 700m deep. The surface water mass (depth < 185m) has low salinity (32 psu), while at a depth range of > 185m, a high salinity water mass is found. Maximum salinity (34.65 psu) can still be found at a depth of > 164m (DGCF, 2001).

2.1.3 Current

The current in the Halmahera Sea waters varies between 0.30 - 74.34 cm/sec. Based on the mooring current data recorded during the period of 1993 - 1994 by the Cooperation Programme between ASEAN and Australia in the Halmahera Sea, it shows that the average maximum current is found highest (25.95 cm/sec) at the depth of 428m in February. Compare this to the current (19.42 cm/sec) at a depth of 720m in December and the lowest flow rate (16.90 cm/sec) at a depth of 912m, also in December.

2.1.4 Tidal Patterns

According to Wyrtki (1961), the tidal patterns in the Western Pacific Ocean and most of the waters in Eastern Indonesia, including the waters surrounding Halmahera Island and Morotai Island is a mixed tide, prevailing semi-diurnal. Tide forecast shows that the tidal range in the waters surrounding Morotai Island is around 0.5 m (neap tide) – 1.4 m (spring tide).

2.2. Tuna Resources

Significant development in tuna fishing industry occurs in Eastern Indonesia that includes North Sulawesi, Maluku, and Papua. National Capture Fisheries Statistics Data of 2009 shows that the percentage of tuna and skipjack production volume in those provinces is estimated at 323,969 tonnes or 59.85% of the total national tuna production. The central of tuna capture fishing industry in Eastern Indonesia is located at Sulawesi (Bitung, Luwuk, Kendari, and Kolaka), Maluku (Ternate, Labuha,

Ambon, and Banda), Papua (Sorong, Biak, and Manokwari) and East Nusa Tenggara (Maumere) (Sala, 1999).

Table 2.1 The main tuna production in the provinces adjacent to WCPFC convention area in FMA 716 and FMA 717 in 2009

(unit: tonnes)

Coastal area	Province	Skipjack tuna	Albacore	Yellowfin tuna	Bigeye tuna
North Sulawesi	**Subtotal**	90,607	15,901	29,561	24,843
	North Sulawesi	60,891	15,191	23,268	18,199
	Gorontalo	9,708	-	3,434	5,010
	Central Sulawesi	20,008	710	2,859	1,634
Maluku-Papua	**Subtotal**	126,011	1,867	30,954	4,225
	Maluku	50,872	-	7,961	2,329
	North Maluku	56,619	-	13,116	-
	Papua	13,762	25	5,964	-
	West Papua	4,758	1,842	3,913	1,896
Total		**216,618**	**17,768**	**60,515**	**29,068**
National		**338,034**	**25,621**	**11,4163**	**62,844**

Source: Capture Fisheries Statistics of Indonesia, 2009
Note: - : Data is not available

The estimation of tuna and skipjack stocks has been done since 1984 with the tagging experiment in Eastern Indonesia to 10,000 tunas and skipjack in the area. The tagged fish were recaptured in Eastern Indonesian waters and in the western Pacific Ocean. This experiment shows that the tuna and skipjack stocks in Eastern Indonesia are also parts of international tuna stocks (Research Center of Capture Fisheries, 2006).

In 1991, a stock assessment exercise was carried out in Eastern Indonesian waters, including in North Sulawesi waters. Results show that tuna and skipjack fisheries can be developed moderately, estimated at 35% (Saila and Uktoselja, 1991 *in* Research Center for Capture Fisheries, 2006). Another stock assessment was repeated in 1999, and results show that the tuna and skipjack fisheries in North Sulawesi waters had experienced an overfishing (Nurhakim and Badrudin, 1999; Merta and Gafa, 1999; Widodo and Susanto, 1999 *in* Research Center of Capture Fisheries 2006). The latest stock assessment was completed in 2005. Tuna exploitation rate in Sulawesi Sea and the Pacific Ocean shows that the exploitation rate in the area had reached 87.54%. Looking at the sequence of stock assessment exercise, it appears that the tuna fisheries resources in the area is decreasing from year to year. The latest data indicates that in 2009, the total production of tuna had decreased by 16.83% compared to previous year (Indonesia Capture Fisheries Statistics, 2009).

The assessment of the tuna stock status is also based on the length frequency distribution of tuna landed in Bitung Fishing Port (PRPT, 2006). Measurement results indicate that captured tuna and skipjack are still small in size (under L_m), more than 50% of catches in select months. The length-at-first maturity (L*maturity* or L_m) of some species of tuna are presented in table below:

Table 2.2 Length at first maturity (L_m) of tunas

Indonesian Name	English Name	Lm (cm)
Cakalang	Skipjack tuna	45 [1)]
Albakora	Albacore	94[4)]
Madidihang	Yellowfin tuna	55 [1)]
Tuna mata besar	Bigeye tuna	132 – 139 FL[2)]; 133.5 – 137.9 FL[3)]

Explanation:

1) Source: Research Center of Capture Fisheries (2006)

2) Indian Ocean 3) Banda Sea; Source: Faizah 2010

4) Source : Ecological Matrix, Fishbase

Note: FL or 'Fork Length' refers to the length from the tip of the snout to the end of the middle caudal fin rays and is used in fishes in which it is difficult to tell where the vertebral column ends (FishBase).

III TUNA FISHERIES ACTIVITIES

The main data used for this chapter is derived from the Statistics Database of Marine Capture Fisheries by Fisheries Management Area (FMA) 2000-2004, 2003-2007, and 2004-2008. If certain data is unavailable in those records, data will be sourced from the Annual Report of Capture Fisheries Statistics of Indonesia, and extracted from the provinces that are adjacent to the Pacific Ocean: North Sulawesi, Gorontalo, Maluku, North Maluku, Papua, and West Papua. The rationale of using those data is also supported by the information provided in the Statistics of Marine Capture Fisheries by FMA. In the latter report, it is recorded that the fish landed in North Sulawesi originated from Seram Sea and Tomini Bay, as well as Sulawesi Sea and the Pacific Ocean. Meanwhile, the fish landed in Gorontalo originated from Seram Sea and Tomini Bay, as well as Sulawesi Sea and the Pacific Ocean; in Maluku the landed fish are recorded from the Banda Sea, Seram Sea, and Tomini Bay, as well as Arafura Sea, Sulawesi Sea and the Pacific Ocean; in Northern Maluku, the landed fish are recorded from Seram Sea, Tomini Bay, Arafura Sea as well as Sulawesi Sea and the Pacific Ocean; and in Papua the landed fish are recorded to have originated from Banda Sea, Sulawesi Sea, the Pacific Ocean and the Arafura Sea.

Statistics of Marine Capture Fisheries by FMA does not include data of the number of total fleets, total fishing gear, and total fishing trip. Therefore, all of these data are taken from the Annual Report of Capture Fisheries Statistics of Indonesia of the provinces noted above. Total catch data are acquired from a workshop held by the Directorate of Fisheries Resources in 2012.

3.1 Fishing fleets

Based on the number of fishing fleets, most of fishing vessel units that operate in the provinces adjacent to the WCPFC Convention Area during the period of 2000-2009 has experienced an increase in numbers. The highest increase occurred during 2001 - 2002 in almost all sizes of vessel, from 30GT to 300GT. However, looking at the size of vessels used, records show that the majority (74.74%) of fishing vessels that operate during the same period are those of less than 100 GT in size.

In 2009, there were 1,403 units of fishing vessels, dominated (80.04%) by those of less than 100 GT. Compared to the previous year (2008), the number of large (> 300 GT) fishing vessels in 2009 experienced a decline in number. In fact, the fishing vessels of 200 – 300 GT in size had experienced a drastic sharp decline since 2004. Meanwhile, vessels of 30 – 200 GT experienced a sharp increase (e.g., for 30 – 50 GT class, it increased from 78 (2008) to 248 (2009); for 50 – 100 GT class, it increased from 246 (2008) to 565 (2009); and for 100 – 200 GT class, it increased from 102 (2008) to 184 (2009)). This situation is prominent in FMA 717 (Cendrawasih Bay and the Pacific Ocean).

Table 3.1. Number of fishing fleets by size of boats in coastal areas adjacent to the WCPFC Convention Area (FMAs 716 and 717)

Unit: units

Year	Size of Boat (GT)							
	20-30	30-50	50-100	100-200	200-300	300-500	500-1000	≥ 1000
2000	333	402	278	342	238 *)	0	0	-
2001	349	17	81	22	10	6	1	-
2002	362	302	520	420	202	1	1	-
2003	394	328	457	366	270	20	0	-
2004	346	28	102	25	23	3	2	-
2005	339	42	157	34	26	4	2	-
2006	323	51	167	42	35	13	2	-
2007	343	56	165	60	52	15	4	-
2008	358	73	246	102	64	39	6	1

Year	Size of Boat (GT)							
	20-30	**30-50**	**50-100**	**100-200**	**200-300**	**300-500**	**500-1000**	**≥ 1000**
2009	310	248	565	184	70	23	3	-

Source : Directorate General of Capture Fisheries 2000-2009 (estimated)
Note: [*)] : ≥ 200 GT

3.2 Fishing gear

The fishing gears that are used to catch tuna in Eastern Indonesia vary, either traditional or modern in design. There are seven types of tuna fishing gear in Indonesia: long line, hand line, troll line, purse seine, pole and line, gill net, and kite (*sensu* kite fishing).

The primary fishing gear operated to catch tuna varies between areas. In North Sulawesi, purse seine, pole and line, hand line, and troll line are primarily operated to catch tuna and skipjack. In Maluku, the primary fishing gear operated to catch tuna and skipjack are pole and line, long line, and troll line. Capture activities with long line and pole and line are mainly operated by fishing industry/company; meanwhile, troll line is mainly operated by artisanal tuna fisheries. The main species target of long line is large tuna, such as yellowfin tuna and bigeye tuna. On the other hand, the species target of pole and line is skipjack, while species targets of troll line are skipjack, little tuna, and yellowfin tuna (Winarso, 2004).

Pole and line is the fishing gear to catch skipjack in and around of Sorong waters area. Catch composition of pole and line by species in Sorong are 52.76 – 65.33 % skipjack, 20.23 – 29.88 % yellowfin tuna, and 8.49 – 17.37 % other fishes. Whereas, the catch composition of hand line/troll line is 8.60% skipjack, 91.1% yellowfin tuna, and 0.3% other fishes.

The negatively skewed catch composition in hand line/troll line towards skipjack is because the troll line is only a sideline gear for skipjack, whereas its main target is to catch large tuna (PKSPL-IPB, 2006). Below are the five primary types of fishing gear used to catch various species of tunas during the period of 2000 to 2009.

Table 3.2. The four most important fishing gear to catch tunas in the coastal areas that are adjacent to the WCPFC Convention Area (FMAs 716 and 717).

Year	Number of fishing units based on types of fishing gear (units)			
	Purse Seine (*Pukat Cincin*)	**Long Line (*Rawai Tuna*)**	**Pole and Line (*Huhate*)**	**Troll Line (*Pancing tonda*)**
2000	1,202	601	1,124	23,529
2001	1,229	473	1,380	23,684
2002	1,232	550	1,279	13,814
2003	1,091	776	1,605	16,168
2004	1,227	1,111	3,657	26,909
2005	1,397	1,001	1,271	14,956
2006	1,539	1,078	1,416	16,402
2007	1,593	965	1,728	15,127
2008	1,852	1,034	1,762	14,840
2009	1,675	1,139	1,547	17,042

Source : Processed from Capture Fisheries Statistic of Indonesia 2000-2009;
Note: "-" = No data

The table above represents a summary of the number of fishing gear in the coastal waters of FMA 716 and FMA 717. Based on the data presented in the table above, during the period of 2000 – 2009, troll line is always the most dominant fishing gear in each year. Until 2003, the number of toll line

significantly dominated (more than 80% of total fishing gear in that year alone). During the period of 2004 – 2009, troll line still dominated although it had declined to around 50% of total fishing gear.

The development of fishing gear in the recent 5 years (2004-2009) indicated that pole and line and troll line decreased in number, while other fishing gear (purse seine and long line) increased. The increasing number of purse seine and long line in FMA 716 and FMA 717 (as compared to total fishing gear) is based on the fact that these two fishing gear were the most dominant tuna fishing gear in Bitung Port.

During the 10-year period of 2000-2009, a much different condition can be seen in 2001 - 2003. During 2001-2003, the number of long line, pole and line, and troll line units had a sharp increase (20% to >100%) in numbers. After 2003, the unit numbers fluctuated, but in general it tended to increase. Sharp increase of fishing gear in 2004, is possibly due to development programs such as *PROTEKAN*[2] *2003* and *Gerbang Mina Bahari*[3], in support of fisheries revitalization programs proclaimed by the President in 2005 as an effort to improve the welfare of fishing communities, especially fishers.

If we observe each FMA, we would see a very different picture for pole and line units in FMA 716 (Sulawesi Sea and northern Halmahera Island). The number of this gear had a significant sharp increase in 2004. There were very high additions of units in 2003 – 2004, from 260 units (2003) to 2,910 units (2004) (Appendix 1 and 2). In 2005, this gear had a drastic reduction down to 509 units and after that; the number was quite stable throughout.

The number s of fishing trip from each of these four types of fishing gear during the 10-year period (2000-2009) are presented in Table 3.3.

Table 3.3. Number of fishing trips of the four most important tuna fishing gear in the coastal areas adjacent to the WCPFC Convention Area (FMAs 716 and 717).

Year	Number of fishing units based on the type of fishing gear (unit)			
	Purse Seine (*Pukat Cincin*)	Long Line (*Rawai Tuna*)	Pole and Line (*Huhate*)	Troll Line (*Pancing tonda*)
2000	No data	No data	No data	No data
2001	No data	No data	No data	No data
2002	107,796	23,239	154,214	1,372,278
2003	133,203	44,562	181,487	1,410,048
2004	172,661	60,698	120,950	1,751,361
2005	209,395	121,038	137,419	1,258,739
2006	168,212	67,901	115,241	442,097
2007	211,160	79,517	158,616	1,439,500
2008	212,786	105,887	151,262	1,646,359
2009	247,661	123,748	156,824	1,443,849

Source : computed from the Fisheries Statistic Indonesia, 2000-2009 – MMAF.

[2] *PROTEKAN* is an acronym of "***Pro****gram* ***Te****knologi Peri****kan****an*" or Fisheries Technology Program.

[3] *Gerbang Mina Bahari* (*Gerbang* = Gate, *Mina* = fish, *Bahari* = Ocean; literally meant to mean 'The Gate of Marine Fish') is a national development program in the marine affairs and fisheries sector, proclaimed by the President in 2003. The program is designed to be integrated, synergized, and focuses on continuity, driven by all sectors of society supported by three main marine economic pillars: fisheries (i.e., aquaculture and capture), marine tourism, and marine transportation.

During 2002 – 2009, fishing trips were dominated by troll line, and pole and line. Average number of fishing trips of these two fishing gear combined was about 80-90% of the total fishing trips of all types of tuna fishing gear. This is understandable because when compared with the long lines, each of troll line and pole and line has a shorter number of fishing days per trip, allowing them to do more fishing trips every year.

Based on its development, the number of fishing trips during the period of 2004 – 2009 is increasing. The highest number of fishing trips was for troll line. In the last couple of years (2008 – 2009) of the period, troll line experienced a reduction (12.3%) of fishing trip.

Significant increase of fishing trips was experienced by troll line during 2006 – 2007, from 442,097 trips (2006) to 1,439,500 trips (2007), an increase of 225.61%. As for long line, the highest increase (99.41%) of fishing trips occurred during 2004-2005 from 60,698 to 121,038 trips. Nevertheless, in 2006, *troll line* experienced a drastic *reduction* (65%) in fishing trips, compared to previous fishing trips, down to 442,097 trips. The sharp decrease in *in all gear* fishing trips in 2006 was probably related with the President Statute on illegal fishing (prepared in 2005). It can be deduced from this trend that the Presidential Statute only allows units that have legal licenses to operate.

3.3 Fishing season

Tuna fisheries activities in Indonesia occur throughout the year; however there are different fishing seasons, depend on the fishing area. In Morotai waters which is adjacent to the Pacific Ocean (particularly northern and western coast of Morotai), tuna fishing season lasts from April to August (in northern coast) and from June to December (in western coast). In the waters surrounding Bitung (North Sulawesi), skipjack can be caught throughout the year (Kekenusa, J.S., 2006). Skipjack fishing seasons usually occur twice a year and reaches their peak in March – April and slightly lower peak in October – November. The lowest yield obtained on December. Studies showed that skipjack fishing seasons around Bitung occur during April – June and September – November (Kekenusa, 2006). Empirical evidence noted from the production volume of PN Perikani Aertembaga in Bitung, North Sulawesi showed that the total catch of skipjack reached its maximum during April and July, but decreasing steadily until reaching its lowest points in December and January (Uktoselja, J.C.B., 1997).

Seasonality of skipjack fishing around Bitung are divided into 4 phases: (1) Fishing Season I (April-June), with June as the peak season, (2) Fishing Season II (September-November), with November as the peak season, (3) Non-Fishing Season I (July – May), with the lowest in May, and (4) Non-Fishing Season II (December – March), with the lowest in January. In December, total skipjack catch tend to decrease due to the west monsoon that is prominent with rough waves, so there are less number of fishing trips (Kekenusa, 2006).

In the north of Sorong Regency, which is also adjacent to the Pacific Ocean, skipjack fishing activities also occur throughout the year; however, there are fluctuations of yield due to seasonality effects. According to the analysis of the monthly capture report from pole and line vessels, the patterns of skipjack fishing season in waters surrounding Sorong are April - July, and September - October. The peaks of the seasons occur in May and October, where production volume increases by 16% and 63%, respectively, from the monthly average production. The patterns of skipjack fishing season are related with the existence of seasonality that happens in Indonesia. Non-fishing season in Sorong waters in February and August occur because of west monsoon season and south-east monsoon season, respectively. In those seasons, weather and the seas are very rough to ply, making it very difficult for fishing activities. Below are fishing seasons for every fishing area:

Table 3.4. Tuna fishing seasons according to fishing area

Description	Fishing Area			
	Sorong[1)]	Around Bitung – North Sulawesi [2)]	Morotai – North Maluku [3)]	
			North	West
Fishing activity	Throughout the year	Throughout the year	Throughout the year	Throughout the year
Peak season	May , October	(1) June (2) November	-	-
Low season	February, August	(1) July– May, lowest in May (2) December – March, lowest in Januari	-	-

Notes:

1) Source : Sala, R. (2000)
2) Source : Kekenusa, J,S. (2006)
3) Source : PKSPL (2005)
- Data not available

3.4 Fishing ground

One of the most important fishing grounds for tuna in Indonesia is in Eastern of Indonesia, which are North Sulawesi waters and the surrounding areas.

Until 1990, skipjack fishing ground by fishers in North Sulawesi was still below 30 miles from the coast line (Kekenusa J.S., 2006). However, since 1991 the fishing ground have become farther offshore in IEEZ, and occur around "*rumpon*" (FADs, Fish Aggregating Device) that belong to national company which cooperate with foreign company. Factors affecting the changes of fishing grounds for pole and line (*huhate*) vessels in 1992 in North Sulawesi are: (1) the increase of fishing effort by pole and line fisheries, (2) fishing pressure by using purse seine, and (3) natural factor, which is the increase of sea water temperature to 30 ^{o}C, as a result of long dry season (Gafa, B., I.G.S. Merta, H.R. Barus, dan E.M. Amin, 1993, *cited in* Kekenusa J.S., 2006).

Fishing grounds for Bitung-based pole and line vessels are around Halmahera Sea (North Maluku) and Sulawesi Sea. These pole and line vessels usually operate around FADs (Research Center of Capture Fisheries, 2006). As for purse seine vessels, the fishing grounds are not around Sulawesi Sea, but in Maluku Sea and above Manggole Island. The yield from purse seine shows that these fishing grounds are potential to be developed, because the average catch per unit of effort is 10.2 tonnes/day (Research Center of Capture Fisheries, 2006).

3.5 Catches

The catch data used in this report are derived from the Sub-Directorate Statistics of the MMAF. The data stems from tuna production estimates in FMAs 716 and 717 which had been discussed during the workshop held by the Directorate of Fisheries Resources. Available data include by-species production data (Skipjack, Yellowfin, Bigeye and Albacore), and by-species production data splitted by fishing gear.

3.5.1 Total Annual Catch

Time series catch data in the WCPFC area for FMAs 716 and 717 in the last 10 years is shown in table below. Trend of total catch during the period of 2000-2009 showed that tuna production fluctuates from year to year. Production increased in 2001 – 2006, then declined in 2007 and in the years that followed after that, production fluctuated. During that period, the highest production was reached in 2009 with 122,837 tonnes; meanwhile the lowest production occurred in 2000 at 30,608 tonnes.

Based on the annual catch record throughout 2000 - 2009, skipjack has always dominated. Total skipjack catch increased sharply up to 2003 (annual increase rate of 29 – 56%). Since 2004 up to the most recent year (2009), the total catch of skipjack is relatively stable and by 2009 it experienced an increase of 10%, compared to previous years (from 68,761 tonnes in 2008, to 75,381 tonnes in 2009).

In total, total catch of all tuna tend to increase. When we see each species of tuna that were caught in the last three years (2007 – 2009), the highest increase occurred in Bigeye tuna (from 4,081 tonnes [2007], to 8,157 tonnes [2009], an increase of 99.88%). Next is Yellowfin tuna (from 27,712 tonnes [2007] to 39,299 tonnes [2009], or an increase of 41.81%) and Skipjack (from 68,118 tonnes [2007] to 75,381 tonnes [2009], or an increase of 10.66%).

Table 3.5. Total tuna catch in FMAs 716 and 717

Year	Total catch estimation (tonnes)			Total
	Skipjack Tuna (*Cakalang*)	**Yellowfin Tuna (*Madidihang*)**	**Bigeye Tuna (*Tuna Mata Besar*)**	
2000	20,759	8,357	1,492	30,608
2001	26,759	10,773	1,924	39,456
2002	41,761	16,812	3,002	61,575
2003	61,600	24,799	4,429	90,828
2004	62,292	25,077	4,478	91,847
2005	62,422	30,751	4,814	97,987
2006	73,196	24,509	5,723	103,428
2007	68,118	27,712	4,081	99,911
2008	68,761	26,839	6,574	102,174
2009	75,381	39,299	8,157	122,837
Average: 2007-2009	70,753	31,283	6,271	108,307

Source: Sub-Directorate Statistics, Directorate of Fisheries Resources,2012

3.5.2 Catch composition

3.5.2.1. Catch composition by species

The standard norm in reporting catch composition to RFMO is to have the total tuna catch categorized by species as per the standards of species categories managed by respective Regional Fisheries Management Organizations (IOTC, CCSBT, WCPFC). Nevertheless, the data that we have are not categorized based on the standards outlined by these RFMOs. Therefore, some adjustments are made to make them as close as possible to the standards outline by RFMOs.

In Indonesia's fisheries statistics 1999-2003, tuna species (yellowfin, bigeye, southern bluefin, and albacore), together with billfish are reported as an aggregated single category, "Tuna". Small tunas are reported as an aggregated single category, "Eastern Little Tuna (*Tongkol*)". In other Indonesia's

fisheries-related reports, “Tuna” are often differentiated as large tunas (*Thunnus spp*. – yellowfin, bigeye, southern bluefin tuna, and albacore), and tuna-like species (marlins, sailfish, and swordfish). Skipjack tuna are usually reported as a distinct group “*Cakalang*”. Meanwhile, “*Tongkol*” are generally includes the Eastern Little Tuna (*Euthynus* spp.), the Frigate and Bullet tunas (*Auxis spp*.), and the Longtail Tuna (*Thunnus tonggol*). “*Tenggiri*” or mackerel (*Scomberomorus spp*.) also includes narrow barred king mackerel (*Scomberomorus commerson*) and Indo-Pacific king mackerel (*Scomberomorus guttatus*). Based on the adjustment that we have outlined above, the adjusted categories of species and total annual catch are presented in the following tables.

Table 3.6 Annual total catch, by species and categories in the FMA 716 (Main tuna, Billfish/tuna-like species, Small tunas/neritic tunas, Seerfish, Others).

Category	Species			Annual Production Volume (tonnes)									
				2000	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**
Main Tuna	**Main Tunas Total**			**920**	**11,678**	**19,027**	**61,594**	**43,182**	**63,698**	**76,095**	**62,854**	**75,020**	**63,616**
	Skipjack Tuna	*Katsuwonus pelamis*	*Cakalang*	603	8,331	13,055	38,005	15,934	37,894	50,257	40,984	44,195	35,648
	Yellowfin Tuna	*Thunnus albacares*	*Madidihang*	317	3,347	5,972	23,589	9,193	97,04	9,195	11,193	13,421	9,424
	Bigeye Tuna	*Thunnus obessus*	*Tuna Mata Besar*				No data	12,801	7,936	9,000	6,183	9,665	9,785
	Albacore Tuna	*Thunnus alalunga*	*Albakora*				No data	5,254	8,164	7,643	4,494	7,739	8,759
	Billfish Total			No data	No data	No data	No data	**57**	**93**	**186**	**287**	**191**	**735**
Billfish/ tuna-like species	Swordfish	*Xiphias gladius*	*Ikan Pedang, Todak*	No data	No data	No data	No data	No data	No data	No data	1	3	No data
	Black Marlin	*Makaira indica*	*Setuhuk Hitam*	No data	No data	No data	No data	21	3	19	63	21	74
	Indo-Pacific Sailfish	*Istiophorus orientalis*	*Ikan Layaran, Geulang, Payung*	No data	No data	No data	No data	36	90	167	223	167	661
Small tunas/neritic tunas	**Small tunas Total**			**215**	**536**	**9,192**	**13,081**	**15,076**	**18,047**	**20,021**	**18,711**	**17,970**	**53,210**
	Longtail Tuna	*Thunnus tonggol*	*Tongkol Abu-abu*	No data	No data	No data	No data	8,964	12,226	12,027	9,974	11,061	33,896
	Frigate (Mackerel) Tuna	*Auxis thazard*	*Tongkol Krai*	No data	No data	No data	No data	2,935	4,678	5,116	6,928	3,690	17,139

Category	Species			Annual Production Volume (tonnes)									
				2000	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**
	Kawa-kawa/ Eastern little tuna	*Euthynus spp*	*Tongkol Komo*	215	536	9,192	13,081	3,177	1,143	2,878	1,809	3,219	2,125
Seerfish	**Seerfish Total**			**8**	**26**	**225**	**189**	**428**	**1,799**	**1,346**	**1,984**	**1,533**	**1,637**
	Narrow-barred Spanish Mackarel	*Scomberomorus commerson*	*Tenggiri, Calong*	6	26	225	189	428	1,732	1,118	1,683	1,249	1,629
	Indo-Pacific King Mackarel	*Scomberomorus guttatus*	*Tenggiri Papan*	2	No data	No data	No data	No data	67	228	301	284	8
	Others Total			**100**	**198**	**1,462**	**1,817**	**1,273**	**1,616**	**1,564**	**1,508**	**1,588**	**1,004**
Others	Sharks	4 species		100	147	1,407	1,771	1,245	1,197	967	998	955	968
	Rays	3 species		No data	51	9	15	5	419	591	451	54	23
	Total Marine Turtle			No data	51	9	15	5	1	3	3	3	3
Total				**1,243**	**12,438**	**29,906**	**76,681**	**60,016**	**85,253**	**99,212**	**85,344**	**96,302**	**120,202**

Source: Statistics of Marine Capture Fisheries by FMA, 2000-2004, 2003-2007, and 2004-2008; and Capture Fisheries Statistics of Indonesia, 2009 (processed).

Table 3.7 Annual total catch, by species and categories in the FMA 717 (Main tuna, Billfish/tuna-like species, Small tunas/neritic tunas, Seerfish, Others)

Category	Species			Annual Production Volume (tonnes)									
				2000	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**
Main Tuna	**Main Tunas Total**			**28,625**	**26,080**	**40,447**	**27,214**	**35,321**	**42,037**	**34,537**	**44,206**	**34,919**	**26,194**
	Skipjack Tuna	*Katsuwonus pelamis*	*Cakalang*	17,255	15,291	22,868	14,782	15,138	27,329	25,461	30,024	24,566	17,984
	Yellowfin Tuna	*Thunnus albacares*	*Madidihang*	11,370	10,789	17,579	12,432	17,540	14,635	9,019	14,158	10,293	7,749
	Bigeye Tuna	*Thunnus obessus*	*Tuna Mata Besar*				No data	2,643	51	33	No data	34	411
	Albacore Tuna	*Thunnus alalunga*	*Albakora*				No data		22	24	24	26	50
	Billfish Total			**2,817**	**2,532**	**1,216**	**3,030**	**29**	**12**	**5**	**17**	**43**	**780**
Billfish/ tuna-like species	Swordfish	*Xiphias gladius*	*Ikan Pedang, Todak*	2,817	2,532	1,216	3,030	4	No data	No data	No data	2	No data
	Black Marlin	*Makaira indica*	*Setuhuk Hitam*	No data	No data	No data	No data	21	2	1	No data	No data	No data
	Indo-Pacific Sailfish	*Istiophorus orientalis*	*Ikan Layaran, Geulang, Payung*	No data	No data	No data	No data	4	10	4	17	41	780
	Small tunas Total			**3,199**	**2,320**	**2,513**	**1,494**	**106**	**3,792**	**4,087**	**4,820**	**5,693**	**6,004**
Small tunas/neritic tunas	Longtail Tuna	*Thunnus tonggol*	*Tongkol Abu-abu*	No data	No data	No data	No data	88	20	No data	No data	No data	No data
	Frigate (Mackarel) Tuna	*Auxis thazard*	*Tongkol Krai*	No data	No data	No data	No data	No data	541	1,887	2,132	1,416	No data

Category	Species			Annual Production Volume (tonnes)									
				2000	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**
	Kawa-kawa/Eastern little tuna	*Euthynus spp*	*Tongkol Komo*	3,199	2,320	2,513	1,494	18	3,231	2,200	2,688	4,277	6,004
	Seerfish Total			**6,489**	**7,544**	**4,135**	**4,938**	**1,887**	**2,640**	**2,729**	**3,301**	**5,266**	**14,655**
Seerfish	Narrow-barred Spanish Mackerel	*Scomberomorus commerson*	*Tenggiri, Calong*	5,529	6707	3386	4,799	665	1,851	2,130	2,414	4,678	13,858
	Indo-Pacific King Mackerel	*Scomberomorus guttatus*	*Tenggiri Papan*	960	837	749	139	1,222	789	599	887	588	797
	Others Total			**165**	**418**	**574**	**527**	**1,212**	**1,708**	**1,343**	**1,487**	**2,697**	**3,776**
Others	Sharks	4 species						717	1,193	933	1,102	2,441	3,459
	Rays	3 species		165	402	574	527	495	515	410	385	244	317
	Total Marine Turtle			No data	16	No data	No data	No data	No data	No data	No data	12	No data
Total				**41,295**	**38,894**	**48,885**	**37,203**	**38,555**	**50,189**	**42,701**	**53,831**	**48,618**	**51,409**

Source: Statistics of Marine Capture Fisheries by FMA, 2000-2004, 2003-2007,and 2004-2008; Capture Fisheries Statistics of Indonesia, 2009 (processed).

The tables above presented the catch composition by category (or group) and by species for the last recent 10 years (2000 – 2009). Due to the fact that pre-2004 data are incomplete, the catch composition is only analyzed from 2004 and onwards. In both FMAs (716 and 717) it is evident that the total catch of main tuna showed a declining proportion trend over the years; on the contrary, small tuna proportions are increasing over the years. Proportion of Seerfish group and Others group in FMA 716 are relatively stable in the overall catch composition, while in FMA 717 they tend to have small increases. The compositions of total catch for each group are presented in the following stack-diagram figures.

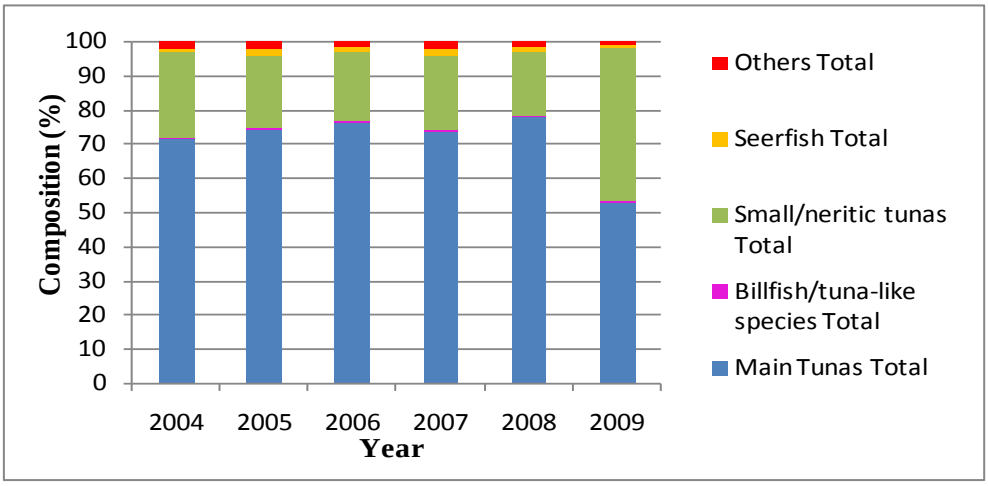


Fig. 3.1 Total catch composition by fish category in FMA 716

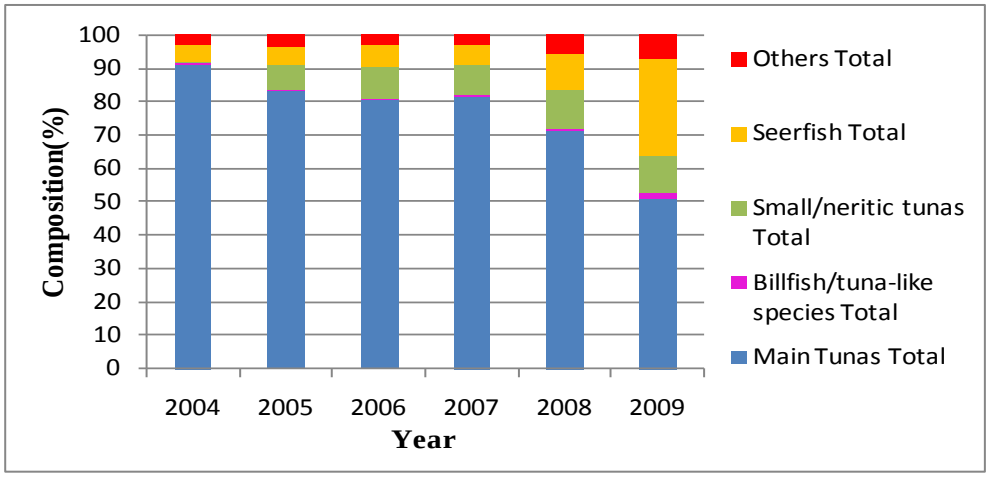


Fig 3.2 Total catch composition by fish category in FMA 717

3.5.2.2 Catch composition by gear type

Catch composition by fishing gear are presented in Fig. 3.3 and Table 3.8. The catch composition is only presented for three species of tuna because catch composition for other species by fishing gear is unavailable.

During the period of 2000-2009, average catch composition of hand line and long line were dominated by yellowfin tuna. On the other hand, skipjack tuna dominated in both pole and line and purse seine catch composition. The catch composition pattern of purse seine follows the catch composition pattern of pole and line, which is dominated by skipjack tuna.

The development of catches per fishing gear type during the period of 2000 – 2009 had shown a similar pattern (Table 3.8). Yellowfin tuna catch increased up to 2003, then fluctuated, and return to increase sharply in 2008. As for Bigeye tuna, it is a bit different. It has the highest increase in

2008, then decline slightly in 2009. Of all four gear types, only purse seine catches all species of tuna (skipjack, yellowfin tuna and big eye tuna).

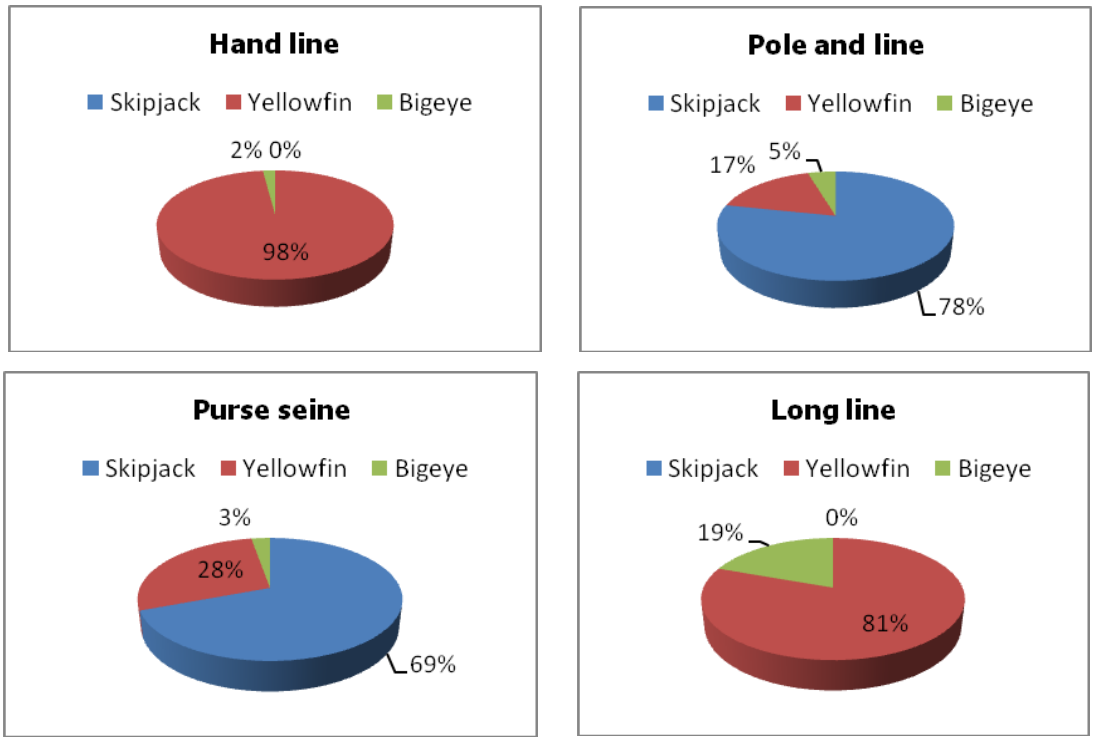


Fig. 3.3 Average catch composition by fishing gear, 2005-2009

Table 3.8. Catch composition by gear types in FMAs 716 and 717

Fishing Gear	Tuna species	Annual production (tonnes)										Average (2005-2009)	Catch composition (%)
		2000	2001	2002	2003	2004	2005	2006	2007	2008	2009		
Handline	Skipjack	0	0	0	0	0	0	0	0	0	0	0	0
	Yellowfin	398	513	800	1.180	1,194	1,393	1,384	1,147	1,097	3,256	1,655.4	98
	Bigeye	8	10	16	24	24	28	28	23	35	33	29,4	2
	Total	**406**	**523**	**816**	**1,204**	**1,218**	**1,421**	**1,412**	**1,170**	**1,132**	**3,289**	**1,684.8**	
Pole and line	Skipjack	8,414	10,846	16,926	24,967	24,247	22,209	28,385	28,064	30,448	23,339	26,489	78
	Yellowfin	1,827	2,355	3,675	5,421	5,482	6,581	5,166	5,332	4,590	6,045	5,542.8	16
	Bigeye	484	624	975	1,438	1,454	1,606	1,673	1,250	1,855	2,515	1,779.8	5
	Total	**10,725**	**13,825**	**21,576**	**31,826**	**31,183**	**30,396**	**35,224**	**34,646**	**36,893**	**31,899**	**33,811.6**	
Purse Seine	Skipjack	6,560	8,456	13,197	19,466	19,684	22,163	25,223	21,022	19,131	28,559	23,219.6	71
	Yellowfin	2,662	3,432	5,356	7,900	7,989	10,873	7,237	9,653	7,218	6,591	8,314.4	26
	Bigeye	259	334	521	769	778	968	1,000	734	1,089	1,465	1,051.2	3
	Total	**9,481**	**12,222**	**19,074**	**28,135**	**28,451**	**34,004**	**33,460**	**31,409**	**27,438**	**36,615**	**32,585.2**	
Long line	Skipjack	0	0	0	0	0	0	0	0	0	0	0	0
	Yellowfin	3,104	4,001	6,243	9,209	9,313	10,762	9,482	10,371	12,689	18,221	12,305	81
	Bigeye	731	942	1,470	2,168	2,192	2,202	3,011	1,993	3,579	4,000	2,957	19
	Total	**3,835**	**4,943**	**7,713**	**11,377**	**11,505**	**12,964**	**12,493**	**12,364**	**16,268**	**22,221**	**15,262**	

Source: Sub-Directorate Statistics, Directorate of Fisheries Resources, 2012

IV. FISHERIES INFRASTRUCTURE

4.1 Port (landing places)

Fishing ports are parts of Indonesia's fisheries system that provide various services for fisheries activities in order to manage the resources. According to Article 4 of the *Ministerial Decree No. 16/MEN/2006* (pertaining to Fishing Port), it is stipulated that fishing ports provide function as a supporting system of fisheries management and its resources, including pre-production, production, post-harvesting, and marketing. Indonesia's fishing ports are classified into four types, namely Ocean Fishing Port (OFP, or *PPS, Pelabuhan Perikanan Samudra*), Archipelagic Fishing Port (AFP, or *PPN, Pelabuhan Perikanan Nusantara*), Coastal Fishing Port (CFP, or *PPP, Pelabuhan Perikanan Pantai*), and Fish Landing Centre (FLC, or *PPI, Pusat Pendaratan Ikan*). The ports are categorized according to the size of vessels that they can accommodate, the geographical range of fishing activities of the vessels, and the volume of fish landings that routinely occur at the ports. In the provinces that are adjacent to the Pacific Ocean, there are several fishing ports fallen under those port categories, although not all of them can accommodate vessels that operate in the Pacific Ocean (Table 4.1):

Table 4.1 Fishing ports in provinces adjacent to the Pacific Ocean

Province	Number of Fishing Port by Category			
	OFP - 2008[1)]	AFP - 2008[1)]	CFP - 2010[2)]	FLC - 2010[2)]
North Sulawesi	1	0	2	11
North Maluku	0	1	1	11
Gorontalo	0	0	1	8
North Papua	0	0	1	18
Papua	0	0	0	19

Source: 1) Indonesian Fishing Ports, 2009
2) Fishing Port Information Centre-MMAF

Of all fourteen fishing ports in North Sulawesi, the fishing bases (ports/centres) for vessels that operate around the Pacific Ocean are in Bitung OFP and 4 FLCs (Tumumpa FLC, Kema FLC, Belang FLC, and Amurang FLC) (Fisheries and Marine Agency of North Sulawesi *cited in* MMAF, 2010). The fishing vessels that are based in North Maluku and Gorontalo fishing ports are of less than 100GT; therefore, they are incapable of plying and operating in the Pacific Ocean. Meanwhile, the fishing ports in West Papua are not visited by vessels that operate in the Pacific Ocean. This is probably because of the damages that occur in the main facilities of the ports (Fisheries and Marine Agency of West Papua, 2010).

4.2 Services and Facilities

4.2.1 Bitung Oceanic Fishing Port - North Sulawesi

- **Port facilities**

Bitung Fishing Port is one of the existing oceanic fishing ports in eastern part of Indonesia. The port is located on the northern coast of Sulawesi Island, close to Bitung Development Zone and Bitung Container Port, and is adjacent to the Pacific Ocean. The facilities in this fishing port are as follows:

Table 4.2. Facilities in Bitung Oceanic Fishing Port, Year 2008

No.	Volume	Volume	Unit
A.	**MAIN FACILITIES**		
1.	Pier-1	1,764	m^2
2.	Pier-2	63	m^2
3.	Roads surrounding the port complex	2,400	m^2
4.	Anchor wharf	1,610	m^2
5.	Road and drainage system	6,550	m^2
6.	Draw well(s)	-5 / -1	m^2
B.	**FUNCTIONAL FACILITIES**		
1.	Administration office	635	m^2
2.	Fish Auction Hall (*TPI, Tempat Pelelangan Ikan*)	1,420	m^2
3.	Electrical installation	13,000	Watt
4..	Forklift	10	unit
5.	Electricity generator	1,500	KVA
6.	IPAL (water treatment facility)	75	m^2
7.	Operational boat	1	unit
8.	Packing building	456	m^2
9.	Reservoir basin	50	m3
10.	Water pump	1	unit
11.	Water tower and installation	1	unit
12.	Alcon pump	3	unit
C.	**SUPPORTING FACILITIES**		
1.	BAP shops	628	m^2
2.	Cool boxes	60	unit
3.	Ice crushers	3	unit
4.	Residence of the Head of Office	150	m^2
5.	Residence of the Operators	108	m^2
6.	Forklift 2.5 tonnes	5	unit
7.	Forklift 2 tonnes	5	unit

Source: Indonesian Fishing Ports, 2009 (DGCF-MMAF)

- **Services**

Services for fishing supplies/logistics needs (i.e., diesel fuel, kerosene, clean water, and ice) in Bitung OFC have been fulfilled well. However, there have been increasing tendencies in the supply and demand for logistics in Bitung OFC.

Table 4.3. Logistic Needs Fulfillment in Bitung OFC, 2008

SUPPLY	DEMAND (Tonnes/Day)	FULFILLED (Tonnes/Day)	SHORTAGE (Tonnes/Day)
Fuel/Diesel fuel	5	5	-
Kerosene	3	3	-
Water	30	30	-
Ice	15	15	-

Source: Indonesian Fishing Ports, 2009 (DGCF-MMAF)

Mooring facilities

Pier

Shops

Auction hall *(TPI)*

Fig. 4.1 Facilities in Bitung OFC (*Source: Indonesia Fishing Ports, 2009*)

- **Operations**

In year 2003 to 2007, the productions of all catches tend to increase rapidly and the trend of its associated values also increased significantly as seen in the following table.

Table 4.4. Fishing activities, fish production and value of all species of fish landed, Year 2001-2007

Year	Boat visits (frequency)	FISH		
		Production (tonnes)	Value (rp 1,000)	Production per day (kg)
2001	-	-	-	-
2002	-	-	-	-
2003	4,017	1,102	-	-
2004	4,958	2,324	-	-
2005	16,014	6,051	26,971,081	16,807
2006	21,571	9,714	48,669,768	26,983
2007	24,952	13,123	93,073,388	36,453

Source: Indonesian Fishing Ports, 2009 (DGCF-MMAF)

Fig. 4.2. Gasoline and diesel fuel station in Bitung OFC
(*Source: Indonesia Fishing Ports, 2009*)

Fishing Fleet Structure

There have been drastic changes in the proportion of landing frequency by size of fishing vessels in Bitung OFP since 2006. In 2006, the size of the vessels that landed was dominated by 50 – 100 GT class size, whereas the previous years were dominated by vessels of <10 GT in size. Subsequently, from 2007 to 2008, the average size of the vessels that landed had increased and were dominated by vessels of > 200GT in size. There was a sharp decline in the total number of vessel landings of 50-100 GT in size, from 1,650 units (2006) to 45 units (2007). Nevertheless, in general, it appears that vessels of > 200 GT in size continue to dominate since 2007.

Table 4.5. Number of landing frequency by size of fishing vessel in Bitung OFP, Year 2001-2008

Year	Fishing vessels (frequency)						
	< 10 GT	10-20 GT	20-30 GT	30-50 GT	50-100 GT	100-200 GT	> 200 GT
2001	-	-	-	-	-	-	-
2002	-	-	-	-	-	-	-
2003	2,700	768	-	340	-	-	-
2004	8,940	2,198	-	867	-	-	-
2005	12,285	533	206	106	86	25	-
2006	294	265	52	70	1,650	34	-
2007	98	97	60	145	45	75	897
2008	98	97	60	145	45	83	973

Source: Indonesian Fishing Ports, 2009 (DGCF-MMAF)

Fig. 4.3 Activities and vessels in Bitung OFC
(*Source: Indonesia Fishing Ports, 2009*)

Fish Landing

In 2007, fish landing in Bitung OFP was dominated by Scad, *Decapterus spp*. (33.85% of total of all landed fish species) and large tuna (Skipjack and Albacore; 22.18% and 10.98%, respectively, of all landed fish species). A record of all fish landed in Bitung OFC in 2007 is presented in Table 4.6.

Table 4.6. Dominant fish landed in Bitung OFP, Year 2007

No.	Name of fish	Total volume (kg)	Total value (rp)
1.	Skipjack tuna	2,910,890	19,746,861,392
2.	Short-body mackerel	870	7,943,066,667
3.	Scad	4,442,470	4,701,223,333
4.	Sardine	168,940	4,268,075,000
5.	Trevallies	221,550	6,830,662,500
6.	Bullet tuna	2,820,950	14,815,042,725
7.	Albacore	1,440,630	17,352,178,058

	Others	1,116,940	17,416,278,058

Source: Indonesian Fishing Ports, 2009 (DGCF-MMAF)

- **Fisheries Industries**

There are 16 fisheries companies/business units in Bitung OFP and occupy an area of 15,706 m^2 with tenant status. These have not included those business units located outside the perimeter of the port area, surrounding Manado. About 66.7% of these business units are in the processing activities and cold storage. These companies generally have more than one type of fisheries business.

Table 4.7. Number of fisheries industries based on the types of industry in Bitung OFC

No.	Type of industries	Number of companies
1	Fuel Supplier	3
2	Processing, fillet	5
3	Processing, fresh fish	4
4	Processing, frozen fish	5
5	Cold storage	4
6	Fishing gear material	1
7	Telecommunication	1
8	Block ice factory	3
9	Processing plant	1
10	Administrative office	1

Source: processed from Indonesian Fishing Ports, 2009 (DGCF-MMAF)

Profile of Bitung OCP can be summarized and presented in table below:

Table 4.8. Bitung OFP Profile

No.	Profile	Descriptions
1.	Port Facility	In good condition
2.	Services	Fishing supplies/logistics (i.e., diesel fuel, kerosene, clean water, and ice) have been fulfilled well.
		Increased tendency in the supply demand of logistics.
3.	Number of vessel visits	Increasing
4.	Fish Production	Increasing
5.	Fleet structure	By 2006, frequency of fishing vessel landed by size had changed significantly. In 2006 - 2008, the vessels that landed were dominated by those of >50GT in size. Meanwhile, previously, they were dominated by those of <50 GT in size.
		During 2007 - 2008, the average size of the vessels that landed had increased and were dominated by vessels of > 200GT in size.
6.	Catch composition	Dominated by scads (33.85% of total landing) and tunas (skipjack and albacore; 33.16% of total landing)
7.	Fisheries industries	There are 16 fisheries companies/business units in the port and occupy an area of 15,706 m^2 with tenant status. These have not included those business units located outside the perimeter of the port area, surrounding Manado.

		About 66.7% of these business units are in the processing activities and cold storage. These companies generally have more than one type of fisheries business.

Source: Indonesian Fishing Ports, 2009 (DGCF-MMAF)

4.2.2 Fish Landing Centre in North Sulawesi related to WCPFC area

1. Tumumpa Fish Landing Centre

Tumumpa Fish Landing Centre is located in Tuminting Sub-District, Manado Regency, North Sulawesi Province. Tumumpa FLC has 4 Ha of port area. Geographically, Tumumpa FLC is on coordinate (Lat) N/S : 1.523183 and (Lon) W/E : 124.842000 (MMAF, 2010)

- **Port facilities**

Main facilities in Tumumpa FLC include pier/quay, breakwater, port pond, road, drainaee system, and fisheries pier/quay. These main facilities are functioning well and have sufficient utilization. Other functional facilities are Fish Auction Hall, water processing, ice crusher machine, fish processing hall, cold storage, harbormaster office, port administration office, motor cycles, parking area, waste processing installation, and garbage dump. Supporting facilities include fishers meeting hall (100 m), employee houses, security house, and toilet. Fisheries port facilities in Tumumpa FLC are relatively complete and are sufficient to support fisheries activities in this area. Almost all of the facilities can be used according to their function, except for road access, fish processing hall, waste processing installation, security hall, and toilet which has unfavorable condition.

Table 4.9. List of facilities in Tumumpa FLC, year 2010

Facilities	Number (units)	Volume	Unit	Condition	Facility Utilization	Year established
Main Facilities						
Pier	1	180	m^2	Good	appropriate	2004
Pier	1	180	m^2	Good	appropriate	2004
Breakwater	1	90	m^2			2004
Port Pond	1	3	Ha			
Road	1	4335	m^2	Minor damage	appropriate	2004
Drainage system	1			Good	appropriate	
Fisheries quay	1	130	m^2	Good	appropriate	2004
Functional Facilities						
Fish auction hall	1	60	m^2	Good	appropriate	2004
Water processing	1			Good	appropriate	2004
Ice crusher machine	1			Minor damage	appropriate	-
Electric generator	1	1000	Watt	Good	appropriate	2004
Fish processing hall	2	400	m^2	Heavy damage	inappropriate	2004
Cold Storage	1	30	Tonnes	Good	appropriate	2004

Harbormaster office	1					
Port administration office	1	4	Ha	Good	Appropriate	2004
Motor cycle	2					
Parking area	1	1	Ha			2004
Waste processing installation	1	4	m^3	Heavy damage	Unused	2004
Garbage dump	1	4	m^3	Good	Appropriate	2004
Supporting Facilities						
Fisherman meeting haal	1	100	m	Good	appropriate	2002
Employee houses	1	30	m^2	Good	appropriate	2004
Security hall				Heavy damage	Unused	
Toilet	1	50	m^2	Heavy damage	Unused	2004

Sumber: MMAF 2010 [b]

Fig. 4.4. Pier in Tumumpa FLC
(*Source: MMAF 2010* [b]**)**

- **Services**

Type of services that are available in Tumumpa FLC are consisted of supports for fishing fleet (fish auction, unloading and loading of landed fish, mooring and docking), logistics (water stock filling, ice, and salt); general public services (fisheries and fishing gear support, outreach for fishers/fishers families, and government function services (security, fisheries surveillance, and enumeration for landed fish).

Fuel supply station

Ice Factory

Fig. 4.5. Functional facilities in Tumumpa FLC
(*Source: MMAF 2010* [b])

- **Operational**

Fishing grounds and landed fish

Fishing grounds that are commonly frequented by fishers that land in this port are Sulawesi Sea and Makalehi. The most dominated fish landed in this fishing port are scad, little tuna, baby tuna, skipjack, and trevallies.

Table 4.10. Dominant fish landed in Tumumpa FLC, year 2010

Name of Fish	Production Volume (tonnes)	Production Value (rp)
Scad	295,738	279,392,800
Little tuna	5,940	54,285,000
Baby Tuna	29,040	544,955,000
Skipjack	445,560	2,962,011,200
Trevalies	2,400	3,212,000

Source:MMAF 2010 [b]

Catch distribution and markets

Fish landed in Tumumpa FLC are marketed both locally (markets in Manado Regency) and regionally (to Amurang), as well as exported as fresh fish (through Bitung City). Meanwhile, marketing data for processed fish are not available.

Table 4. 11. Tumumpa FLC Profile

Profile	Descriptions
Facilities and services	Port facilities in Tumumpa FLC relatively complete and sufficient to support fisheries activities in that area
	Almost all facilities can be utilized according to their functions, only the road whose access has unfavorable condition.
	Types of services are consisted of supports for fishing fleet, general public services, and governmental function services.
Catch composition	Dominant fish landed are scads, little tuna, baby tuna, skipjack, and trevallies
Distribution and marketing	Fish landed is marketed locally, regionally and exported as fresh fish

Source:MMAF 2010 [b]

2. Amurang Fish Landing Centre

Amurang Fish Landing Centre (FLC) is located in West Amurang Sub-District, South Minahasa Regency, South Sulawesi Province. Geographically, Amurang FLC is located in coordinate 01^0 674”433’ N Latitude and 125^0 060” 967’ W Longitude. This fish landing centre has an area extent of about 5 ha.

- **Port facilities**

Main facilities in Amurang FLC are port land area, pier/quay, jetty, revetment, fender, bollard, road, and drainages system. Meanwhile, the functional facilities include fish auction hall, SSB (single-

side band modulation) radio, internet, water tank, water supply, fire hydrant, power generator, electrical power, power generator house, fishers' fuel station, fuel tank, docking, slipway, workshop, net-drying place, net reparation facility, port administration office, fisheries surveillance office, parking area, and garbage dump. The supporting facilities are fishers meeting hall, employee house, security house, toilet and food stalls/stores.

Table 4.12. List of facilities in Amurang FLC, year 2010

Name of Facilities	Number (unit)	Volume	Unit	Condition	Facility Utilization	Year established
Main facilities						
Port land areal	1	2		Good	Appropriate	
Pier/Quay	1	400	m^2	Good	Appropriate	2006
Jetty	1	2	m^2	Good	Appropriate	2006
Revetment	1	500	m^2	Good	Appropriate	2006
Fender	10	100		Good	Appropriate	2006
Bollard	4	50		Good	Appropriate	2006
Road	1			Good	Appropriate	2006
Drainage system	4			Good	Appropriare	2006
Functional facilities						
Auction hall	1	96	m^2	Good	Inappropriate	2007
SSB Radio	1	2		Good	Appropriate	2009
Internet	1			Good	Appropriate	2009
Water tank	2	2200	m^3	Good		
Water supply	1					
Fire safety/ hydrant	2					
Power generator	1	23	kva	Good	Appropriate	2008
Electrical Power	5	4500	watt	Good	Appropriate	
Genset house	1					
Fishers' fuel station	1			Good	Appropriate	2007
Fuel Tank	2	8000	m^2	Good	Appropriate	2007
Docking	1			Good		2010
Slipway	2	60	m	Good		2010
Workshop	1	120	m^2	Good		
Net-drying place	1	1450	m^2	Good		
Seine reparation	1					
Port Administration Office	1	150	m^2	Good	Appropriate	
Fisheries surveillance office	1	36	m^2	Good	Appropriate	2006
Parking area	1	6400	m^2	Good	Appropriate	2006
Garbage dump	2	4	m^2	Good	Appropriate	

Supporting facilities						
Fishers' meeting hall	1	160	m^2	Good	Appropriate	2001
Employee house	2	120	m^2	Good	Appropriate	2008
Security house	1	4	m^2	Good	Appropriate	2010
Toilet	2					2009
Food Stalls / stores	3	106	m^2			2008

Source:MMAF 2010 [c]

Fig. 4.6. Jetty in Amurang FLC
(*Source: MMAF 2010* [c])

- **Services**

Services that are provided in Amurang FLC include services that directly support fisheries activities (fish auction hall, loading and unloading facilities, fueling facility, vessel docking, fishing gear repair, water stock filling, ice, and salt); harbormaster services (i.e., Receipt of Vessel Arrival Report, *STBLKK* or *Surat Tanda Bukti Lapor Kedatangan Kapal*; Sailing Approval License, *SIB/SPN* or *Surat Ijin Persetujuan Berlayar*); permission and legal document services (i.e., Vessel License); general public services (i.e., port area lease); and government function services (i.e., enumeration of landed fish).

Fig. 4.7. Fueling station and water installation in Amurang FLC
(*Source: MMAF 2010* [c])

- **Operational**

Fleet structure and vessel operation

Fishing vessels that actively operate in this FLC are inboard-engine vessels of <5 GT, 5-10 GT and 10-20 GT in size. Number of each registered fishing vessels are presented in table below:

Table 4.13. Number of fishing vessel based on size in Amurang FLC for 2010

Type of vessel	Number per year (unit)
<5 GT	22
5-10 GT	2
10-20 GT	32

Source:MMAF 2010 [c]

The most frequently visited fishing grounds by the fishers from this port are located in FMA 717, with peak fishing season in March, April, May, September, October and November

Fig. 4.8. Fishing vessel in Amurang FLC
(*Source: MMAF 2010* [c])

Landed Fish

The annual reported landed fish in this port showed a decreasing trend. In 2005, the reported landed fish was 11,764 tonnes, while in 2009 it became 6,657 tonnes.

Tabel 4.14. Trend of reported landed fish in Amurang FLC

Year	Fish Production (tonnes)
2005	11,764
2006	12,947
2007	16,039
2008	6,083.09
2009	6,657

Source:MMAF 2010 [c]

Various fish species are landed everyday in this port, such as trevallies, scads, little tuna, skipjack, yellowfin tuna and hairtails. However, three species dominate: skipjack, frigate tuna, and scads and their production for 2012 are presented in Table 4.15 below.

Table 4.15. Dominant species of fish landed in Amurang FLC, year 2010

Type of fish	Production volume (tonnes)
Skipjack	2,048
Frigate tuna	6,825
Yellowfin tuna	4,778

Source: MMAF 2010 [c]

Catch distribution and markets

Fish production in Amurang FLC is not only marketed as fresh fish, but also in processed forms. Marketing of fresh fish is done locally and inter-provincially. Meanwhile, processed products is intended for exports. Destination for each marketed products are as below:

Fresh fish marketing destination:

1. Local : South Minahasa Regency
2. Inter-province : DKI Jakarta

Processed fish marketing destination:

1. Local : South Minahasa Regency
2. Export : Japan

- **Fisheries Industries**

Until 2010, there are no types of work/industry/investment operating in this FLC area. However, because the port is located in an area included in a *Minapolitan* program, therefore, to support the program, this port is also supported by various facilities outside the port area. Economic centre that is located outside Amurang FLC area are comprised as follows:

Table 4.16. Economic centre outside the Amurang FLC Area, year 2010

No	Name of facilities	Number (unit)	Distance with Port (km)
1	Fish Market	1	3
2	Fish Processing Industry	1	5
3	Banking	4	3
4	Maritime Tourism Area	1	30
5	State-owned Pawnshop Office	1	3
6	Fuel station	2	4,3
7	NearestPublic Port	1	0,5
8	Bus Terminal	1	3
9	Hospital	2	3

Source:MMAF 2010 [c]

Table 4.17. Amurang FLC Profile

Profile	Description
Port facilities	All facilities are in good condition and appropriate utilization
Services	Type of services that are available in Amurang FLC are consisted of services that directly support fisheries, permission and legal document services, general public services and governmental function services
Fleet structure	Fishing vessels that operate actively are inboard engine vessels of <5 GT, 5-10 GT and 10-20 GT in size.

Landed Fish	Landed fish have a tendency to decrease. Commonly landed fish in this port are trevallies, scad, little tuna, skipjack, frigate tuna, yellowfin tuna and hairtails.
Catch distribution and markets	Production of fish in Amurang FLC is not only marketed as fresh fish, but also as processed fish. Fresh fish are marketed at local markets and inter-province markets, while processed products are sent to export markets.
Fisheries Industries	Until 2010, there are no types of work/industry/investment operating in this FLC area. However, because the port is located in an area included in a *Minapolitan* program, therefore, to support the program, this port is also supported by various facilities outside the port area.

Source:MMAF 2010 [c]

3. Kema Fish Landing Centre

Kema Fish Landing Centre (FLC) is located in Kema III Village, Kema Sub-District, North Minahasa Regency, North Sulawesi Province. The distance between Kema and the capital of North Sulawesi and North Minahasa Regency is 31 km and 15 km, respectively. Geographically, Kema FLC is located in 01°21'36" N. Lat dan 125°04'30" E. Lon coordinates.

- Port facilities

The main facilities in Kema FLC include the land area of the port, pier/quay, fender, bridge, and road. Whereas the functional facilities in Kema FLC are fish auction hall, control tower, water supply, ice factory, electricity, Fishers' Fuel Station, harbormaster office, fishery surveillance office, motorcycle, parking area, and patrol boat. Besides, there are several supporting facilities, namely employee dorm and toilet which are in good condition and are functioning functions. However, facilities in Kema FLC can be categorized as incomplete.

Table 4.18. Facilities in Kema FLC, Year 2010

Facility Name	Number (unit)	Condition	Facilities Utilization	Year Established
Mean Facilities				
Land area of the Port	1	Good	Appropriate	2010
Pier/quay	1			
Fender		Good	Appropriate	
Soil Retaining Wall (*Revetment*)		Good	Appropriate	
Road		Heavy damage	Appropriate	
Drainage system		Good	Appropriate	
Functional Facilities				
Fish Auction hall	1			
Control tower	1	Good	Appropriate	2010
Water supply	1	Good	Appropriate	2010
Ice factory	1	Little damage	Unused	2006

Electricity	1	Good	Appropriate	-
Fishers' Fuel Station	1	Good	Appropriate	-
Harbormaster office	1	Good	Appropriate	-
Fishery surveillance office	1	Good	-	2008
Motorcycle	1	Good	-	2008
Parking area	1	-	-	-
Patrol boat	1	Good	Unused	
Supporting facilities				
Employee dorm	1	27	Appropriate	2010
Toilet	2	Good	Appropriate	

Source:MMAF 2010 [c]

Fig. 4.9. Pier in Kema FLC
(Source: MMAF 2010 [c]*)*

- **Services**

In supporting fisher's activities, the Kema FLC provides several kinds of services: supports for fishing vessels (i.e., loading and unloading of fish, fuel filling, mooring and anchoring the vessels), harbormaster services (to issue *Surat Ijin Berlayar/Persetujuan Berlayar (SIB/SPB)* or Certificate/Approval Letter for Sailing), permission and legal documents services (i.e., Vessel Licensing), and government function services (i.e., surveillance)

Fig. 4.10. Vessel services office in Kema FLC
(*Source: MMAF 2010* [c])

- **Operational**

Fleet structure

Fishing fleet that land their catch in Kema FLC consists of non-powered boats, outboard engine boats, and inboard engine boats of up to 30 GT in size. These fishing vessels use various fishing gear and include purse seine, tuna long line, and hand line. The most dominant vessels are outboard engine and inboard engine boats; while the most dominant fishing gear is purse seine. Details of the fishing vessels and fishing gear that land their fish in Kema FLC are described in Table 4.28 and 4.29.

Table 4.19. Number of landing frequency by fishing vessel in Kema FLC, Year 2010 (January - July)

Type of fishing vessel	Unit
Non-powered boats	50
Outboard engine boats	30
<5 GT	10
5-10 GT	10
10-20 GT	15
20-30 GT	20

Source: MMAF 2010[c]

Table 4.20. Number of landing frequency by fishing gear in Kema FLC, Year 2010 (January - July)

Type of fishing gear	Unit
Purse seine	30
Tuna long line	1
Hand line	20

Source: MMAF 2010[c]

Landed Fish

The dominant species of fish landed in Kema FLC are scads, little tunas, baby tuna, and snappers. Other fishes include trevallies, jack trevallies, and groupers. Whereas fishing grounds for fishers in Kema FLC is in the vicinity of Maluku Sea.

Table 4.21. Kema FLC Profile

Profile	Description
Port facilities	In good condition and functioning, but can be categorized as incomplete
Services	Supports for fishing vessels, harbormaster services, permission and legal documents services, and government function services.
Fleet structure and fishing gear	Consists of non-powered boats, outboard engine boats, and inboard engine boats with size up to 30 GT.
	Dominant vessels are outboard engine and inboard engine; meanwhile, dominant fishing gear is purse seine.
Landed Fish	Dominant species of fish landed are scads, little tunas, baby tuna, and snappers. Other fishes are trevallies, jack trevallies, and groupers.

4. Belang Fish Landing Centre

Belang FLC is located in Borgo village, Belang Sub-District, South-East Minahasa City, North Sulawesi province. Belang FLC has an areal extent of 3.5 ha, comprising of 2 ha of land area and 1.5 ha of waters area. Geographically, Belang FLC is located in coordinates 0°.56’22” S. Lat and 124°47’15” E. Lon.

- Port facilities

Facilities to support the operational activities of Belang FLC are consisted of main facilities, functional facilities, and supporting facilities. Main facilities that belong to Belang FLC are land area of the port, pier/quay, jetty, soil retaining wall (revetment), bridge, road, and drainages system. These main facilities are in good condition and used according their functions. Whereas the functional facilities that belong to Belang FLC are fish auction hall, water tank, ice factory, electricity, workshop, harbormaster office, administration office, surveillance office, and waste treatment installation. These functional facilities are in good condition, except for the fish auction hall which has minor damage condition. All facilities are used according their functions; except for the repair shop which is unused. The supporting facilities in Belang FLC include fishers’ meeting hall, employee house, and toilet. Details of the facilities are as follow:

Table 4.22. Facilities in Belang FLC,2010

Facilities	Number (unit)	Volume	Unit of Measure	Condition	Facility utilization	Year Established
Main Facilities						
Land area of the port	1	2	ha	Good	Sufficient	2000

Pier/quay	1	60	m^2	Good	Sufficient	2000
Jetty	1	800	m^2	Good	Sufficient	2000
Revetment	1	110	m^2			2000
Bridge	1	40	m^2	Good	Sufficient	2000
Road	1	400	m	Good	Sufficient	2000
Drainage system	3	900	m^2	Good	Sufficient	2000
Functional Facilities						
Fish auction hall	1	2100	m	Light damage	Sufficient	2000
Water tank	2	1100	Liter	Good	Sufficient	2010
Ice factory	1			Good	Sufficient	2009
Workshop	1	400	m	Good	unused	-
Harbormaster office	1			Good	Sufficient	2010
Fisheries surveillance office	1	300	m	Good	Sufficient	2008
Waste treatment installation	1	50	m	Good	Sufficient	2008
Supporting Facilities						
Fishers' meeting hall	1	750	m	Heavy damage	Unused	2000
Employee house	2	40	m	Good	Sufficient	2005
Toilet	1					

Source:MMAF 2010 [c]

Some facilities are available and in good condition, however, they still have inappropriate utilization or completely unused; these include the workshop and fishers' meeting hall.

Some services are not functioning well, these include data system and collection, supports for loading and unloading activities, and fish auction. There is only one (1) employee in Belang FLC which makes it unrealistic to manage the FLC optimally. Thereby, the role and functions of Belang FLC are not running well.

Fig. 4.11. Jetty in Belang FLC
(*Source: MMAF 2010* [c])

Fig. 4.12. Pier in Belang FLC
(*Source: MMAF 2010* [c])

- Operational

Fleet structure

The most dominant fishing boats that land fish in Belang FLC are those boats with size of < 5 GT with outboard engines. Fishing ground for those vessels are Tomini Bay, the Pacific Ocean, Sulawesi Sea, and Maluku Sea. Details of fishing vessels that land their fish in Belang FLC are described in the table below.

Table 4.23. Number of landing by fishing vessels for the year 2005-2010

Kind of boat	Number of unit					
	2005	**2006**	**2007**	**2008**	**2009**	**2010 (Jan-July)**
Non-powered boat	20					20
Outboard engine	200					700
<5 GT	70			112	114	116
5-10 GT						30
10-20 GT						24
30-50 GT						2
50-100 GT						2

Catch composition

The most dominant fish landed in this port are skipjack and tuna. From January - July 2010, the tuna and skipjack that are landed in this port are 470 tonnes and 14.4 tonnes, respectively. It is said that the skipjack and tuna landed in Belang FLC have relatively higher value compared to those in other FLC in North Sulawesi (DGCF-MMAF, 2010).

Fig. 4.13. A Fishing Vessel in Belang FLC
(*Source: MMAF, 2010*[c])

Catch distribution and markets

The marketing destination of fresh fish from Belang FLC is for local markets in Minahasa Regency, and for inter-city/regency markets to Bitung Regency.

Table 4.24. Belang FLC Profile

Profile	Description
Port facilities	Main facilities are in good condition and used according their functions
	The functional facilities are in good condition, except for the fish auction hall which has minor damages condition. All facilities are used according their functions; except for workshop, which is still unused
Fleet structure	Dominated by outboard engine boats of < 5 GT in size
Catch composition	Dominant fish landed are skipjack and tuna
Catch distribution and markets	The marketing destination of fresh fish from Belang FLC is for the local markets in Minahasa Regency, and for the inter-city/regency markets to Bitung Regency

V. MARKET AND PROCESSING

5.1. National Marketing

Tuna in Gorontalo, North Maluku, Papua, West Papua, and North Sulawesi, are sold in fresh and processed form. According to Susenas 2008 result, it is known that household absorption for tuna fish, little tuna, and skipjack tuna in those five provinces are in fresh form (76,731.20 tonnes), processed form (4,929.09 tonnes) and salted form (1,904.67 tonnes). Therefore total number of these absorption is 86,564.96 tonnes. Among those 5 provinces, the biggest absorption for fresh and processed tuna comes from North Sulawesi, while salted/preserved tuna comes from North Maluku Province. The absorption of tuna in each of those provinces is very small compared to other provinces in Indonesia.

Table 5.1. Household absorption for tunas and little tunas in 5 provinces which are adjacent to the Pacific Ocean (SUSENAS 2008)

Unit: ton/year

National/Province	Fresh Fish	Salted/Preserved Fish
National	**649,603.68**	**216,092.65**
Gorontalo	14,068.09	252.95
North Maluku	19,776.69	1,213.24
Papua	10,459.99	110.49
West Papua	2,124.61	40.79
North Sulawesi	30,301.81	3,287.20

Source: Directorate General of Fisheries Product Processing and Marketing-MMAF (2010)

Table 5.2 National marketing of processed tunas and little tunas, 2009

National/Province	Volume (tonnes)
National	**225,705.57**
North Sulawesi	3,952.29
Maluku	495.08
North Maluku	197.34
Papua	133.82
West Papua	150.57
Total	4,929.09

Source: Directorate General of Fisheries Product Processing and Marketing-MMAF (2010)

Production of tunas in FMA 716 and 717 for 2009 was 122,837 tonnes (Table 3.5); meanwhile, it was 59,214 tonnes for little tunas (Table 3.6 and 3.7), Therefore, the total production for tuna, little tuna and skipjack in 2009 was 182,051 tonnes. Looking at this production number, it appears that the local marketing of tuna and little tuna in those five provinces was only 47.55% of the total production of tuna, little tuna and skipjack in FMA 716 and 717. The rest of this, it is possible that the tuna was marketed inter-provinces/inter-island as well as to export market. Therefore, we see an indication that the marketing of tuna in FMA 716 and 717 is biased towards out-of-province and export markets, rather than the local markets.

5.2. International Marketing

Tuna fish and tuna-like species are sold to overseas in frozen, fresh, processed, and canned form. Total volume of tuna exported during 2001-2010 ranges from 84,206 tonnes – 122,450 tonnes and tends to increase with average increase of 5.32% per year. The highest increase happened during 2006-2007 and the highest decrease happened during 2003-2004. Development of tuna export volume in recent years (i.e., 2009-2010), experienced a decrease of 6.92%. Total export volume during 2001 – 2010 can be seen in the following table.

Table 5.3. Development total national export volume of tunas and little tunas

Year	Volume (ton)	Increase (%)
2001	84,206.00	
2002	92,797.00	10.20
2003	117,092.00	26.18
2004	94,221.00	-19.53
2005	91,631.00	-2.75
2006	91,822.00	0.21
2007	121,316.00	32.12
2008	130,056.00	7.20
2009	131,550.00	1.15
2010	122,450.00	-6.92

Source: Export Statistics of Fishery Products, Directorate General of Fisheries Product Processing and Marketing-MMAF (2010[d])

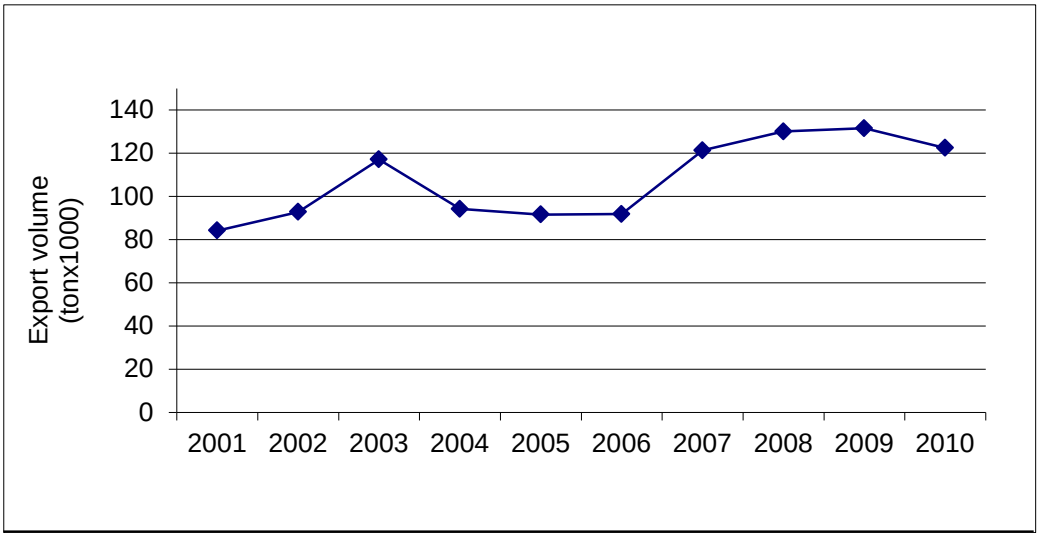


Figure 5.1. Development of **total national export volume of tunas and little tunas**
Source: Export Statistics of Fishery Product,
Directorate General of Fisheries Product Processing and Marketing-MMAF (2010[d])

Among 5 provinces that are adjacent to the Pacific Ocean, export marketing of tunas was only recorded in North Sulawesi and Maluku. In North Sulawesi, exports of tuna were in the forms of fresh, frozen, and processed form, while in Maluku, it was only in frozen form. Tuna species that were marketed through those two provinces were consisted of yellowfin tuna, skipjack, and other tunas, whereas albacore

was not exported through those two provinces, but through Surabaya (in East Java). Total export from those two provinces was 58,894.22 tonnes with 57,697 tonnes from North Sulawesi and 1,196.26 tonnes from Maluku. The contribution of these two provinces in the national export of tuna is fairly big, and that is 44.77% from the total national export of tuna.

Table 5.4. Export volume according to commodity in Maluku and North Sulawesi, for the year of 2009

Processed	Commodity	Volume (Kg)		
		Maluku	**North Sulawesi**	**National**
Fish, Fresh or chilled		67,428,696	1,234,013	**226,727,337**
Marine water fishes		67,428,696	1,234,013	**218,348,861**
	Albacore	0	0	**316,274**
	Yellowfin Tunas	0	32,288	**7,479,322**
	Skipjack	0	0	**460,588**
	Other tunas	0	221,337	**18,418,038**
Frozen fish		1,196,263	1,955,630	**116,127,727**
Marine water fishes		1,196,263	1,955,630	**114,948,636**
	Albacore	0	0	**3,367,027**
	Yellowfin Tunas	343,404	232,319	**8,058,929**
	Skipjack	616,500	1,311,479	**24,699,783**
	Other tunas	236,359	411,832	**13,556,546**
Fish prepared or preserved		0	18,967,246	**72,911,589**
In Airtight containers		0	18,513,935	**66,758,242**
	Tunas, skipjack, Atlantic bonito	0	18,466,643	**51,069,922**
In Not Airtight containers		0	453,311	**6,153,347**
	Tunas, skipjack, Atlantic bonito	440	453,311	**4,123,139**
Grand total		**1,196,263**	**57,697,955**	

Source: Export Statistics of Fishery Product, Directorate General of Fisheries Product Processing and Marketing-MMAF (2010[d])

Table 5.5. Contribution of provinces surrounding the WCPFC Convention Area (FMA 716 and 717) in export of tuna, year 2009

Export Marketing (tonnes)	Maluku	1,196
	North Sulawesi	57,698
	Total	58,894
National Total Tuna Export		131,550
Contribution of FMA 716 and 717 in national tuna export (*yellowfin tuna,skipjack* dan tongkol; %)		44.77

Source: Processed from Fisheries Production Export Statistic Data, Directorate General of Fisheries Product Processing and Marketing-MMAF (2010[d])

Export developments in North Sulawesi are supported by the development of fishery product processing unit. Until 2004, there were 40 units of fishery product processing companies in North Sulawesi with 22 cold storages. In 2010, there were 60 exporters of fishery commodities. Export destinations include Japan, Korea, USA, China, Spain, Australia, Germany, Britain, Hong Kong, Denmark, South Africa, Ireland, Netherlands, Switzerland, Slovenia, Belgium, Ireland, Italy, Poland, France, Greece, Malta, Cyprus, Canada, Thailand, Taiwan, Singapore, Africa and the Philippines (Kaunang, 2010)

VI. FISHERIES SOCIO-ECONOMIC CHARACTERS

Similar with other chapters, data used in this chapter are chosen from the provinces that are adjacent to the Pacific Ocean; these are: North Sulawesi, Gorontalo, Maluku, North Maluku, Papua, and West Papua provinces. The data came from various sources, particularly from the Statistics of Marine Capture Fisheries by Fisheries Management Area (FMA) for the periods of 2000-2004, 2003-2007, and 2004-2008 and from the Annual Report of Capture Fisheries Statistics of Indonesia.

6.1 Fishers

In Indonesia's Fisheries Statistic system, the statistics of fishers are classified based on their working time into three categories:

1. Full time fishers are fishers who spend all of their working time for fishing.
2. Part time (major) fishers are fishers who spend a majority of their working time for fishing.
3. Part time (minor) fishers are fishers who spend a minor part of their working time for fishing.

Total numbers of fishers per those categories are presented in Table below.

Table 6.1. Number of Fishers by category in the provinces that are adjacent to the WCPFC Convention Area (FMA 716 and 717)

Unit: person

Year	Fishers category			
	Total	Full-time	Part-time (major)	Part-time (minor)
2000	453,451	151,599	183,661	118,191
2001	435,006	140,881	113,902	61,885
2002	387,934	142,110	147,646	98,178
2003	539,301	195,668	196,006	147,627
2004	385,948	140,389	138,187	107,372
2005	292,550	111,937	96,539	84,074
2006	307,504	117,340	101,777	88,387
2007	315,236	113,881	107,233	94,122
2008	326,298	122,165	112,975	96,158
2009	536,296	174,787	149,885	93,286

Source: Fisheries Statistic of Indonesia, 2000-2009

During the period of 2000 - 2009, the number of fishers increased annually with an average annual rate of 5.22%. The number of fishers in 2000 was 453,451 persons, and then increased to 536,296 persons in 2009. The number of fishers was the lowest in 2005, at 292,550 persons; meanwhile the highest number of fishers was in 2009. In the last ten years, the number of fishers fluctuates. The number of fishers decreased during the period of 2000 – 2005, and then relatively stable, and followed by a sharp increase during 2008 – 2009.

Most of the fishers in the last ten years period (2000 – 2009) were full-time fishers, they increase in numbers each year with an average annual rate of 3.91%. The number of major part-time fishers and minor part-time fishers also increase every year, with an average annual increase of 1.51% and 2.58%, respectively.

In 2009, the total number of fishers was 536,396 persons, comprising of 174,787 full-time fishers, 149,885 major part-time fishers, and 93,286 minor part-time fishers. Compare to 2008 data, two categories of fishers have a sharp increase: the full-time fishers and the major part-time fishers. Moreover,

as a whole, the increasing number of fishers in the last two years (2008 - 2009) was the highest in the last 10-year period (2000 – 2009).

The number of fishers in 2000 was 453,451 persons; then increased to 536,296 persons in 2009. The lowest number of fishers was in 2005 (292,550 persons), whereas the highest number of fishers was in 2009. In the last ten years, the number of fishers fluctuates. The number of fishers decreased during the period of 2000 – 2005, and then relatively stable, and followed by a sharp increase during 2008 – 2009.

6.2 Production Volume and Production Value

Tuna production and production value of main tuna are presented in the table below. During the period of 2000 - 2009, tuna production increased, with the lowest production in 2000 and the highest production in 2006. Production tends to increase in almost every year, except in 2004 and 2009, when decreased production occurred

Table 6.2. Production volume and production value of tuna (*Main Tuna*) in FMA 716 and FMA 717

Year	Production volume (tonnes)	Production value ('000 Rp)
2000	29,545	847,941,500
2001	37,758	1,083,654,600
2002	59,474	1,706,903,800
2003	88,808	2,548,789,600
2004	78,503	2,253,036,100
2005	105,735	3,034,594,500
2006	110,632	3,175,138,400
2007	107,060	3,072,622,000
2008	109,939	3,155,249,300
2009	89,810	2,577,547,000

Source: Processed from Indonesia's Capture Fisheries Statistics

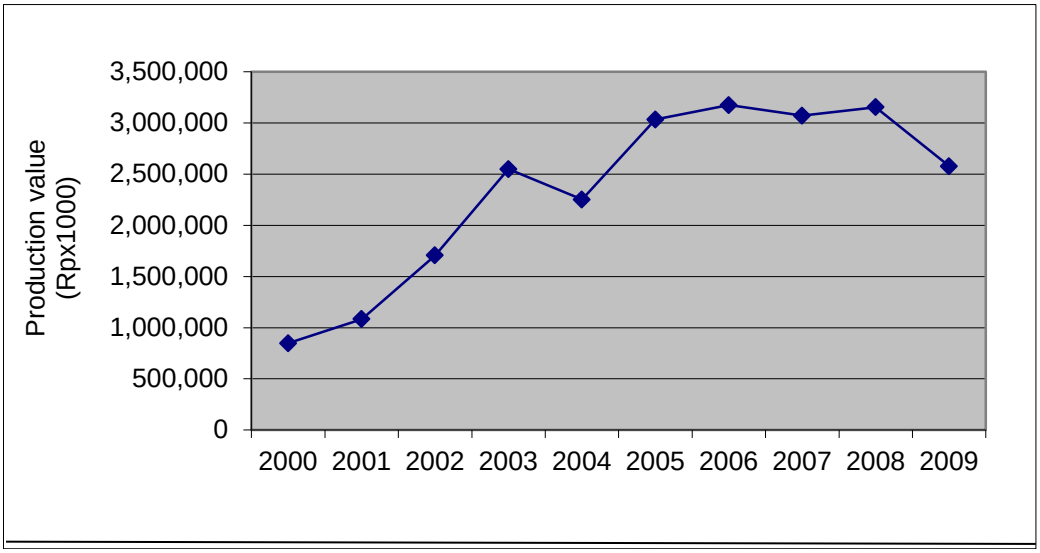


Figure 6.1. Development of tuna production value in FMA 716 and 717

With constant price assumption, the increase of tuna production imply an increase in tuna production value. This can be seen in 2000, when the production value of tuna was recorded at Rp. 847,941,500,000 and became Rp. 2,577,547,000,000 in 2009. The lowest production value is Rp. 847,941,500,000 (in 2000) and the highest production value is Rp. 3,175,138,400,000 (in 2006). These production values are obtained by assuming that the average price of fresh tuna is US$ 2.96/tonne or equivalent to Rp.28,700/kg (exchange rate US$ 1 = Rp 9700). Along with the decreasing of total production, the total production value in 2009 also experiencing a decrease compare to previous year.

6.3 The Contribution of Fisheries Sub-Sector towards the Economics of Bitung City and the Employment

Based on the economic sector data of Bitung City in 2000 – 2007, the fisheries sub-sector becomes the basic economic sub-sector in Bitung City (Apsari, 2009). In other words, the fisheries sub-sector is able to support the economic needs of Bitung City, and even more, it is able to export out of Bitung City. The types of tuna species produced by Bitung City are comprised of skipjack, little tuna and tuna (Table 6.3). During that period, the average contribution of fisheries sub-sector towards Gross Domestic Products (GDP) of Bitung City was 20.09%. This GDP contribution is quite significant for the regional economy, because it can influence the GDP size of Bitung City. Additionally, fisheries commodity drives the fish processing industry, trade and supports local employment.

Table 6.3. Production volume and production value of main capture fisheries product in Bitung City, 2007

Species	Production volume (tonnes)	Production value ('000 Rp)
Skipjack	54,243.7	371,477,930
Albacore	12,657.8	138,521,670
Yellowfin	12,785.8	80,157,550
Bigeye tuna	12,480,0	77,260,817
Little tuna	14,352.2	46,749,251
Scads	26,003.5	116,043,730

Source: Fisheries and Marine Office of Bitung City in Apsari (2009)

The contribution of capture fisheries towards the exports of Bitung City during the period of 2000 – 2007 is quite high, at 34.26% of the total export value of Bitung City. This shows that the fisheries sub-sector has a high role in the economy of Bitung City by being an important contributor of revenues.

Fisheries sub-sector is a productive sub-sector. In addition to providing local employment, the sub-sector is also able to create other activities that spawn new employments. In 2007, the total employment from fisheries sub-sector in Bitung City is 26,584 persons. If we compare this with the results of the 2007 SUSENAS Survey of North Sulawesi Province whereby it was noted that the total employment in Bitung City was 169,562 persons; this means that fisheries sub-sector contributed to 15.68% to total employment in Bitung City (Apsari, 2009) – a proof that fisheries sub-sector has an important role in the employment of Bitung City.

VII. FISHERIES MANAGEMENT

7.1. Institutional Arrangements

In regards to fisheries management in the high seas, Indonesia has had a set of laws and prepared a variety of rules as well as policies to support the forming and strengthening of related institutions. The institution that has the role of managing the fisheries in the high seas is the Ministry of Marine Affairs and Fisheries (MMAF, or *KKP*). Several institutions underneath the Ministry that have specific roles of managing the high seas fisheries include Directorate General of Capture Fisheries (DJPT), Directorate General of Surveillance of Marine and Fisheries Resources (PSDKP), Directorate General of Marine, Coasts and Smal Islands (KP3K), and Agency for the Research and Development of Marine and Fisheries (Balitbang KP). In addition to that, supports were also prepared in the form of Ministerial Regulations (Permen), Minister Decrees (Kepmen), and other policies. Institutional strengthening to manage fisheries resources are then guided by competent authorities (formed by MMAF), such as National Commission for the Assessment of Fisheries Resources (Komnas Kajiskan) and the Quality Assurance Authority. Descriptions about those institutions are as below:

- The National Commission for the Assessment of Fisheries Resources (*Komnas Kajiskan*) was formed based on the Ministerial Regulation No. 13/2009, and then it was amended by the Ministerial Regulation No. 13/2010. This commission is responsible to give inputs and/or recommendations to the Minister in setting the potential yield and total allowable catch, as inputs for the policy materials in responsible fisheries management within the Fisheries Management Areas (FMAs) of the Republic of Indonesia.
- Competent authority to control the implementation of Quality Assurance System and the Safety of Seafood Products was also formed by the Ministry of Marine Affairs and Fisheries. This was stipulated in the Ministerial Decree No. KEP.01/MEN/2007.
- Besides government institutions and private institutions, there is an association for fisheries entrepreneurs under the umbrella of GAPPINDO (*Gabungan Pengusaha Perikanan Indonesia*, or Indonesian Fishery Federation). One of the objectives of GAPPINDO is to spread awareness on natural conservation and preservation. As a federation, GAPPINDO has members that consist of several associations. The association of companies that involve in tuna capturing that operate in Pacific Ocean is ASTUIN (*Asosiasi Tuna Indonesia*, The Association of Indonesian Tuna), who has two (2) member companies. Member ships of ASTUIN are all long liners with a size of > 100 GT and are equipped with cold storage. ASTUIN is export oriented (Japan, about 82 – 83%), and the rest are for the domestic market. In general, there are several roles of the association. However, in relation to tuna fisheries management in WCPFC, the association's roles are: 1) Giving recommendation for *SIPI* and *SIKPI* licenses, 2) Giving inputs to the government in in making regulations, 3) As a partner of the government in the development of marine and fisheries sector, and 4) Strengthening the domestic and foreign fish market. Below is the list of GAPPINDO's association members that are involved in the tuna capture in the WCPFC Convention Area:

Table 7.1. Association of tunas fishing operate surround WCPFC convention area (FMA 716 and FMA 717)

Asosiation names	Number of vessels >30GT	
	Longliner	Purse Seiner
ASTUIN	17	0
AKPN	0	37
HIPPBI	37	11

Source: Directorate of Fisheries Resources - MMAF

- In order to support the forming of institutions that consist of local fisheries associations and local organizations, and institutions that consist of association or organization (GAPPINDO) that are healthy, professional, transparent, and independent, a policy to regulate recommendation-giving from capture fisheries associations or organization (as a pre-requisite to get business/operating license for the individuals/business entities that operate fishing vessels and fish transporting vessels), had been enacted. This policy is contained in the Regulation of the Director General of Capture Fisheries (*Peraturan DirJen KP*) No. 5364/2008 pertaining to Recommendation-Giving from Associations or Organizations in Capture Fisheries Sector as a Pre-Requisite to get Business/Operating License, dated on December 22, 2008. This rule is expected to be one of the monitoring tools for fishing management and empowerment of fisheries association.
- The roles of association in the monitoring and fisheries management are also encapsulated in the Ministerial Regulation (*PerMen KP*) No. 05/2008 pertaining to Capture Fisheries Bussines. Several articles in this regulation requested recommendations from local fisheries association or organization that are listed in the Directorate General of Capture Fisheries as a pre-requisite for the application and extension of Fishing Permission Letter (*SIPI*) and Fishing Business License (*SIUP*).

7.2. Laws, Regulations, and Policies, as well as Problems in Tuna Fisheries Management

7.2.1 Laws

Laws and regulations that become the legal foundation for fisheries management in Indonesia is Act No. 31/2004 pertaining to Fisheries:

- Chapter 1, article 1, verse 7: fisheries management is every effort, including integrated process in information collection, analyses, planning, consulting, 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.
- Chapter 1, part 2, article 2, stated that fisheries management is implemented based on sustainability principle
- Chapter 4, article 7, stated that the fish resources management policies are supported by Ministerial Decisions. In regards to fisheries resources management in the high seas, 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.
- Chapter 4, article 10, part 1, letter a, the government cooperates with neighboring countries or other countries in the context of conservation and fisheries resources management in the high seas. In part 2, it is stated that the government participate actively in the membership of regional and international institution/organization in order to cooperate in the regional and international fisheries management.
- Article 26, 27, 28, stated that every Indonesian person or institution that will carry out business in the fishing sector and/or fish transporting sector in Indonesia's FMA is required to have:

    1. Fishing Bussines License, or *Surat Ijin Usaha Perikanan* (*SIUP*), is a written permission (license) that needs to be owned by fishing companies before doing any fishing effort

using the production facilities stated in the license. In the *SIUP*, the Fish Allocation of the Capital Investment (*Alokasi Penangkapan Ikan Penanaman Modal*) will be determined.

2. Fishing Permission Letter, or *Surat Ijin Penangkapan Ikan* (*SIPI*), is a written permission (license) that needs to be owned by every fishing vessel before starting any fish capturing.
3. Fish Transporting Permission Letter, or *Surat Ijin Pengangkutan Ikan* (*SIKPI*), is a written permission (license) that needs to be owned by every fishing vessels before any fish loading/colecting and transporting

7.2.2. Rules and Policies

1. Ministerial Regulation No. 05/2008 pertaining to Capture Fisheries Business:

   - Article 14, verse (1), every person or Indonesian institution that carry out fishing activities in a single fishing fleet are required to have SIUP, SIPI, and SIKPI in a unit of a single fishing fleet.
   - Article 22, verse (2), letter f, pertaining to the issuance of Fishing Business License, it is stated that one of the requirements to get a Fishing Business License is to get 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 by requiring recommendation from association or organization.

2. Decree of the Director General of Capture Fisheries No. 08/DJ-PT/2010
   This decree regulates the moratorium of new permission for fishing gear and auxiliary fishing gear. The moratorium applies only to new licensing of fishing gear for five (5) types of fishing gear and auxiliary fishing gear in certain locations. The banned fishing gear and auxiliary fishing gear (in relation to fishing gear used in the WCPFC Convention Area) are: purse seine for big pelagic fishes for fishing vessels that are more than 200 GT in size in all fishing grounds, and FADs (Fish Aggregating Devices) in Indonesia's Exclusive Economic Zone, respectively.

3. The Strategic Plan of the Ministry of Marine Affairs and Fisheries, 2009 – 2014
   The Strategic Plan of MMAF (2009 – 2014) stated that one of the aims of the development on the marine and fisheries sector until 2014 becomes part of the Natural Resources and Ecology Sector Development, and are directed to achieve 2 sector priorities; one of them is the Improvement of Marine Resources Management. In the strategic plan it is stated that the contribution of MMAF in improving the marine and fisheries resources management is the notion that Indonesian marine jurisdiction is free from illegal, unreported, and unregulated fishing (IUU-fishing), and also free from the damaging activities that affect the marine and fisheries resources from 34% in 2010 to 89% in 2014. This contribution is implemented in the Marine and Fisheries Resources Surveilance Program.

Several regulations and policies also support tuna fisheries management in the high seas, notably:

1. Ministerial Regulation No. PER.03/MEN/2009 pertaining to Fish Capturing and/or Fish Transporting in the High Seas.
2. Ministerial Regulation No. PER.12/MEN/2009 pertaining to Changes in the Ministerial Regulation No. PER.05/MEN/2008 pertaining to Captured Fisheries Effort.
3. Ministerial Regulation No. PER.28/MEN/2009 pertaining to Certification of Captured/Landed Fish.

4. Ministerial Regulation No. PER.27/MEN/2009 pertaining to Fishing Vessels Registration and Marking.
5. Ministerial Regulation No. PER.18/MEN/2010 pertaining to Fish Log Book
6. Ministerial Regulation No. PER.19/MEN/2010 pertaining to the Control of Quality and Safety Assurance System for Fisheries Products.
7. Ministerial Decree No. 24/2010 pertaining to Priority Bills that will be enacted in 2010. The bills are proposed in the form of Government Regulations and Minister Regulations.
8. Indonesia has an information list on Authorized Vessels and Active Vessels, or vessels that are active and legal to catch tuna.
9. Implementation of fisheries log-book as an implementation of Ministerial Regulation No. PER.18/MEN/2010
10. Tuna fisheries revitalization program

7.2.3. Problems and Challenges

Challenges in the tuna fisheries in Indonesia nowadays are: (1) stock decrease; (2) increasing operational costs; (3) IUU Fishing; (4) Government Regulations; (5) Capital; (6) Trade Barriers; and (8) Tuna farming fisheries. From those 5 problems, they can be categorized into 2 issues: capture issues and trade issues (Komisi Pengawas Persaingan Usaha, 2009 and WPI June 2010 edition).

1. Capture Issues

The main problem that plagues tuna fisheries is the issue surrounding illegal fishing perpetrated by fishers from other countries (i.e., foreign fishing vessels). There are three reasons why illegal fishing happens (*Komisi Pengawas Persaingan Usaha*, 2009)::

a. Economically, illegal fishing occurred because of the absence of legal Indonesian fishing vessels in several fishing grounds. This absence had prompted foreign fishing vessels to ply and illegally fish in these fishing ground; additionally, there is no need for long-term investment commitment with Indonesia.
b. Generally speaking, investment climate in Indonesia is generally unconducive (i.e., capital barrier to entry). This is because the macro-economic condition is unsafe, uncertain, complicated, and the amount of levies that should be paid to the central and regional government to invest in the fisheries sector is considered too expensive. Investment in fisheries that should have been done by the domestic investor does not happen much due to the lack of capital amongst domestic investors. These 'government policy-induced situations' are then taken into advantage by foreign fishing vessels to illegally or legally engage in a short-term investment
c. From the context of legal, illegal fishing may happen because of ineffective surveillance/monitoring. The government tends to focus on surveillance through security approach. Surveillance through security approach has been proven expensive and probably ineffective. Therefore, illegal fishing would be handled better through two approaches: economic approach as a priority, supported by security approach.

2. Trade Issues:

a. Import duty tariff

For countries that have tuna fishing fleets, tuna is protected through tariff and other instruments. Some developed countries still allow escalated tariff for tuna, although there is an exception called 'Generalized Special Preference or GSP' for select countries.

b. CITES and Catch Certification

Another issue is the sashimi market that use a lot of Bluefin Tuna. Several international environmental NGOs are concerned on sustainability problem of Bluefin Tuna. Even though Bluefin Tuna was not included in the Appendix 2 of CITES during the last COP CITES in Qatar in March 2010, external pressure on the environmental and sustainability issue of Bluefin Tuna is predicted to continue.

Since January 1, 2010, the European Union had regulated the requirement of catch certificate to prevent, restrict, and remove illegally caught products to get into Europe. Because of these regulations, every captured fisheries product which are exported to the European Union should proof the origin, including the location (fishing ground) where the fish was caught, and the vessel's name. If these requirements are not fulfilled, the product will be rejected from entering the EU.

c. Ecolabeling

Ecolabelling issue continues to hover over tuna product. "Dolphin safe tuna" requirement has been going on since 18 years ago and the certification had been done by a US NGO, namely Earth Island Institute. After the dolphin issue, now a number of retailers also require another kind of ecolabel. There are at least two certified institutes for tuna. The first one is Friend of the Sea (FOS), which covered 8 tuna fishery entities in Papua New Guinea, Maldives, the Philippine, Sri Lanka, Azores, Brazil, Namibia, and Senegal. The second one is Marine Stewardship Council (MSC), which has certified two tuna fishery entities for albacore in North and South Pacific and also skipjack fisheries in Japan that use traditional method and low-waste principle.

7.3 Management Plan

In CCRF Guideline No. 4 and Act No. 31/2004 (pertaining to Fisheries) article 1, verse 7, it is stated the clear definition of fisheries management. The management definition can be use as a basis in drafting Tuna Fisheries Management Planning in the WCPFC Convention Area (Indonesia). In article 2 of the Act, it is stated that fisheries management is based on the principle of utility, justice, partnership, equity, integrity, transparency, efficiency, and sustainable conservation, and management of fisheries shall be performed in accordance with the purposes stated in the article. As stated in article 2 of the Act, the management of tuna fisheries in the WCPFC Convention Area need to be done at least for these objectives:

- Ensuring sustainability of fisheries resources
- Increasing the country's foreign exchange
- Enforcing job expansion and opportunity
- Optimizing fisheries resources management
- Increasing productivity, quality, value added, and competitiveness
- Reaching optimal utilization of the fisheries resource and the resources environment

Tuna fisheries management plan in this convention area need to refer to the above definition and objectives. Fisheries management plan framework can be described into several important points:

1. Definition and scope

2. Description and relevant information about the biophysics of the marine environment
3. Issues, problems, challenges, and opportunities of fisheries development
4. Management objectives and target
5. Management action

The most important thing in drafting a management plan is the commitment to draft a fisheries management plan that refers to the principles of Ecosystem-Based Fisheries Management and Sustainable Management.

7.4 International requirement

The United Nations Convention on The Law of the Sea (UNCLOS 1982) is a set of laws that governs all forms of use and utilization of the marine resources.

UNCLOS 1982 had outlined some regulations onto some species of fish that have special properties, including fish species that has limited migratory characteristics (i.e., straddling fish), and the fish species that has long-distance migratory characteristics (highly migratory fish). Straddling fish is fish which occur both within the exclusive economic zone of a country and in an area beyond and adjacent to the zone; therefore, its management has to cross jurisdictions of several countries. Highly migratory fish is fish that migrate from an Economic Exclusive Zone to the high seas and then return; its scope would cross several oceans rendering it prone to conflicts between coastal states and distant water fleet countries, particularly on the utilization and conservation of fish in the EEZ and high seas adjacent to the EEZ.

To overcome those problems, there need to be conservation arrangement and management as an agreed solution for many countries. Hence, international agreements as outlined in the UNCLOS or those outlined in the UNIA (United Nations Implementing Agreement/UNIA 1995 - particularly for straddling fish and highly migratory fish) are regulations that give authority to utilize those fish. UNIA 1995 is multilateral agreement that bind several parties in the matter of conservation and management of straddling fish and highly migratory fish, as an implementation of Article 63 and Article 64 of UNCLOS 1982. This agreement was drafted based on the long-term sustainability principle for the straddling fish stock and highly migratory fish stock and to promote optimal utilization objective of those fish stocks and also to apply precautionary approach in fish resources management.

Then in 2000s, it was considered necessary to make regional institution that specially handles straddling fish stock and highly migratory fish stock in western and central Pacific Ocean (WCPO). This agreement had been followed up by the formation of several regional fisheries management organizations (RFMO), namely *Western and Central Pacific Fisheries Commission* (WCPFC) based on the *Convention on the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean*; Honolulu, September 4 2000, as the implementation of fisheries technical problem.

To see how far the harmony between the conservation regulations and the management of highly migratory fish stock in the UNCLOS, UNIA, and the Indonesia's laws and regulation, we analyze them using the following matrix:

Table 7.2. Policy Analysis of UNCLOS, UNIA and Indonesia's Fisheries Act No. 31/2004

No	UNCLOS	UNIA	Act No 31/ 2004	Explanation (Indonesia's laws)	Status
1	Art 22 Sea channel and cross permission Art 61 (e) vessel's position report	Art 18 Measurement for the capturing effort and having license or	Act 31:Art 27,30 SIPI, Art36 Registration of fisheries vessels Art 42(2):Sailing	Indonesia Government (Minister) issue SIPI, govern the provision of SIUP	Fully comply

No	UNCLOS	UNIA	Act No 31/ 2004	Explanation (Indonesia's laws)	Status
	Art 62(4)a fisher's fish capturing vessel and fishing gears license Art 94 (1) Every country require to do effective jurisdiction and control in administration, technical, and social for every vessel hang its flag	authorization to capture Annex1 Art 5	permission letter Art 50:fisheries collection	(Business License) which proceeded an agreements and other arrangements, and registration of ships, and gave authority to harbormaster to issue sailing permits for flagged ships that utlize or crossing Indonesian waters	
2	Art 64(1) ensuring cooperation of country to conserve highly migratory fishes with the objective to optimize utilization	Art 19 compliance and enforcement by the flag state	Act 31:Art 10(2) Government participate actively in regional and international organization membership in order to cooperate in fisheries management	Indonesia has actively participated in the regional and international organizations in regards to conservation and fisheries management	Fully comply
3	Art 62 (4)c Regulate fishing season and area, type, size, and number of gears and also number of fishing vessels Art 62(4) letter a, fisher's of fishing vessel and fishing gears license	Annex1 Art 4 Flag vessels identification and vessel registration port	Act 31:Art 37 Every Indonesian fishing vessels are given fishing vessel identity mark in the form of sign, fishing area mark, fishing line mark, and fishing tools mark.	Indonesia issues license or permission by determining certain requirements, take record of the vessel, and give mark on the vessel	Fully comply

No	UNCLOS	UNIA	Act No 31/ 2004	Explanation (Indonesia's laws)	Status
4	Art 21(1)d, 61, natural resources conservation Art 73(1) Coach State sovereign right to explore, exploit, conserve, and manage resources in EEZ	Art 5 conservation and management of stock	Act 31 Art IV Fisheries management Article 6, 7(1) c number of capturing allowed in Indonesia's fisheries management area Description of Article 35 (1) In order to manage fish resources utilization, structuring, and controlling of new and or second vessel procurement need to be controlled in order to comply with fish resources support capability	Natural resources conservation obligation in the Convention of the Law of the Sea, followed by sovereign rights to explore, exploit, conserve, and manage resources in the EEZ had been regulated in Indonesia with stock control approach or vessel number control.	Fully comply
5	Art 42(1)c Restriction to capture non target fishes and related species	Art 5(d) Assess the effect of fish capturing, human activities, and other environmental factor to stock target	Act 31:Art 6(1) Fisheries management in Indonesia's Fisheries Management Area is performed to attain optimal and sustainable benefit and to ensure the sustainability of fish resources	Indonesia doesn't restrict fish capturing vessels carrying non-target fish as long as those fish can be utilized optimally and, even though there is advice to prevent catching non-target fish	Partly comply
6	Art 61(2) Fishing capacity, 62 (3)b fishing quota	Art 5 (h) taking measurement to prevent or eliminate overfishing Art 8 Countries do consultation for over exploitation	Act 31, Chapter IV Fisheries management, Article 6, 7 (1)c, Total Allowable Catch in Indonesia's Fisheries Management Area, Act 31, Art 7(3) Minister determines the	Determination of capacity for harvesting and catch quota can prevent overfishing to ensure resource conservation	Fully comply

No	UNCLOS	UNIA	Act No 31/ 2004	Explanation (Indonesia's laws)	Status
			potential yield, and total allowable catch		
7	Art 42(1)c Restriction to capture non-target fish and related species Art 62 (4)b Determining capturing species, and fixing capturing quota during certain period	Art5(d) Assess the effect of fish capturing, human activities, and other environmental factor to stock target	Act 31:Art 7 (2)n protected species of fish Description Act 31:Art 9 Prevent the capturing of non-target species of fish	Indonesia determines protected species of fish and prevents the capturing of non-target species	Partly comply
8	Art 64(1) Coach states cooperate for optimal utilization of highly migratory species	Art 6 Preventative approach for the conservation, management, and exploitation of straddling fish stocks and highly migratory fish stocks	Act 31:Art 6(1) Fisheries management within the boundary of Indonesia's water is implemented to achieve optimal and sustainable benefits, and also to ensure the conservation of fish resources	Optimal utilization with precautionary approach in fisheries management	Fully comply
9	Art 42(1)c Prevention to capture non-target fish and related species	Art5(d) Assessing the effect of fish capturing, human activities, and other environmental factor against the target stocks	Act 31:Art 6(1) Fisheries management within the boundary of Indonesia's water is implemented to achieve optimal and sustainable benefits, and also to ensure the conservation of fish resources	Fishing vessels to prevent the catching of non-target fish and related species	Partly comply
10	Art 62 (4)b Determining capturing species, and fixing capturing quota during certain period	Art 6 Preventative approach for conservation, management, and exploitation of straddling fish stocks and highly	Act 31:Art 6(1) Fisheries management within the boundary of Indonesia's water is implemented to achieve optimal	Fisheries management approach based on MSY and MEY to achieve optimal and sustainable utilization and also	Fully comply

No	UNCLOS	UNIA	Act No 31/ 2004	Explanation (Indonesia's laws)	Status
		migratory fish stocks	and sustainable benefits, and also to ensure the conservation of fish resources	to ensure conservation of fish resources	
11	Art 62 (4)b Determining capturing species, and fixing capturing quota during certain period	Art 6 Preventative approach for conservation, management, and exploitation of straddling fish stocks and highly migratory fish stocks	Act 31:Art 6(1) Fisheries management within the boundary of Indonesia's water is implemented to achieve optimal and sustainable benefits, and also to ensure the conservation of fish resources	Indonesia had regulated and assessed the fish resources and determined the total allowable catch (TAC).	Fully comply
12	Art 62 (4)b Determining capturing species, and fixing capturing quota during certain period	Art 6 Preventative approach for conservation, management, and exploitation of straddling fish stocks and highly migratory fish stocks	Act 31:Art 6(1) Fisheries management within the boundary of Indonesia's water is implemented to achieve optimal and sustainable benefits, and also to ensure the conservation of fish resources	Indonesia had regulated and assessed the fish resources and determined the total allowable catch (TAC); however, the assessment for tuna is non-existent.	Fully comply
13	Art 21(a) navigation safety and maritime traffic regulation Art 22 Sea channel and permission to cross Art 61 (e) vessel position report	Art18(3)g Development and implementation of vessel monitoring system and satellite transmitter system	Act 31:Art 44(3) Administration and technical feasibility requirement to activate VMS through Ministerial Regulation No. 05/2007 Description Act 31:7(1) j Vessel monitoring system (VMS) is one of the surveillance system in capture fisheries, that uses fisheries vessel monitoring tools	Indonesia places observer and installation of VMS as a requirement to get a permission to catch fish	Partly comply

No	UNCLOS	UNIA	Act No 31/ 2004	Explanation (Indonesia's laws)	Status
14	Art 165(2)h. Monitoring, observation program, measurement, evaluation, and analysis program based on scientific method	Annex1, Art 1 Collecting stock data in waters area under state jurisdiction and verification data.	Act 31: Art 7 (2)e, Obligation to obey requirement about fisheries vessel monitoring system Act 31: Art 47 Government builds fisheries information networks with other institution, nationally and internationally	Indonesia had carried out monitoring through port sampling program in Benoa, Bitung and Kendari	Partly comply
15	Art 94(1) Every country has to do effective authority in law and control in administration, technical, and social for every flagged vessel.	Art 18d Giving mark and identification for fishing vessel and fishing gear Art 22 Rights and obligations to inspect and the willingness of flagged vessels to be inspected in accordance to the procedure	Act 31:Pasal 7 (2) e, Obligation to obey rules about fishing vessel monitoring system Art 42 (3), Besides issuing sailing permission letter, harbormaster re-check and examine the completeness and validity of fisheries vessel document	Monitoring in the administration and technical of vessels that cross Indonesian waters	Fully comply
16	Art 73, Utilization and management of coach state and taking steps for fisheries law violation	Art 19 Making investigation and law procedure for IUU violation, removing benefits from illegal activities	Act 31: Art10 (c) Informing and convey proofs related to the flag state of the vessel suspected of conducting activities that hamper conservation and management of fish resources Art 31(2), Vessel carrying fish should be equipped with SIKPI	Indonesia does not have any regulations relating to the prosecution of criminal violations on the high seas	Partly comply

No	UNCLOS	UNIA	Act No 31/ 2004	Explanation (Indonesia's laws)	Status
17	Art 165(2)h. Monitoring observation, measurement, evaluation, and analysis program based on scientific method	Art 22(1) The state guarantees the authority of officers	Act 31: Art 47, Government develops fisheries information networks with other institutions, nationally and internationally.	Indonesia does not have any regulations relating to the observers program	Partly comply
18	Art 21(a) Navigation safety and maritime traffic regulation Art 22 Sea channel and permission to cross, Art 61 (e) vessel position report	Art18(3)g Development and implementation of vessel monitoring system and satellite transmitter system	Description Act 31:7(1) j Vessel monitoring system (VMS) is one of the surveillance system in capture fisheries, that uses fisheries vessel monitoring tools	Indonesia has implemented monitoring system conducted by the harbormaster	Fully comply
19	Art 73 Utilization and management of coach state and taking steps for fisheries law violation	Art 19 Making investigation and law procedure for IUU violation, removing benefits from illegal activities.	Act 31: Art10 (c) Informing and convey proofs related to the flag state of the vessel suspected of conducting activities that hamper conservation and management of fish resources Art 31(2) Vessel carrying fish should be equipped with SIKPI. Art 66 Fisheries surveillance	Indonesia does not have any regulations relating to the prosecution of criminal violations on the high seas	Partly comply
20	Art 21(f) Environmental conservation Art 42(1)c Prevention to capture non-target fish and related species	Art 5(d) Assess the effect of fish capturing, human activities, and other environmental factor to stock target	Act 31:Art 6(1) Fisheries management in Indonesia's Fisheries Management Area is performed to attain optimal and sustainable benefit and to ensure the	Indonesia does not have any regulations relating to the mitigation to prevent the capture of seabirds	Partly comply

No	UNCLOS	UNIA	Act No 31/ 2004	Explanation (Indonesia's laws)	Status
			sustainability of fish resources		
21	Art 62 (4)b Determining species that can be caught, and revising catch quota during certain periods	Art 6 Prevention approach for conservation, management, and exploitation of straddling fish stocks and highly migratory fish stocks	Act 31:Art 6(1) Fisheries management in Indonesia's Fisheries Management Area is performed to attain optimal and sustainable benefit and to ensure the sustainability of fish resources	Indonesia has not determined the catch quota for tuna in the high seas	Non-comply
22	Art 72 Restrictions on transfer of rights directly transferred to a third country with a lease or license.	Art 17 Non-member countries are subject to the obligation to cooperate in stock assessment	Act 31:Art 10(2) Government participated actively in regional and international organization membership in the context of cooperation in the framework of fisheries management	Indonesia as CNM	Fully comply
23	Art 42(1)c Prevention of fish capture Art 62 (4)b Determining species that can be caught, and revising catch quota during certain periods	Art 10d Evaluating various scientific advice, reviewing status and stock estimation, and assess the effect of non-target and other species captured	Act 31:Art 7 (2) n, Protected species of fish	Indonesia stipulates protected species of fish	Partly comply
24	Art 62 (4)c Regulate fishing season and fishing ground, type, size, and number of fishing gear and as well as number of fishing vessels	Art 6 Preventative approach for the conservation, management, and exploitation of straddling fish stocks and highly migratory fish stocks	Act 31:Art 5(2) Fisheries management outside the territory of the Republic of Indonesia is carried out based on prevalent regulations,	Determination of types and size of fishing gear	Fully comply

No	UNCLOS	UNIA	Act No 31/ 2004	Explanation (Indonesia's laws)	Status
			requirements, and/or international standards that are generally accepted Act 31: Chp IV Fisheries management, Art 6		
25	Art 42(1)c Prevention of fish capture Art 62 (4)b Determining species that can be caught, and revising catch quota during certain periods	Art 6 Preventative approach for the conservation, management, and exploitation of straddling fish stocks and highly migratory fish stocks	Act 31:Art 6(1) Fisheries management in Indonesia's Fisheries Management Area is performed to attain optimal and sustainable benefit and to ensure the sustainability of fish resources	Indonesia does not have any fishing vessels that specifically target swordfish (redundation)	Non-applicable
26	Art 62 (4)b Determining species that can be caught, and revising catch quota during certain periods	Art 6 Preventative approach for the conservation, management, and exploitation of straddling fish stocks and highly migratory fish stocks	Act 31:Art 6(1) Fisheries management in Indonesia's Fisheries Management Area is performed to attain optimal and sustainable benefit and to ensure the sustainability of fish resources	Indonesia has drafted a National Plan of Action for sharks	Partly comply
27	Art 22 Sea channel and permission to cross, Art 61 (e) vessel position report Art 62(4)a Fishing license and fishing gear license	Art 18 Measurements should be taken, including the control of the fishing vessel, license to arrest and authorizing to arrest	Act 31:Art 27,30 SIPI, Art36 Fishing vessel registration, Art 42(20) Sailing Permission Letter: Art 49 Fisheries levies	Indonesia has actively engaged in vessel registration	Fully comply
28	Art 62 (4)b Determining species that can be caught, and	Art 5 Stock conservation and management	Act 31:Art 7 (2)b Requirement to obey the rules about type, number,	Indonesia has not made any regulations on the governance of Fish Aggregating	Non-comply

No	UNCLOS	UNIA	Act No 31/ 2004	Explanation (Indonesia's laws)	Status
	revising catch quota during certain periods	Art 6 Preventative approach for the conservation, management, and exploitation of straddling fish stocks and highly migratory fish stocks	size, and placement of auxiliary fishing gears (adopted)	Devices (FADs) or other auxiliary fishing gear	
29	Art 62 (4)b Determining species that can be caught, and revising catch quota during certain periods	Art 6 Preventative approach for the conservation, management, and exploitation of straddling fish stocks and highly migratory fish stocks	Act 31:Art 6(1) Fisheries management in Indonesia's Fisheries Management Area is performed to attain optimal and sustainable benefit and to ensure the sustainability of fish resources	Indonesia does not have any fishing vessels that specifically target swordfish (redundation)	Non-applicable
30	Art 62 (4)b Determining species that can be caught, and revising catch quota during certain periods	Art 6 Preventative approach for the conservation, management, and exploitation of straddling fish stocks and highly migratory fish stocks	Act 31:Art 6(1) Fisheries management in Indonesia's Fisheries Management Area is performed to attain optimal and sustainable benefit and to ensure the sustainability of fish resources	The determination of type and size of fishing gear does exist, however, it does not state about straddling fish stock	Partly comply
31	Art 147(2)c Safety zones marking	Art 6 Preventative approach for the conservation, management, and exploitation of straddling fish stocks and highly migratory fish stocks	Act 31:Art 46 Government arrange and develop information system	Indonesia has not made regulations on safety zones	Non-comply
32	Art 72 Restrictions on transfer of rights directly transferred to a third country with a lease or	Art18 h Regulation on transshipment on the high seas to ensure that	Act 31: Art 31(2) Vessels carrying fish require to be equipped with SIKPI	Indonesia has regulated transshipment	Partly comply

No	UNCLOS	UNIA	Act No 31/ 2004	Explanation (Indonesia's laws)	Status
	license.	effectivity of conservation and management are not undermined	Art 41(3) Each fishing vessel and fish transporting vessel should land their catches in defined fishing port		
33	Art 62 (4)b Determining species that can be caught, and revising catch quota during certain periods	Art 6 Preventative approach for the conservation, management, and exploitation of straddling fish stocks and highly migratory fish stocks	Act 31:Art 6(1) Fisheries management in Indonesia's Fisheries Management Area is performed to attain optimal and sustainable benefit and to ensure the sustainability of fish resources	Indonesia determines management in its jurisdiction area	Non-applicable
34	Art 92 Vessel status under two or several countries Art 72 Restrictions on transfer of rights directly transferred to a third country with a lease or license.	Art 18gi Implementation of inspection schemes for cooperation in law enforcement, including access permissions	Act 31: Art 31(1) Fishing vessel should be equipped with SIPI	Indonesia sets SIPI and SIKPI on vessels passing through the territorial waters, i.e., vessels that no one in Indonesia hired	Non-applicable
35	Art 62(4)a Fishing license and fishing gear license	Art 21 Forms of cooperation of regional and sub-regional organizations Member States and legal inspection, under international law, for violations committed	Act 31: Art 31(1) Fishing vessel should be equipped with SIPI	Indonesia does not provide port services to vessels without nationality	Fully-comply
36	Art 62h The landing of all or half load of catches by vessels in coastal states	Art 18e Requirements for recording and timely reporting of vessel position, catch of target and non-target species, and other fishing	Act 31: Art 41(3) Each fishing vessel and fish transporting vessel should land their catches in defined fishing port	All of the fish caught should be landed in the port	Partly comply

No	UNCLOS	UNIA	Act No 31/ 2004	Explanation (Indonesia's laws)	Status
		effort.			
37	Art 64(1) Ensuring cooperation amongst countries for the conservation of highly migratory fishes with the objective of optimal utilization	Art 21 Forms of cooperation between members and non-members of the organization in order to ensure compliance with the measures	Act 31:Art 10(2) Government participated actively in regional and international organization membership in the context of cooperation in the framework of fisheries management	Cooperation need to be continuously carried out with the objective of optimal utilization	Fully comply
38	Art 62 (4)b Determining species that can be caught, and revising catch quota during certain periods	Art 6 Preventative approach for the conservation, management, and exploitation of straddling fish stocks and highly migratory fish stocks	Act 31:Art 6(1) Fisheries management in Indonesia's Fisheries Management Area is performed to attain optimal and sustainable benefit and to ensure the sustainability of fish resources	Indonesia does not have fishing vessels that specifically target highly migratory fishes	Non-applicable
39	Art 62 (4)c Regulate fishing season and area, type, size, and number of gears and also number of fishing vessels	Art 15 The implementation of conservation and management in closed and semi-enclosed sea. States should pay attention to the natural characteristics of the sea.	Act 31:Art 10 (1)b Cooperation with neighboring countries or other countries in the framework of the conservation and management of fish resources in the high seas, closed seas or semi-closed seas and the enclaves	Enclaves are excluded from the fishing grounds plied by Indonesian flagged fishing vessels	Non-applicable
40	Art 62(4)a Fishing license and fishing gear license	Art 19(1)c Compliance in giving information to the authority about vessel's position, catches, fishing gear, and	Act 31:7(1)j Fishing vessel monitoring system	Vessel monitoring system through licensing or sailing permission letter (for vessels). Indonesia does not have authority on the high	Non-applicable

No	UNCLOS	UNIA	Act No 31/ 2004	Explanation (Indonesia's laws)	Status
		fishing operation related to violation Art 18gi Implementation of inspection schemes for cooperation in law enforcement, including access permissions		seas (Act 31)	
41	Art 62 (4)b Determining species that can be caught, and revising catch quota during certain periods	Art 6 Preventative approach for the conservation, management, and exploitation of straddling fish stocks and highly migratory fish stocks	Act 31:Art 6(1) Fisheries management in Indonesia's Fisheries Management Area is performed to attain optimal and sustainable benefit and to ensure the sustainability of fish resources	Blue fin tuna fishing grounds are not Indonesia's fishing ground	Non-applicable
42	Art 62 (4)b Determining species that can be caught, and revising catch quota during certain periods	Art 6 Preventative approach for the conservation, management, and exploitation of straddling fish stocks and highly migratory fish stocks	Act 31:Art 6(1) Fisheries management in Indonesia's Fisheries Management Area is performed to attain optimal and sustainable benefit and to ensure the sustainability of fish resources	Albacore tuna fishing grounds are not Indonesia's fishing ground	Non-applicable
43	Art 73 Utilization and management of coach state and taking steps for fisheries law violation	Art 20(6) Illegal or unlicensed/without permit catch	Act 31: Art10 (c) Informing and convey proofs related to the flag state of the vessel suspected of conducting activities that hamper conservation and management of fish resources	Indonesia participates in combating the violations on fisheries laws and regulations; however, violations that occur on the high seas are not yet regulated.	Partly comply

No	UNCLOS	UNIA	Act No 31/ 2004	Explanation (Indonesia's laws)	Status
			Act 31: Art 31(2) Vessels carrying fish require to be equipped with SIKPI. Art 66, Fisheries surveillance		
44	Art 62 (4)b Determining species that can be caught, and revising catch quota during certain periods	Art 6 Preventative approach for the conservation, management, and exploitation of straddling fish stocks and highly migratory fish stocks	Act 31:Art 6(1) Fisheries management in Indonesia's Fisheries Management Area is performed to attain optimal and sustainable benefit and to ensure the sustainability of fish resources	All of the fish caught should be landed in the port	Partly comply

According to table above, we can see that conservation management and fisheries resources management rules in UNCLOS have been adopted by UNIA agreement. UNIA agreement has also been adopted by Act No. 31/2004. Regulation which has not been adopted should be considered in drafting regulations on conservation and fisheries resources management on the high seas, especially in the WCPFC Convention Area. This is because management principles and actions adopted by WCPFC should be applied in the national policies for the management of highly migratory fish stocks in the territorial area under the jurisdiction of coastal state.

CONCLUSION

Tuna resources management and utilization as highly migrated fish stocks need to be regulated by regional fisheries management organization or RFMO, such as WCPFC. One of the consequences of this organization existence is the needs to exchange information and accurate and precise fisheries data between country members, and technology transfer for developing countries in activities on tuna resources conservation in the convention area. The presentation of this Tuna Fisheries Report is one of the efforts in order to transfer that information and for timely review about tuna fisheries in areas related with the WCPFC convention area, which in the case for Indonesia are FMA 716 and 717.

The presentation of this report is still not perfect. There should be improvement measures in the availability of data in order to do more in-depth study on tuna resources in the WCPFC Convention Area. The study will involve about optimization and utilization of tuna in the WCPFC to find an equilibrium between conservation and economic interests as the objective of Indonesia's fishing industry. Besides, it is necessary to determine the quota so that it can be used as a basis to determine policy measures that need to be taken by Indonesia, including taking into account the escalation in Indonesia's membership status as a full member. Finally, we hope that tuna fisheries management in Central and Western part of the Pacific Ocean can increase Indonesia's fishing industry and while at the same time, maintain fisheries resource sustainability

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APPENDICES

Appendix 1. The four most important fishing gear for catching tunas (tuna, skipjack and *little tuna*), in Fisheries Management Area 716

Year	Number of sishing gear (fishing units)			
	Purse Seine (*Pukat Cincin*)	**Tuna Long Line (*Rawai Tuna*)**	**Pole and Line (*Huhate*)**	**Troll Line (*Pancing Tonda*)**
2000	597	116	122	9,306
2001	615	127	123	10,092
2002	804	295	340	3,348
2003	624	474	260	3,711
2004	745	741	2,910	5,293
2005	896	601	509	2,985
2006	980	657	558	3,244
2007	1,012	702	545	2,810
2008	1,174	771	581	2,540
2009	1,046	876	563	2,566

Appendix 2. The four most important fishing gear for catching tunas (tuna, skipjack and *little tunal*), in Fisheries Management Area 717

Year	Number of fishing gear (fishing units)			
	Purse Seine (*Pukat Cincin*)	**Tuna Long Line *(Rawai Tuna*)**	**Pole and Line (*Huhate*)**	**Troll Line (*Pancing Tonda*)**
2000	605	485	1,002	14,223
2001	614	346	1,257	13,592
2002	428	255	939	10,466
2003	467	302	1,345	12,457
2004	482	370	747	21,616
2005	501	400	762	11,971
2006	559	421	858	13,158
2007	581	263	1,183	12,317
2008	678	263	1,181	12,300
2009	629	263	984	14,476