Highlights:

- Indonesia's tuna industry began in 1965. By 2004 it had become the world's leading tuna supplier, and remains #1, accounting for 11% of total world supply, although catches declined from 624,000 t in 2004 to 562,00 t in 2006 [FISHSTAT data].
- Indonesia is the biggest fresh and frozen tuna supplier to the U.S. contributing about 36% (or about 9 thousands t) of total U.S. fresh and frozen tuna import in 2007, followed by Philippines (23%), Canada (5%), and Korea (3%) [Globefish 2008].
- Indonesia is also the #1 supplier to Japan, air-shipping 15,000 t of principally yellowfin and bigeye to the sashimi market [Infosh 2007].
- Out of total seafood exports worth USD 2.1 billion in 2006, tuna was the 2nd biggest contributor at about USD 250 million (12%) (shrimp has been the biggest commodity export from Indonesia, contributing 53% of total export value or USD 1.1 billion in 2006) [MMAF 2007].
- Data from 2002-2004 shows that exported tuna products from Indonesia are dominated by canned tuna (44%), followed by frozen tuna (29%) and fresh tuna or high quality tuna (27%) for sashimi (MMAF 2007).
- In terms of export value, during period 2001-2006, 44% of total Indonesian tuna export went to Japan, followed by U.S. (27%), Saudi Arabia (4%), Germany (4%), and Singapore (3%).

- The Western Central Pacific Ocean currently supports the largest industrial tuna fishery in Indonesia, contributing to almost 80% of total Indonesian commercial tuna production with total catch of approximately 303 thousands t in 2005, consist of albacore, bigeye tuna, yellowfin tuna, and skipjack. Meanwhile, Eastern Indian Ocean contributes to 20% of total commercial tuna catch from Indonesia (albacore, bigeye tuna, skipjack tuna, Southern bluefin tuna and yellowfin tuna), with total catch of 79 thousands t in the same year (FISHSTAT data).
- FAO (2005) believes that there has been an unknown portion of the longline catch originates from locations outside of Indonesia. FAO (undated) suggested that most of tuna in Western Central Pacific Ocean is caught within EEZs, but only 20% of tuna in Eastern Indian Ocean is caught within EEZ. Meanwhile, some government officials and industry representatives believe that most of the catch in Eastern Indian Ocean (about 54,000 tonnes per year) is from locations outside of Indonesia's EEZ.
• Maluku-Papua contributes the biggest portion of skipjack landings in Indonesia, contributing about 33% of total skipjack landings, followed by North Sulawesi (23%), and South Sulawesi (18%). These three coastal landings that located in Pacific Ocean already contribute about 74% of total skipjack landings in Indonesia (Indonesia Captures Fisheries Statistics - MMAF 2007).

• Maluku-Papua also contributes the biggest landings of albacore, bigeye tuna, and yellowfin tuna, contributing 26% of total landings of tuna in Indonesia, followed by North Sulawesi (24%), Bali-Nusa Tenggara (16%), South Sulawesi (12%), North Java (10%) and West Sumatra (8%) (Note: for Bali-Nusa Tenggara, North Java and West Sumatra, the landings include albacore, bigeye and yellowfin tuna plus Southern bluefin tuna).

• In 2005, Indonesian fleet comprises 2013 longliners with available super-cold storage facilities which target yellowfin tuna and bigeye tuna principally for Japanese *sashimi* market (Oceanic Development 2006), about 3872 tuna pole and line vessels which target skipjack tuna, in particular for processing into *fushi* (dried and smoked skipjack tuna) but also for canning (Indonesia Captures Fisheries Statistics - MMAF 2007); and 1474 purse seiners.

• There are no scientific stock assessments of the status of Indonesia's tuna resources, though several collaborative projects are monitoring the fishery, collecting data, and tracking key indicators.

• Average size of fish caught has declined by over one third in the past twenty years, and catch rates are down 72%.

• There are no set TACs, and the fishery is managed via input controls, essentially vessel licensing.

• Catches are reported below levels advised by scientists, but IUU is reportedly significant and actual catches are likely significant higher than reported.

• At the regional level, in 2007, Indonesia has just achieved of Full Member status of both Indian Ocean Tuna Commission (IOTC) and Commission for the Conservation of Southern Bluefin Tuna (CCSBT) and made a firm commitment to achieve Full Member status of Western and Central Pacific Fisheries Commission (WCPFC) during the coming year.

• Main fishing gears for the tuna fishery in Indonesia are longliner, traditional hook & line, and purse-seiner combined with FADs (Fish Aggregation Devices).

• Survey by WWF (2005) estimated that Indonesian tuna longline bycatch rate in the Pacific is estimated to be 256 to 768 animals per year for leatherback turtles and 768 to 2,304 animals per year for loggerhead turtles. In the Indian Ocean, bycatch rate for leatherback turtles is estimated to be 1,349 to 4,032 animals per year, while bycatch for loggerhead turtles is 4,032 to 12,098 animals per year.

• In addition to that, data from IOTC (2005) also noted that based on research vessel undertook purse seine and longline fishing in the eastern Indian Ocean between 2001 and 2005, about fifteen families with about 30 species of fishes and one family of octopus were caught by purse seine and longline operations targeted and caught yellowfin, bigeye and skipjack tunas. Other species caught included mainly sharks (thresher, blue, white-tip, spot tail, crocodile and silky) and also stringrays.
Indonesian Tuna to World Landings

Indonesia became the biggest tuna landing nation in 2004, after its total production exceeded total tuna production from Japan. Indonesia's total tuna landing in 2004 amounted to some 624,000 t, compared to 39,000 in 1970, with an average growth rate of 7 percent per annum. However, since 2005, the landings of tuna started to decline to 574,000 t in that year and further down again to 562,000 t in 2006. There are at least 10 tuna species caught in Indonesian waters, but only five species that are commercially important, which are skipjack (62%), yellowfin tuna (29%), bigeye tuna (7%), albacore (1%), and Southern bluefin tuna (1%) [FISHTAT data].

In 2006, Indonesia contributed to 11% of total world landings, followed closely by Japan with 10% world landings. Other important tuna fishing nations are Philippines (9.6%), Taiwan Province of China (7.5%), the Republic of Korea (5.8%), Ecuador (4.27%) and Papua New Guinea (3.4%).

The Western Central Pacific Ocean currently supports the largest industrial tuna fishery in Indonesia, contributing to almost 80% of total Indonesian commercial tuna production with total catch of approximately 303 thousands t in 2005, consist of albacore, bigeye tuna, yellowfin tuna, and skipjack – Chart 1. Meanwhile, Eastern Indian Ocean contributes to 20% of total commercial tuna catch from Indonesia (albacore, bigeye tuna, skipjack tuna, Southern bluefin tuna and yellowfin tuna), with total catch of 79 thousands t in the same year – Chart 2 (FISHTAT data).

Chart 1. Landings of Commercial Tunas and Other Tunas from Western Central Pacific Ocean (1970-2006)

Source: FISHSTAT data
History of Tuna Fisheries in Indonesia

Indonesia’s tuna industries began in 1965 when Indonesia’s first commercial tuna longline operation with one company, B.P.U. Perikanan that had two vessels (modified pole and line vessels of 167 and 185 GT) established. These vessels were gifts from the Japanese Government. With further financial assistance from the Japanese Government the state-owned fishing company PT. Perikanan Samudera Besar (PT. PSB) commenced operations in 1972 and its fleet quickly expanded to 18 vessels by 1975 with bases at Benoa in south Bali and Sabang in Banda Aceh (IOTC 2006). The PT. PSB vessels fished in Indian Ocean waters, but also in areas to the east - Timor and Arafura Seas, and north-east - Flores and Banda Seas.

In 1985 the Japanese sashimi market opened to fresh tuna imports from Indonesia and in the years that followed Indonesia’s commercial tuna longline fishery underwent dramatic expansion both at Benoa (Bali) and at Muara Baru (North Java). From 36 vessels (34 Indonesian) in 1986, the number of longline vessels based in Indonesia and operating in the Indian Ocean waters had increased by year 1991 to 536 (158 Indonesian). The majority of foreign vessels were Taiwanese, but there were also vessels from Japan, Korea, Honduras, and Philippines. In 1998 the Indonesian government introduced regulations requiring all fishing vessels based in Indonesian ports to be Indonesian flagged, and by 2000 all vessels were officially classed as Indonesian-owned vessels (IOTC 2006).

Industrial Tuna Fishing Fleets in Indonesia

Most of industrial tuna fishing in Eastern Indian Ocean use longliners, usually with GT below 200 tons, with available super-cold storage facilities. This type of fishing gear can undertake long voyages and operate over large areas of the region. More than 1,000 longliners were estimated to operate in Indian Ocean in 1999 and 2000, all
under the Indonesian flag, as the consequence of regulations put forward by the Indonesian government to prevent fishing by foreign vessels in the Indonesian Economic Exclusive Zone (EEZ). Many fresh tuna longliners currently operating under the Indonesian flag were before operating under Taiwanese (and Chinese) flags.

Meanwhile, industrial tuna fishing in Western Central Pacific Ocean waters of Indonesia is mainly purse seineing, and pole-and-line (*huhate*) fishing from vessels greater than 15 GT. Compared to pole and line, purse seine was considerably a new tuna fishing method in Indonesia, targeting small size skipjack and yellowfin tuna. So far, purse seiners are only confined to the EEZ (Widodo et al, 2001). Simorangkir (2002) indicated that there were 39 licensed purse-seine vessels in Indonesia’s Western Central Pacific Ocean at area, mostly of about 300 GT in size, and three 900- to 1000-GT seiners based in Biak (FAO 2005).

Purse seiners have fished in North Sulawesi since the late 1990s, some in Indonesia–Philippines joint ventures, catching tuna associated with rumpons (FADs), most of which is landed directly into General Santos City and other southern Philippine ports. The offshore fishery lands more than 50,000 tonnes per year from waters around North Sulawesi and Northern Papua (Naamin, et al 1995).

Pole and line (*huhate*) was developed by state enterprises located in Sorong, Bitung and Ambon in the 1970s. Most vessels range in size from under 10 GT to up to 30 GT. Small pole and line vessels using sail, with small engines, are called ‘funai’ and ‘rorehe’ in North Sulawesi and Ambon respectively. In addition to that, since 1992, many longliners less than 50 GT that were based in Benoa and that fished in the Indian Ocean have moved to Bitung to fish in the Banda Sea and the Sulawesi Sea (Naamin 1995).

More recent report noted that in 2005 Indonesian fleet comprised the followings: 2013 longliners with available super-cold storage facilities which target yellowfin tuna and bigeye tuna principally for Japanese *sashimi* market (Oceanic Development 2006), about 3872 tuna pole and line vessels which target skipjack tuna, in particular for processing into *fushi* (dried and smoked skipjack tuna) but also for canning (Indonesia Captures Fisheries Statistics - MMAF 2007); and 1474 purse seiners.

**Indonesian Tuna Industries**

Larger industrial companies operate longline fleets mostly catch yellowfin and bigeye tuna and exported fresh to Japan. Other large industrial companies deal primarily with the export of fresh and frozen product (loin, fillet, steak), and operate with *mitra kolaborasi* (collaboration) arrangements with small-scale local vessels. Other companies operate wholly or partly the production of canned tuna and *fushi* (dried and smoked tuna) and get their supply generally from pole-and-line vessels and mini purse-seiners under *mitra kolaborasi* arrangement (WCPFC 2007).

In 2001, MMAF estimated the presence of 25 tuna processing factories, 16 of which were canneries with 9 factories processing into *fushi* (dried and smoked products). Approximately 30,000 t (though the production capacity is 70,000 t) of canned tuna is produced per annum, whereas the production of *fushi* products is 7,000 t per annum. Its production is mainly skipjack for the international market (Japan, U.S., Middle East and Northern Europe) [Oceanic Development 2006].
Indonesian tuna export started to grow rapidly from 1980s to early 1990s. Indonesia tuna export in 1991 amounted to 103.4 thousands t (net weight), compared to 14.4 thousands t in 1981, with an average growth rate of 17 percent per annum. These exports have been dominated by canned tuna (44%), followed by frozen tuna – loin, steak and fillet (29%) and fresh/chilled tuna or high quality tuna for sashimi (27%) [MMAF 2007].

Uktolseja (1995) suggested that the rapid development of the Indonesian tuna industry in this period was due to the support by the government of such as: encouraging the export of non-fuel and natural gas commodities such as shrimp and tuna, providing loans to the fishermen, establishment of physical infrastructure, such as fishing ports, piers, market halls, dockyards, and slipways, creation of production, processing, and marketing facilities, such as fishing boats, fishing gears, engines, cold storage, and deployed rumpon (FADs) and subsidizing air cargo for the export of fresh tuna.

**Indonesian Tuna at Global Market**

Indonesia contributes to about 3% of total fresh and frozen tuna exports in the world, with total export reached about 45 thousands t in 2006, valued at USD 120 million (Globefish 2008). Indonesian fresh and frozen tuna export reached its peak in 2003, with 70.2 thousands t. However, in 2004, fresh and frozen tuna export started to decline.

Indonesia was the leader of tuna supplying countries to Japan (mainly yellowfin and bigeye), with a 28% (or about 15 thousands t) share in the air-flown tuna imports for sashimi into Japan. The other main exporters to Japan were Australia (southern bluefin, bigeye, yellowfin and albacore), Mexico (bluefin), Sri Lanka (bigeye and bluefin) and Taiwan Province of China (yellowfin and bigeye). Indonesia is also the biggest fresh and frozen tuna supplier to the U.S. contributing about 36% (or about 9 thousands t) of total U.S. fresh and frozen tuna import in 2007, followed by Philippines (23%), Canada (5%), and Korea (3%) [Globefish 2008].

Indonesia contributes to more than 4% of total canned tuna exports in the world, with total export reached about 50 thousands t in 2005 but then declined slightly to 47 thousands t in 2006, valued at USD 130 million (Globefish 2008). Thailand dominates the world canned tuna export, contributing more than 46% of total canned export in the world in 2006, followed by Ecuador (9.7%), Spain (6.4%), Mauritius (4.8%) and Indonesia (4.4%). In 2007, Indonesia exported about 30 thousands t fresh and frozen tuna to Thailand, contributing 4.3% of total Thai fresh and frozen tuna imports.

Out of 47 thousands t Indonesian canned export in 2006, about 17.5 thousands t (or 37%) was exported to U.S. and 7.8 thousands t (or 17%) to European Union countries. It means that U.S. and European Union has been the most important market destination for Indonesian canned tuna products, purchasing more than 50% of total Indonesian canned tuna export.

**Contribution of Tuna in Indonesian Export Value**

Total Indonesian exports of fishery products in 2006 were valued at USD 2.1 billion, USD 190 million more than in 2005. Tuna products are the second biggest
Indonesian fishery product exports, contributing 12% of total export value or about USD 250 million in 2006. Shrimp has been the biggest commodity export from Indonesia, contributing 53% of total export value or USD 1.1 billion in 2006. In terms of export volume, tuna contributed to about 10% of total export volume in 2006 or amounted to 91.8 thousands t.

In terms of the products, fresh and frozen tuna initially dominated total export, covering more than 80% of total export until early 1990. Export of canned tuna started to grow rapidly in 1991, contributing to 40% of total export compared to 26% in previous year. Data from 2002-2004 shows that exported tuna products from Indonesia are dominated by canned tuna (44%) with the average price of USD 2,479 per t, followed by frozen tuna (29%) with the average price of USD 1,022 per t and fresh tuna or high quality tuna (27%) for sashimi with the average price of USD 3,784 per t (MMAF 2007).

Historically, Japan has been the biggest market for Indonesian tuna export. In terms of export value, during period 2001-2006, 44% of total Indonesian tuna export went to Japan, followed by U.S. (27%), Saudi Arabia (4%), Germany (4%), and Singapore (3%). Other important countries for Indonesian tuna market are Jordanian (3%), Netherland (2%), Thailand (1%), Hong Kong (1%), Australia (1%), United Kingdom (1%) and Belgium (1%) [MMAF 2007].

Stock Assessment of Indonesian Tuna

Several workshops have been conducted as attempts to assess the stock size of tuna in Indonesian waters. However, up until now, due to lack of accurate statistical data (that meet data requirements for scientific stock assessments), there is no scientific stock assessments relating to tunas and tuna-like species in Indonesia. Therefore tuna experts then came into agreement that until this point, there is no one that can estimate the reasonable stock size of Indonesian tuna. The tuna experts then agreed that the most important thing to assess the stock size of Indonesian tuna fisheries is by studying indicators to predict the condition of Indonesian tuna fisheries rather than trying to estimate the Indonesian tuna stock size.

Some joint initiatives have also been established to provide data useable in scientific stock assessments and management of tuna stocks in Indonesian waters:

In Indian Ocean, a collaborative project between Indonesia’s Research Centre for Capture Fisheries/Research Institute for Marine Fisheries (RCCF/RIMF) and DGCF, CSIRO, DAFF, Australian Centre for International Agricultural Research (ACIAR), Indian Ocean Tuna Commission (IOTC) and Overseas Fisheries Cooperation Foundation-Japan (OFCF), established an integrated monitoring program at three major ports (Jakarta, Benoa and Cilacap) where tuna and billfish caught by longline fleets operating in the Indian Ocean are landed and processed. The project has three primary objectives: (1) to improve and extend existing national systems and capabilities for the collection, compilation and analysis of reliable, high quality fisheries data for Indian Ocean tuna longline fisheries in Indonesia; (2) to conduct a thorough review on Indonesia's tuna fisheries operating in the eastern region, including Banda Sea and Western Pacific Ocean waters review of Eastern Indonesia tuna fisheries; (3) to develop a broader based capacity within Ministry of Marine Affairs and Fisheries (MMAF) to analyse and interpret fisheries data and to ultimately be able to independently produce and report fisheries assessments in line with
international requirements for shared fish stocks (CSIRO 2008).

Meanwhile, in Pacific Ocean, Indonesia and Philippines Data Collection Project (IPDCP) was established with objectives are (1) to collect and compile data that can be used to reduce the uncertainty of the assessments of tuna stocks in the Western and Central Pacific Ocean and (2) to improve the monitoring of tuna fisheries in the Philippines and Indonesia so that both countries will be able to fulfill their future obligations in regard to the provision of fisheries data to the WCPFC.

Directorate General of Capture Fisheries (DGCF), in collaboration with RCCF/Research Institute for Marine Fisheries, Directorate General of Marine Fisheries and Resources Surveillance, Indonesian Tuna Commission and other industry bodies such as Indonesia Tuna Association (ASTUIN), Indonesia Longline Tuna Association (ATLI) also had a plan to develop a formal fisheries observer program for Indonesia during 2007. Until now there have been discussions about the best strategy for the development of a broader, more formal observer program.

**Current Status**

Since there are no set biological reference points, the status of Indonesian tuna population cannot be determined against the reference points. However, some approaches to estimate population status has been done using some other available parameters, such as stock density, size of fish, CPUE and composition domination.

There has been a tendency of real decline in tuna weight (using longline) and hook rate in Eastern Indian Ocean. The individual tuna weight declined from 37 kg/individual (in 1973) to 27 kg/individual (in 2000). In the same period, the hook rate also declined from 2.16 individuals per 100 baits in 1977 to 0.60 individuals per 100 baits in 2000 (Merta et al, 2003). In addition to that, in the workshop on Stock Assessment of Indonesian Fishery Resources conducted by Ministry of Marine Affairs and Fisheries (MMAF) in Jakarta in 2003, the scientists agreed that high commercial value of big tuna (yellowfin tuna, bigeye tuna, southern bluefin tuna, and albacore) in Indian Ocean are being fully exploited using longline fishing vessels above the Maximum Sustainable Potential.

Although until this point, there is no scientific stock assessments relating to tuna species in Indonesia, at regional level WCPFC and IOTC have completed some stock assessments related to these species. The results of those stock assessments could provide some indication on the current status of some tuna species in Indonesia.

IOTC (2007) suggests that although the results of stock assessment of Indian Ocean albacore that was attempted in 2004 were considered unreliable, it is suggested that current catch levels might not be sustainable. Other indicators, such as the average size in the catch and catch rates, have not shown declines in recent years. Meanwhile, the report suggests that the stock of Indian Ocean bigeye tuna is being exploited at around its maximum level. Furthermore, biomass trajectories indicate that the spawning stock biomass of bigeye tuna in Indian Ocean is currently just above the MSY level, but it has been declining since the late 1970's. Similarly, the current fishing mortality is estimated be to just above the MSY level, but fishing mortality has been increasing steadily since the 1980's. No quantitative stock assessment is currently available for skipjack tuna in the Indian Ocean. The range of stock indicators available to the Scientific Committee does not signal that there are
any problems in the fishery currently. However, the SC noted that, although there might be no reason for immediate concern, the catches should not be increased at the current rate indefinitely and skipjack should be monitored regularly. Four stock assessment models were applied to the Indian Ocean yellowfin tuna stock in July 2007; however, there remained strong uncertainties in each of the assessments conducted. However, the models indicate that fishing levels have exceeded MSY in recent years, so the stock is considered to be fully exploited.

The estimate of $F_{\text{current}}/F_{\text{MSY}}$ reveals that overfishing of bigeye tuna is occurring in the Western Central Pacific Ocean (WCPFC 2008). WCPFC (2007) suggests that the yellowfin stock in the Western Central Pacific Ocean is not in an overfished state. Nonetheless, current exploitation rates are likely to be, at least, approaching the $F_{\text{MSY}}$ level and any further increase in exploitation rates will not result in an increase in equilibrium yields from the stock. The stock size of the skipjack is above its reference point and its fishing mortality is below its reference point. The present fishing pattern and intensity is sustainable. Yield projections indicate that increases in the fishing mortality would not result in long-term increases in the catches, and might result in overexploitation (de Leiva and Majkowski 2003).

**Trends**

Indonesian skipjack tuna that contributes the biggest portion of commercial tuna landings in Indonesia showed the fast growing trend during period 1979-1999, where it grew by almost 7 times within 20 years, from 36 thousands t in 1979 to 248 thousands t in 1999. Skipjack landings in Indonesia then started to decline in period 2000 to 2003 before improving again and back to level of 255 thousands t in 2006. Meanwhile, yellowfin tuna landings also increased in slower path and reached its peak in 2000 with 141 thousands t production. However, after that year, the landings of yellowfin tuna started to decline significantly to the level of 55 thousands t in 2006, dropped by 60% within 6 years period (FISHTAT data).

Landings of tuna in Eastern Indian Ocean of Indonesia waters show the tendency to decline in 1999 and 2002. Landings of commercially important tuna in that area reached its peak with 138 thousands t in 1998 and dropped to 103 thousands t in 1999 and further down to 91 thousands t in 2002. However, in 2003 landings of tuna in this fishing area started to rise slightly as a result of increase in skipjack landings. In 2005, landings of commercially important tuna in Eastern Indian Ocean reached 127 thousands t. Meanwhile, landings of tuna in Western Central Pacific Ocean of Indonesian waters started to decline in 2001. In 2000, the catch reached its peak with 286 thousands t and dropped to 251 thousands t in 2001, before increased again to 274 thousands t in 2005 (Indonesia Capture Fisheries Statistics, various years, MMAF 2007).1

Maluku-Papua contributes the biggest portion of skipjack landings in Indonesia, contributing about 33% of total skipjack landings, followed by North Sulawesi (23%), and South Sulawesi (18%). These three coastal landings that located in Pacific Ocean already contribute about 74% of total skipjack landings in Indonesia. In general,

1 There are discrepancies of landings data from Fishstat Plus (FAO) and Indonesia Capture Fisheries Statistics, MMAF (2007). Data from FAO shows that in 2005, total landings of five commercially important tuna species from both oceans in Indonesia was 382 thousands t – see page 2 (or about 19 thousands t difference from MMAF data).
skipjack landings in South Sulawesi, North Sulawesi and Maluku-Papua show steady growth.

Maluku-Papua also contributes the biggest landings of albacore, bigeye tuna, and yellowfin tuna, contributing 26% of total landings of tuna in Indonesia, followed by North Sulawesi (24%), Bali-Nusa Tenggara (16%), South Sulawesi (12%), North Java (10%) and West Sumatra (8%).

Total landings of albacore, bigeye tuna, Southern bluefin tuna and yellowfin tuna in Bali-Nusa Tenggara reached its peak in 2000 with landing of 45 thousands t, jumped dramatically from 10 thousands t in previous year. However, in 2001, the landing fell off and back again to 17 thousands t and experiencing up and down with downward trends until now. Meanwhile in North Java, tuna landing reached its peak in 2004 with 38 thousands t, about 22 thousands t more than previous year. In 2005 landing in North Java coastal area started to decline sharply and hit 12 thousands t in 2006.

The downward landing trend in Bali above is also supported by data from CSIRO (2005) showing that in Benoa-Bali (Eastern Indian Ocean), the catch of bigeye and yellowfin tuna has exhibited a continuous decline since 2002. On the other-hand, landings of Southern bluefin tuna that declined markedly between 2002 and 2003, showed a slight recovery in 2004, and then the significant rise in 2005.

Meanwhile, total landings of other tuna in Maluku-Papua and South Sulawesi show noticeable downward trends since 2001 until 2004, although in recent years, it seems to slightly improve again. Meanwhile, declining trend of tuna landings in North Sulawesi just started in 2003 until 2005, and in 2006 it started to rise again.

Data from Benoa-Bali (Eastern Indian Ocean) also noted that although the production increased in parallel with the increase of number of fishing vessels, the total catch per fishing day has been declining with average of 4.7% per year. In 1992, Catch per Unit Effort was 406 (kg/one fishing day) and in 2000, it declined to 177 (kg/one fishing day). Meanwhile, data from Northern Papua (Western Central Pacific Ocean) also shows worse condition. The total catch per trip has been declining with average of 10% per year. In 1991, the Catch per Unit Effort was 18.7 t per trip and in 2000 it dropped to just 4.2 t per trip. (Muripto et al 2001).

**Fishery Management in EEZ**

Management of the tuna fisheries, as in other fisheries in Indonesia, is mainly by input controls through licensing, implementation of log book system, installment of a vessel monitoring system, and institutional strengthening. License is granted on the basis of fish stock utilization status, and a new license will not be issued when fish stock is fully or over exploited. Fishing fee is charged on the basis of resource rent. Tuna fishery protection also covered through regulation and limitation on the fishing fleets, fishing ground and fish landing. However, direct impact of protection still not found in the ground level.

There is no specific scientific advice provided for this fishery. In general, scientific advice for TAC is set at level of 80% of MSY. Using 1997 data on potentials of tuna fisheries then the approximately advised TACs for 4 commercial tuna species (albacore, bigeye tuna, Southern bluefin tuna and yellowfin tuna) is estimated to be 73,528 t for Eastern Indian Ocean and 102,000 t for Western Central Pacific Ocean.
Based on Decision of the Minister of Agriculture No 392 of 1999 Concerning Fishing Zones, fishing vessels flying the Indonesian flag which are not greater than 200 GT are allowed to operate in Indonesian waters. Foreign-flagged fishing vessels are permitted to operate in Fishing Zone III in accordance with the prevailing law and regulations.\(^2\)

In regard to licensing, the government provides opportunities for foreign persons or legal entities to use their vessels to undertake fishing activities in the Indonesian EEZ on the basis of the special bilateral agreement. In 2001-2002, Indonesia has entered into agreements with Thailand, Philippines and China. The fishing vessels of the People’s Republic of China are permitted to take tuna and billfish stocks in the Indonesian EEZ off the Pacific Ocean within the coordinates 128°E and 140°E, and the Indonesian EEZ off the Indian Ocean, within the coordinates 92°E and 102°E. These fishing vessels are also allowed to carry out fishing activities in the Indonesian EEZ off the north of Riau Province and the Arafura Sea. The fishing vessels flying the flag of the Philippines operating under the Indonesia-Philippines Arrangement can fish tuna and billfish stocks in areas of the Indonesian EEZ and pacific Ocean between 120°E and 140°E and in the Indonesian EEZ off the Indian Ocean between 92°E and 102°E, whilst under the Indonesian-Thai Agreement, Thai fishing vessels are permitted to fish demersal fish species in the Indonesia EEZ off the South China Sea and Arafura Sea (Sodik 2007).

It is not easy to assess the compliance of this fishery since there is no set TACs by the fishery managers so far. Using assumption that TACs are set at Advised TAC level, then in general, the actual catch of 4 commercial species (albacore, bigeye tuna, bluefin tuna and yellowfin tuna) in Pacific Ocean and Indian Ocean waters have been below the set TACs. So the compliance is considerably high.

**Fishery Management in High Seas**

At present a number of Indonesian tuna fishing vessels are operating on the high seas areas under the competence of regional fisheries management organization (RFMOs), including IOTC, CCSBT and WCPFC. The fishing activities of Indonesian flagged vessels that fall under the competence of RFMO are not covered by the regulations on Indonesian fishing zones (Decision of the Minister of Agriculture No 392 of 1999). Hence, any conflict that may result in the absence of clear rules on fishing zones may lead to unregulated fishing.

In 2007, Indonesia has just achieved of Full Member status of both Indian Ocean Tuna Commission (IOTC) and Commission for the Conservation of Southern Bluefin Tuna (CCSBT) and made a firm commitment to achieve Full Member status of Western and Central Pacific Fisheries Commission (WCPFC) during the coming year. This also means that Indonesia should follow the quota of catches and level of efforts of tuna fisheries outside EEZ area.

Vessels registered with the IOTC are permitted to fish outside of their national territorial fishing waters, so long as they remain within the Indian Ocean region

\(^2\) Fishing Zone I covers the coastal fishing belt measured from the seaward low-water land of each island up to a limit not exceeding 6 nautical miles towards the sea. Fishing Zone II covers the coastal fishing belt outside Fishing Zone I up to 12 nautical miles seaward. Fishing Zone III covers the coastal fishing belt outside Fishing Zone II and up to the outer limit of Indonesian EEZ
covered by the IOTC regulatory framework. At the moment, there are about 877 vessels registered with the IOTC. However, in 13th meeting of the Indonesian Ocean Tuna Commission in Bali in March 2009, Indonesia proposes to expand its tuna fishing fleet by 500 vessels. Government of Indonesia argued that with more vessels registered with the IOTC, Indonesia would get the chance to significantly expand its tuna fishing areas and was expected to increase its tuna production by 20 percent this year (Jakarta Post, 30 March 2009).

**Illegal, Unreported and Unregulated Fishing in Tuna Fisheries**

It is important to note that the data of total catches is based on government statistical data using data reported from each port in main coastal landings. It is believed that the actual catches are more than what presented in government’s figures. This is due to rampant violation of fishery regulation, including in the tuna fishery. The most conspicuous are: 1) poaching (fishing without an entitlement or license to fish); 2) the use of falsified or forged documents, which were either the supporting documents required when applying for a fishing license or the fishing license itself; 3) fishing in violation of the fishing license or license entitlements with respect to vessel size and gear type, fishing ground, zone, home port or crew (particularly in the remote areas of Indonesia); and 4) underreporting or misreporting of catch.

Herrera (2002b) indicated that many small longliners (< 200 GT) operating in Indian Ocean have almost never reported their activities since early seventies. It is believed that the numbers of these fleets have constantly increasing, exceeding the 1,000 vessels in early 2000. This fleet is almost fully made up by Taiwanese and Indonesian owned longliners although some Chinese longliners are also operating since 1995. These vessels target yellowfin and the bigeye tuna, which are generally kept in crushed ice (seldom in refrigerated sea water) to be unloaded to processing plants in different ports of the Indian Ocean, where they are graded and, if complying with the ‘sashimi’ quality standards, air-freighted to Japan. These vessels have been using different ports of landing in the Eastern Indian Ocean, mainly in Indonesia, Malaysia, Thailand and Sri Lanka. Small numbers of these longliners also use Seychelles and Maldives as their ports.

In the Northern portion of Indonesia, tuna fishing situation has been complicated by legal, semi-legal (authorized vessels making unauthorized landings outside Indonesia), and illegal fishing by Philippine tuna fishing vessels. Most of the fish catches caught by Philippine purse seiners are not recorded. It is estimated that approximately 70 to 80 per cent of all tuna catches by Philippines vessels in the Indonesian EEZ are landed in the Philippines without being reported to designated Indonesian ports. In addition to that, most of the FADs deployed in this area are not regulated in practice because it is often not clear which country has jurisdiction over them (Sodik 2007). Report by Sea Fare Group (2008) also reported that most tuna landed by Philippines pump boats is caught in Indonesian water (80% by most estimates). These pump boats operators do not have fishing agreements with Indonesia.

**How much tuna is caught on the high seas, versus EEZs?**

FAO (undated) suggested that most of tuna in Western Central Pacific Ocean is caught within EEZs, but only 20% of tuna in Eastern Indian Ocean is caught within
EEZ. FAO (2005) believes that there has been an unknown portion of the longline catch originates from locations outside of Indonesia. Some government officials and industry representatives believe that most of the catch (about 54,000 tonnes per year) is from locations outside of Indonesia's EEZ.

Information provided by industry during the past years suggests that as catches of the primary target species (yellowfin and bigeye tunas) on the ‘traditional’ grounds in Eastern Indian Ocean have declined, some vessels are fishing in other areas further from their home ports. Correspondingly these vessels are spending much longer periods at sea – up to 4 to 5 months, compared to 1 – 2 months for closer fishing grounds. There has been a corresponding increase in use of carrier vessels and fishing vessels acting as carrier vessels, landing their own catch but also catch transhipped at sea from ‘sister vessels’ of their company. Such activities have been necessary to overcome the absence of freezer facilities on the majority of the longline vessels (IOTC 2005b).

**Impacts on Environment and Biodiversity**

Main fishing gears for the tuna fishery in Indonesia are longliner, traditional hook & line, and purse-seiner combined with FADs (Fish Aggregation Devices). Longline fishing is controversial in some areas because the lines can lead to bycatch, in endangered species such as sea turtles and this can sometimes have a significant effect on populations.

Survey conducted by WWF in 2005 in major tuna fishing ports in Indonesia (i.e. Muara Baru, Cilacap, Bitung, Kendari/Bau-bau, and Makassar/Bone found out that 95% of longline fishermen (boat captains and crews) and non-longline fishermen (i.e. those using gillnets and purse seine) that were interviewed acknowledged usually catching at least one sea turtle per month. With an estimated 1,600 Indonesian tuna longline vessels catching three sea turtles per trip (one trip takes three months on average), the average sea turtle bycatch is estimated to range from 6,400 to 19,200 animals per year. The most common sea turtle bycatch species in both the Indian and Pacific Oceans is loggerhead turtles (*Caretta caretta*). Leatherback turtles (*Dermochelys coriacea*) were also frequently caught in both oceans, although catch rates in the Pacific Ocean were higher. Indonesian tuna longline bycatch in the Pacific is estimated to be 256 to 768 animals per year for leatherback turtles and 768 to 2,304 animals per year for loggerhead turtles. In the Indian Ocean, bycatch for leatherback turtles is estimated to be 1,349 to 4,032 animals per year, while bycatch for loggerhead turtles is 4,032 to 12,098 animals per year. This Indian Ocean estimate exceeds Lewison’s (2004) bycatch calculation for the year 2000, of 4,000 leatherback turtles and 6,000 loggerhead turtles, and confirms the importance of longline fisheries in bycatch issues in Indonesia (http://www.fpir.noaa.gov/IFD/ifd_sea_turtles_indonesia.html).

These last past years, government in collaboration with NGO (WWF Indonesia) have been carrying out the project for reducing the bycatch. Satellite transmitters were placed on leatherback turtles nesting at the beach in Papua and on green turtles nesting at the beach in Berau to give information about the routes and distances travelled after nesting. As the areas where the turtles swim through are heavily fished, interaction of turtles with fishing gear - bycatch – could be a significant threat to adult turtle survival. Together with some early adopters in the tuna long-line (Pelabuhan Ratu-West Java, Benoa-Bali, Bitung-North Sulawesi) and shrimp trawl fisheries industries (Sorong-Papua), WWF initiated trial observer programs and
trained crew members on appropriate release techniques that can increase survival rates of turtles captured in the gear. Gear trials will soon be implemented adjusting long-line hooks with a more circular model that reduces the hook-up rate of turtles and allows for easier release in case a turtle is hooked after all (http://www.wwf.or.id). However, since the hook is still imported from U.S. then the implementation of it is still on piloting scheme (under collaboration program of WWF Indonesia and DKP).

In addition to that, data from IOTC (2005) also noted that based on research vessel undertook purse seine and longline fishing in the eastern Indian Ocean between 2001 and 2005, about fifteen families with about 30 species of fishes and one family of octopus were caught by purse seine and longline operations targeted and caught yellowfin, bigeye and skipjack tunas and swordfish, marlins and sailfish. Other species caught included mainly sharks (thresher, blue, white-tip, spot tail, crocodile and silky) and also stringrays, lancet fish, escolar, snake mackerel, great barracuda, oil fish, common dolphin fish, sickle pomfret and wahoo.

Data from South Pacific Commission (1996) shows that bycatch rate of purse-seine fleets targeted tuna operating in Indonesia part of Western Pacific Ocean is about 0.02% and tuna discards rate is about 0.39%.

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