FISHING AND CATCH PERFORMANCE OF THE TROPICAL TUNA FISHERIES IN THE INDIAN OCEAN

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1. Introduction

Indonesian marine waters is very influenced by two oceans, Indian Ocean and Pacific Ocean. It is therefore, the fisheries management area concerned to those two ocean divided into two fishing areas, the first is directly connecting to Indian Ocean from Northern Mallacca strait, western Sumatera, southern Java to Nusa Tenggara, Sawu Sea and the western Timor. This area code number is 57. The second is connecting to Pacific Ocean, including southern Mallacca strait, South Chinese sea, Java sea, Macassar Strait, Flores sea, Sulawesi sea, Ternate sea, Flores sea, Banda sea, Timor sea, Arafura sea, Northern Papua a part of Pacific Ocean with the fishing area code number of 71. On occasion of IOTC's management area the Indonesia marine area is go together with or a part of Eastern Indian Ocean.

Indonesia's total marine production in 2007 amounted to 4.737.280 tonnes, compared to 3.966.480 tonnes in 2001, with an average growth rate of 3,89 % per annum (DGCF, 2008 and 2009). The annual growth rate of retained marine production from the Indian Ocean to Western Timor Sea including northern Mallacca Strait with the fishing area code number of 57 in the same period was 1,14% from 974.142 tonnes in 2001 to1.188.071 tonnes in 2007. Since 2006 to 2007, the retained marine fishes production from this area was significantly increase from 1.126.137 tonnes in 2001 to 1.188.071 toones in 2007. (Table 1)

Table 1.Volume of Marine Capture Fisheries Production by FAO area, 2001 – 2007

No	Area	Catch Production in Tones by Year							Increasing Average(%)	
		2001	2002	2003	2004	2005	2006	2007	01 s/d 07	06 s/d 07
1	Total	3966480	4073506	4383103	4320241	4408499	4512191	4737280	3.89	4.92
2	57 area	974142	1038180	1126866	1080559	1109866	1126237	1188071	1.14	5.49
3	71 area	2992338	3035326	3256237	3239682	3298633	3385954	3546209	4.83	4.73

The annual growth rate for marine production in Indian Ocean in which outstretced from western Sumatera until Sunda Strait in 2005 - 2007 was 17,35%, but in Indian Ocean from southern Java to western Timor in the same period it seems to be fluctuative or not significantly increased. (See Table 2)

Table 2. Volume of Marine Capture Fisheries Production
by Indonesia Fisheries Management Area of Indian Ocean, 2005 -2007

No	Fisheries Management Area	Catch Production in Tones by Year			
		2005	2006	2007	Increasing Average (%)
1	Indian Ocean of Western Sumatera and Sunda Strait	390303	424675	497216	17.34725784
2	Indian Ocean of Southern Java, Southern of Nusa Tenggara, Sawu Sea and Western Timor	435498	417539	437998	-1.673833942

In connection to descent of catch and effort (CE) the tuna fisheries management issue seems to become crucial. This such issue really not only caused by those two indications of total catch and/or fishing effort, but also any other indicators such as fish biological structure, interrelation among habitat or ecosystem, fisheries interaction it could cause the stock damage. In tuna fisheries interaction among tuna fisheries activity it can be bother growth and recruitment of target species. Hence, how it is important to do phenomenological to achieve better solution onto fisheries management area as a point of view. In the matter of highly migratory of tuna fishes it should be better to afforded close collaboration the management on tuna fisheries among regions.

2. Big Pelagic Fishes in Indonesia

Big pelagic fishes spreading in Indonesian marine area waters it can be divided into groups, such as : tunas, seerfish, billfish, and sharks. All those species in groups are considered as economically important species. Most of them, at least 26 species can be recorded in statistical marine fish production, but there are some species could not be significantly yet caught or rarely or very little in amount caught by local fishers or domestic fisheries. Those some species could not be recorded yet consisting of : wahoo and streaked spanish mackerel (seerfish), black skipjack (tunas), shortbill spearfish (billfish), and some sharks (white cheek shark, leaf scale gulper shark). (Table 3).

Table 3. Economically Important Big Pelagic Fishes in Indonesia

No	English Name	Group	Scientific Name
1	Indo-pacific sail fish (SFA)	Billfish	*Istiophorus platypterus*
2	Black Marlin (BLM)	Billfish	*Makaira indica*
3	Indo-pacific blue marlin (BLZ)	Billfish	*Makaira mazara*
4	Striped Marlin (MLS)	Billfish	*Tetrapturus audax*
5	Broadbill Swordfish (SWO)	Billfish	*Xiphias gladius*
6	Bullet Tuna (BLT)	Tunas	*Auxis rochei*
7	Frigate tuna (FRI)	Tunas	*Auxis thazard*
8	Kawakawa (KAW)	Tunas	*Euthynnus affinis*
9	Skypjack tuna (SKJ)	Tunas	*Katsuwonis pelamis*
10	Short bodied mackerel	SEERFISH	*Rastrelliger brachysoma*
11	Indian/sripped Mackerel	SEERFISH	*Rastrelliger kanagurta*
12	Striped Bonito	SEERFISH	*Sarda orientalis*
13	Spotted chub/slimmy mackerel	SEERFISH	*Scomber australasicus*
14	Narrow barred spanish mackerel (COM)	SEERFISH	*Scomberomorus commerson*
15	Indo-pacific king mackerel (GUT)	SEERFISH	*Scomberomorus guttatus*
16	Albacore (ALB)	Tunas	*Thunnus alalunga*
17	Yellowfin tuna (YFT)	Tunas	*Thunnus albacarus*
18	Shorthern bluefin tuna (SBF)	Tunas	*Thunnus maccoyii*
19	Bigeye tuna (BET)	Tunas	*Thunnus obesus*
20	Longtail tuna (LOT)	Tunas	*Thunnus tonggol*
21	Thresher sharks (SKH)	Sharks	*?*
22	Requiem sharks (SKH)	Sharks	*?*
23	Mackerel sharks/makos (SKH)	Sharks	*Isurus glaucus*
24	Hammerhead sharks	Sharks	*Sphyrna blochi*
25	Dogfish sharks	Sharks	*Squalus mitsukurii (?)*
26	Sawfish	Sharks	*Pristopsis microdon*
26	Wahoo	SEERFISH	*Acanthocybium solandri*
27	Black skipjack (SKJ)	Tunas	*Euthynnus lineatus*
28	Streak spanish mackerel	SEERFISH	*Scomberomorus lineatus*
29	Shortbill spearfish	Billfish	*Tetrapturus angustirostris*
32	White cheek shark	Sharks	*Carcharias dussmieri*
33	Leaf scale gulper shark	Sharks	*Centrophorus squamus*

Commonly all those big pelagic fishes never caught in maximum size. It was reported by Waluyo Subani from Fisheries Research for Capture Fisheries, that most species was caught in reasonable size. In some cases it is often happened early fishing. The fish catch composition of some fisheries could dominatly be in small size. The tendency of fishing activity at the surrounding area of FAD by using pelagic payao or lamps, produce result of multiple diverse of fish size. In this result, unhappily it was caught fishes including in small size. It seems to be not selective fishing. In this case, fisheries management scheme it should properly be implemented. It can be seen in Table 4 of some species in rows of the yellow are commonly caught in ranging still far below from maximum size. Luckily, it was reported that skipjack, bigeye and yellowfin are commonly caught in reasonable size.

Table 4. FISH SIZE, among the Maximum size (Ms) and Commonly Caught Size (Cs) (RCCF),

No.	Species		Size (cm)	
	English Name	Scientific Name	Maximum Size	Caught Size
1	Indo-pacific sail fish (SFA)	*Istiophorus orientalis*	350	120 - 170
2	Black Marlin (BLM)	*Makaira indica*	450	150 - 350
3	Indo-pacific blue marlin (BLZ)	*Makaira mazara*	450	215 - 300
4	Striped Marlin (MLS)	*Tetrapturus audax*	350	200
5	Broadbill Swordfish (SWO)	*Xiphias gladius*	450	100 - 220
6	Shortbill spearfish (SSP)	*Tetrapturus angustirostris*	200	125 - 150
6	Bullet Tuna (BLT)	*Auxis rochei*	50	25 - 35
7	Frigate tuna (FRI)	*Auxis thazard*	50	25 - 35
8	Kawakawa, komo, eastern litle tuna (KAW)	*Euthynnus affinis*	100	50 - 60
9	Skypjack tuna (SKJ)	*Katsuwonis pelamis*	100	40 - 60
10	Short bodied mackerel	*Rastrelliger brachysoma*	30	15 - 20
11	Streaked spanish mackerel Mackerel	*Scomberomorus lineatus*	90	50 - 70
12	Striped mackerel / Bonito	*Rastrelliger kanagurta*	35	20 - 25
13	Spotted chub/slimmy mackerel	*Scomber australasicus*	40	20 - 30
14	Narrow barred spanish mackerel (COM)	*Scomberomorus commerson*	200	60 - 90
15	Wahoo	Acanthocybium solandri	210	60 - 90
16	Indo-pacific king mackerel (GUT)	*Scomberomorus guttatus*	82	45 - 55
17	Albacore (ALB)	*Thunnus alalunga*	125	40 - 90
18	Yellowfin tuna (YFT)	*Thunnus albacarus*	200	70 - 150
19	Shorthern bluefin tuna (SBF)	*Thunnus maccoyii*	225	160 - 200
20	Bigeye tuna (BET)	*Thunnus obesus*	225	160 - 180
23	Longtail tuna (LOT)	*Thunnus tonggol*	130	40 - 70
24	Mackerel sharks/makos (SKH)	*Isurus glaucus*	394	195 - 250
25	Hammerhead sharks	*Sphyrna blochi*	160	130 - 140
26	Sawfish	*Pristopsis microdon*	450	150 - 200
27	White cheek shark	*Carcharius dussmieri*	100	75 - 85
25	Leaf scale gulper shark	*Centroporus squamosus*	158	110 - 137

According to statistical marine production of those big pelagic fishes in Indonesia, some species can be recorded since last along years ago before 2001, but some others those can be recorded since 2004 or after, these since just 2006 up to 2007. (Table 5). The trend of catch production of some species such as kawa-kawa, skipjack tuna, bigeye tuna, short bodied mackerel, indian mackerel seems to be steadily increase. Some others species their catch production looks fluctuation or tend to decrease.

Table 5. Statistics of Marine Capture Fisheries Production (in ton) by Species of Big Pelagic Fishes in Indonesia, 2001 - 2007

No	Species	Group	2001	2002	2003	2004	2005	2006	2007	IA (%)
1	Indo-pacific sail fish (SFA)	Billfish				2075	2054	2661	3878	43,78
2	Black Marlin (BLM)	Billfish				1150	1834	1508	1931	51,05
3	Indo-pacific blue marlin (BLZ)	Billfish				1537	1426	167	282	-72,57
4	Striped Marlin (MLS)	Billfish				2	185	434	877	9318,61
5	Broadbill Swordfish (SWO)	Billfish				2711	2559	1826	2815	-16,20
6	Bullet Tuna (BLT)	Tunas				8	17	553	3712	3455,86
7	Frigate tuna (FRI)	Tunas				69947	130181	115111	134593	80,18
8	Kawakawa (KAW)	Tunas	233051	266955	267339	133000	86459	118470	143101	5,14
9	Skypjack tuna (SKJ)	Tunas	214077	203102	208626	233319	252232	277388	301531	19,62
10	Short bodied mackerel	Seerfish	214387	221634	194427	201882	222032	254960	259458	25,05
11	Indian/sripped Mackerel	Seerfish				10557	10073	13240	13045	26,36
12	Striped Bonito	Seerfish				7	18	54	165	425,66
13	Spotted chub mackerel	Seerfish				214	179	1329	597	607,74
14	Narrow barred spanish mackerel (COM)	Seerfish	83522	88435	100242	116014	131225	114214	115424	0,67
15	Indo-pacific king mackerel (GUT)	Seerfish	25056	23554	27204	26220	22903	23081	28928	-7,59
16	Albacore (ALB)	Tunas				29135	33790	20293	34335	-0,90
17	Yellowfin tuna (YFT)	Tunas	153110	148439	151926	94904	110163	94406	103655	3,02
18	Shorthern bluefin tuna (SBF)	Tunas				665	1831	747	1079	130,95
19	Bigeye tuna (BET)	Tunas				52292	37360	43958	52489	-4,43
20	Longtail tuna (LOT)	Tunas				107438	93119	94981	117941	-3,27
21	Thresher sharks (SKH)	Sharks	65860	56906	58100	50717	13274	14474	13767	-65,84
22	Requiem sharks (SKH)	Sharks					12971	25530	29687	104,96
23	Mackerel sharks/makos (SKH)	Sharks				250	272	1363	497	388,72
24	Sawfishes	Sharks						6	22	266,67
25	Hammerhead sharks	Sharks					253	99	1423	607,81
26	Dogfish sharks	Sharks					16536	14472	12066	-20,79

3. Tropical Tuna Fisheries in Indian Ocean

3.1 Tunas Fishing Operation and Gears

The Indonesian tuna fisheries can be divided into industrial fisheries and artisanal fisheries. The former are mostly long line, pole and line fisheries. Nowdays other fisheries of purse seines and gill nets are getting improve to be industrial fisheries. The artisanal fisheries use the trolling gears, hand lines, danish seines, small purseines and gill nets, and hand line gears. All those fisheries capture tunas, but acoording to the main target of tuna (yellowfin, bigeye, albacore and south bluefin tuna), the tuna long line is the real fishing gear for capturing tuna. Pole and line is considered fishing gear for capturing skipjack. Those two fisheries including hand line fisheries are could considerately much more selective gears rather than others. However, long line gears frequently experience to capture billfishes and sharks, while hand line also frequently experience to capture seerfishes.

The major tuna fisheries, especially artisanal fisheries are concentrated along the west coast of Sumatera (Banda Aceh, Sibolga, Padang, Bengkulu, Lampung), the south coast of Java (Banten, Pelabuhan Ratu, Cilacap, Yogyakarta, Trenggalek/Prigi), Malang/Sendang Biru, Banyuwangi), Bali (Benoa), Nusa Tenggara Barat, Nusa tenggara Timur (Kupang). Big fishing ports such as Bungus (Padang), Pelabuhan Ratu (West Java), Cilacap (Central Java), Benoa (Bali), Kupang (East Timor), including Jakarta fishing port spur on the development of Industrial tuna fisheries activities in Indian Ocean, of which mainly tuna long line fishing fleets.

Typical gears used in the artisanal fisheries almost spread to all the fishing bases, such as : hand line, troll line, gill-nets, small purseines, and danish seines (locally called *payang*). Initially certain fishing gears developed in certain region or fishing village. For example, previously troll line was only very famous in Padang, west Sumatera, danish seine in coastal southern west Java, small purse seine in Banda Aceh and in south coast of east java, and gill nets at all along coast of southern Java. In order to increase their fishing efiiciency they use FAD of payao (locally called *rumpon*), both for artisanal fisheries and industrial fisheries as well. Rumpon-FAD become very important to assure of their effort be more sucessfull. At least this is such kind of minimazing fishing riks, so they can decrease navigation time or trip duration, and operational cost as well. On the other hand, precence of payao can bringing on social conflict among fishers do fishing operation nearby. The details fishing gears information and contruction those can be seen in appendix.

Industrial tuna long line well developed in Benoa-Bali since 1970s, and skipjack purse seine in Banda sea including Timor sea since 1980s. In some tens years ago the skipjack purse seine mostly bankrupt. Industrial long line fisheries still continue to do operation in Indonesian waters of tuna fishing grounds. Both Indonesian and foreign long liners usually use the fishing bases in Jakarta or Benoa in Bali, depending on the fishing season. If the tuna fishing seasons occurs along the west coast of

Sumatera and the south coast of Java they use Jakarta. The long line fishing management nowdays try to do closer to fishing ground in order to decrease navigation days. Agung wahyono (2007) reported that the long line fishing of each vessel per year spend 252 days at sea consisting of 40 navigation days go to fishing grounds, 172 actual fishing operation at fishing grounds and 40 days return back to fishing base. The distribution of the above fishing bases or fishing ports of the Indian Ocean fishing areas is shown in figure 1.

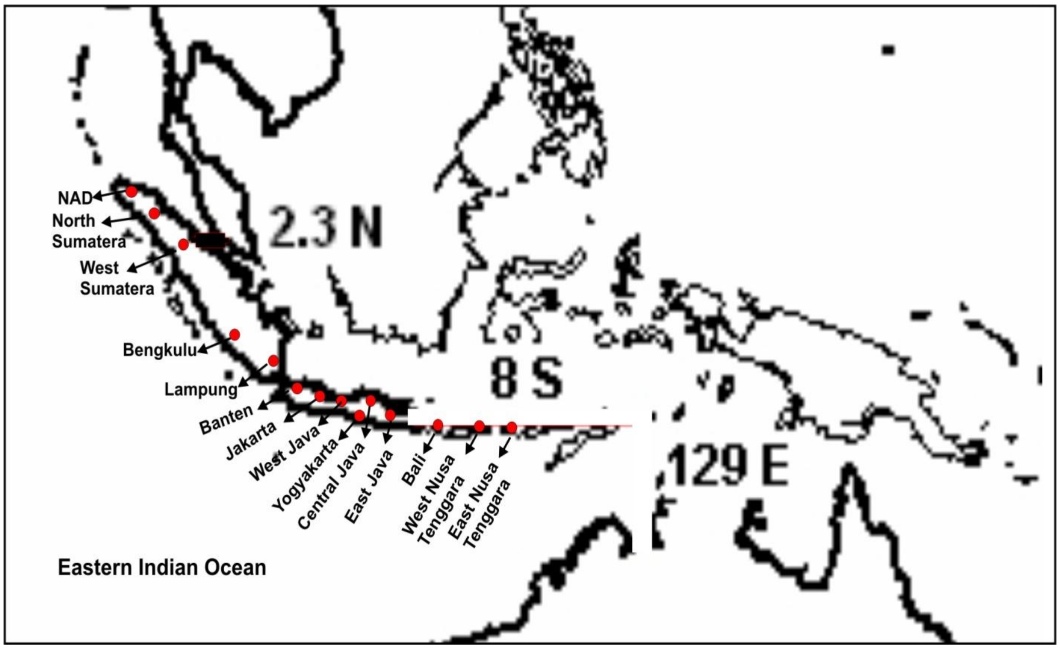

Figure 1 Map of Fish Landing Place all along coast facing with Indian Ocean.

3.2 Tropical Tunas Cathes and Production

Catch production of tropical tunas in Indonesia was not significantly increase, except skipjack which tend to slowly increase. Bigeye tuna recorded in statistical production since 2004. Bigeye catch seem to fluctuative that was relatively short period, just for four years, from 2004 to 2007. Trend of catch production of Yellowfin tuna was relatively down, and catch production of skipjack tend to increase in weight amount. (Table 6 and 7). Trend of production of those three species of tropical tuna it can be shown in Figure 2, 3, and 4). Production of bigeye tuna declined from 2004 to 2005, afterward increased until 2007. Bigeye tuna' production in Indian Ocean slowly increase since 2005 to 2007. Production of yellowfin tuna both from all Indonesian waters area and Indian ocean these was seen fluctuative down. Production of yellow tuna in Indian Ocean significantly declined since 2006. Catch production of skipjack in Indian ocean, just the opposite, that it was relatively decrease in weight amount, it significantly occured since 2006.

Table 6. Statistics of Marine Capture Fisheries Production (in ton) by Species of Tropical Tuna Group in Indonesia, 2001 -2007

No	Species	Fish Catces Production by Years							Increasing Average (%)
		2001	2002	2003	2004	2005	2006	2007	
1	Big Eye Tuna (BET)	ND	ND	ND	52292	37360	43958	52489	3,02
2	Yellow Fin Tuna (YFT)	153110	148439	151926	94904	110163	94406	103655	-4,43
3	Skipjack tuna (SKJ)	214077	203102	208626	233319	252232	277388	301531	19,62

Table 7. Statistics of Marine Capture Fisheries Production (in ton) by Species of Tropical Tuna Group from Indian Ocean, 2001 -2007

No	Species	Fish Catches Production by Year							Increasing Average (%)
		2001	2002	2003	2004	2005	2006	2007	
1	Big Eye Tuna (BET)	ND	ND	ND	24133	13337	12062	16537	2,359436
2	Yellow Fin Tuna (YFT)	54568	42147	58552	42862	57328	27229	29831	-50,6793
3	Skipjack tuna (SKJ)	47768	41271	50065	50843	48668	41619	43345	-13,7428
	Total	102336	83418	108617	117838	119333	80910	89713	-30,17

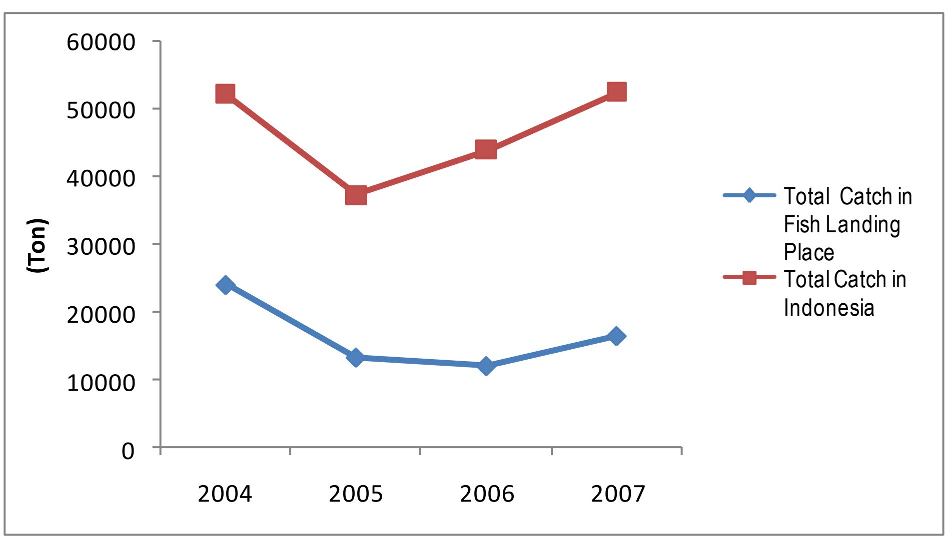

Figure 2. Trend production of Bigeye Tuna of total catch in Indonesia compared to total catch of Indian Ocean.

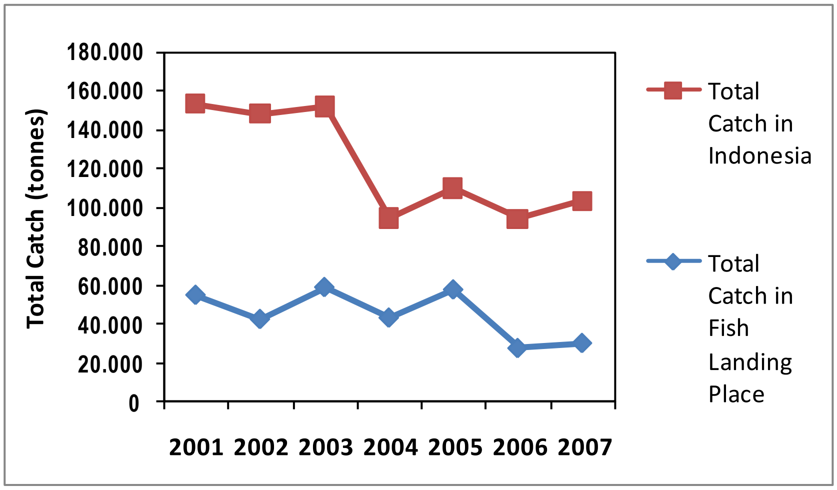

Figure 3. Trend production of yellowfin tuna of total catch in Indonesia compared to total catch of Indian Ocean.

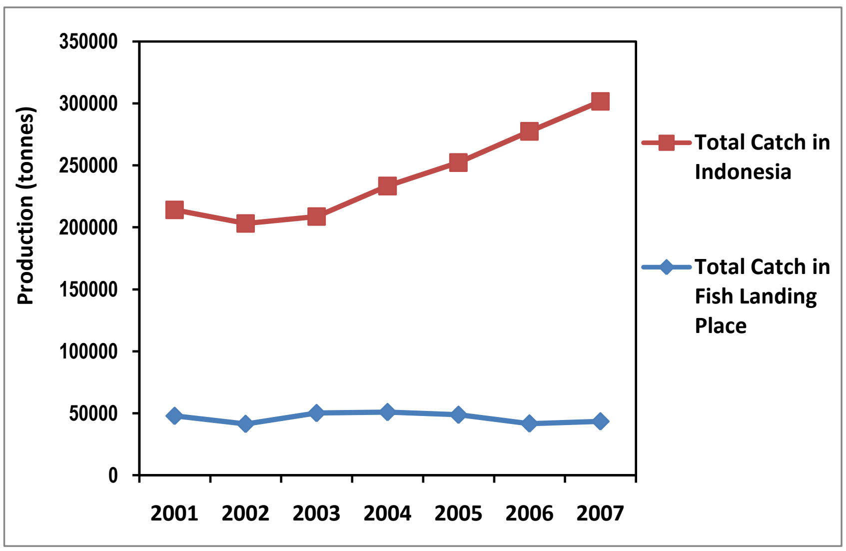

Figure 4. Trend production of skipjack tuna of total catch in Indonesia compared to total catch of Indian Ocean.

In accordance with monthly catch production reported from Pelabuhan Ratu and Cilacap fishing ports, it can be expressed the catch fluctuation every month in all the year of these species. The peak catch of each species some diference between two those fishing ports, it is becaused of type fisheries seem to some difference. (Figure 4 and 5). For example, skipjack in Cilacap was mainly caught by gill nets, but in Pelabuhan Ratu skipjack was mainly caught by troll line. It seems that fishing ability of skipjack gill net in Cilacap for catching skipjack was more effective rather than troll line in Plabuhan Ratu.

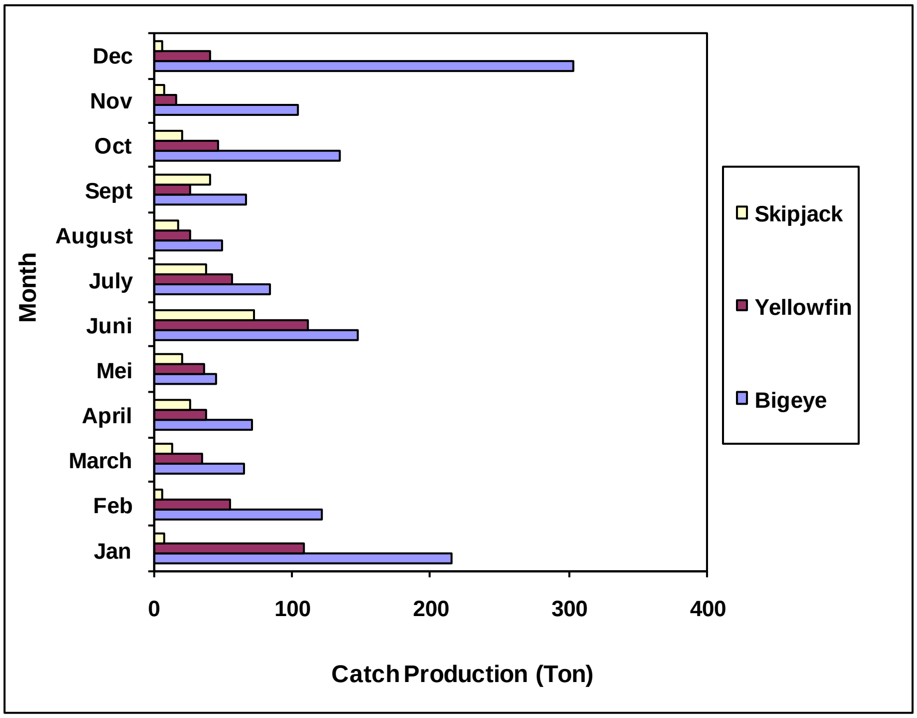

Figure 4. Graphics of monthly catch of SKJ, YFT, BET landed at Pelabuhan Ratu fishing port in 2008

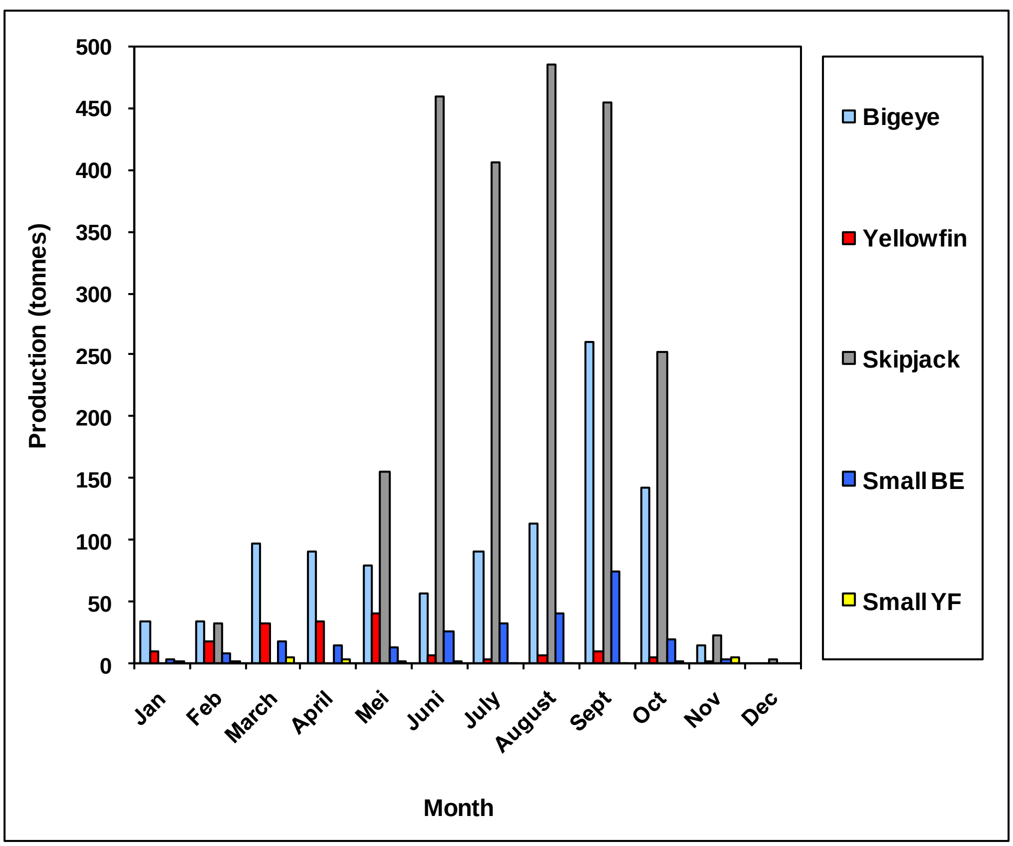

Figure 5. Graphic of monthly catch of SKJ, YFT, BET landed at Cilacap fishing port in 2008

- Bigeye Tuna Catch Performance based landing place from Indian Ocean

Bigeye tuna was caught from Indian Ocean can be disembarked or landed through 14 fishing ports spreading from all along west coast of Sumatera until to south coast of west Timor. In the graphics (see figure 6) it is shown that threre are two important fishing ports of bigeye landing place such as : Benoa fishing port in Bali and Jakarta fishing port. Bigeye fish product was dominated coming from these two fishing ports. Fishing fleets of these fisheries are consisted of big fishing vessels with long distance fishing grounds. As consequence, fishing capacity of those fisheries much bigger and these would be able to unload much fishes at the fishing port. If fish catch data from those fishing port is not available, it will, of course the statistics of catch marine production of bigeye, become unrealistic. It is how important the available report from those fishing vessels.

Bigeye fish product is mostly proposed as export product. It is therefore the landing place for the export commodity likes bigeye product should close to the International harbour likes in Jakarta and Bali. Not far from Jakarta there are some potential fishing ports such as Pelabuhan Ratu, Cilacap, Banten and Lampung fishing ports. These fishing ports are directly faced with Indian Ocean so they would be good landing place for exportable fishes including bigeye tuna. All of these Jakarta fishing ports around could be prospective for landing exportable fish catch likes bigeye. In other word, these fishing ports will be prospective for landing bigeye tuna in future. (See Figure 8).

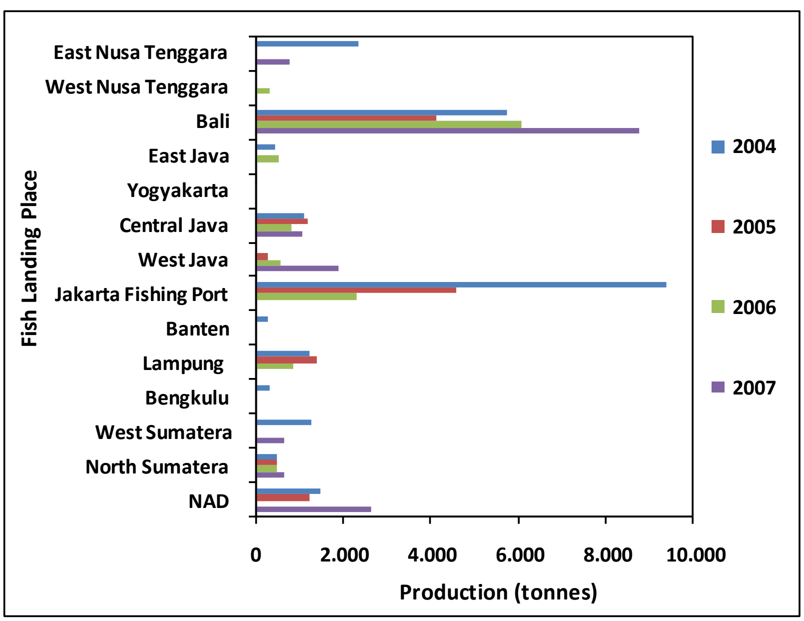

Figure 6. Graphics of bigeye catch production by landing places from Indian Ocean

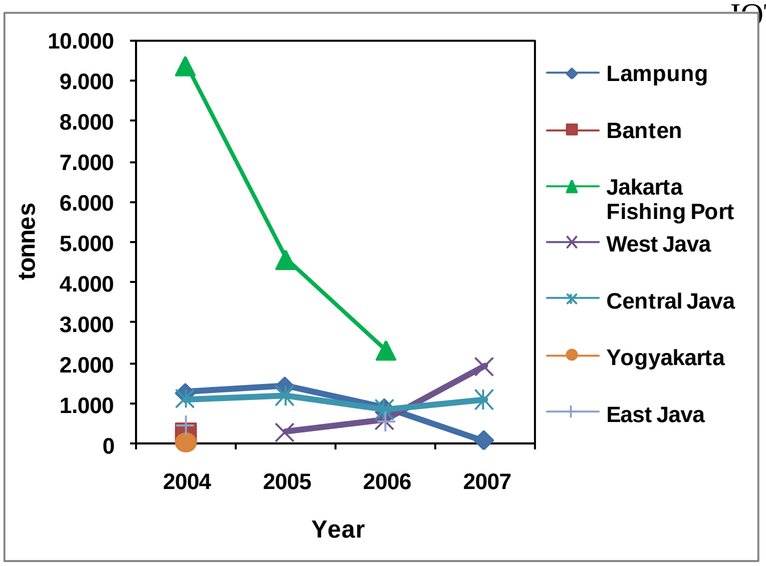

Figure 8. Catch Production from Jakarta fishing port and some fishing port it's around

In addition the fishing port especially for landing bigeye tuna fish should also available for bigger fishing vessels of long liners. The bigeye long line fishing is considerably long distance fishing ground, hence the bigger long liner should be available. Despitefully, the commodity product of bigeye tuna is mostly caught by using tuna long line fishing gear. It was reported from Pelabuhan Ratu Fishing Port that bigeye tuna fishes almost all of these fish (more than 97%) was caught by long line fishing gear (figure 8).

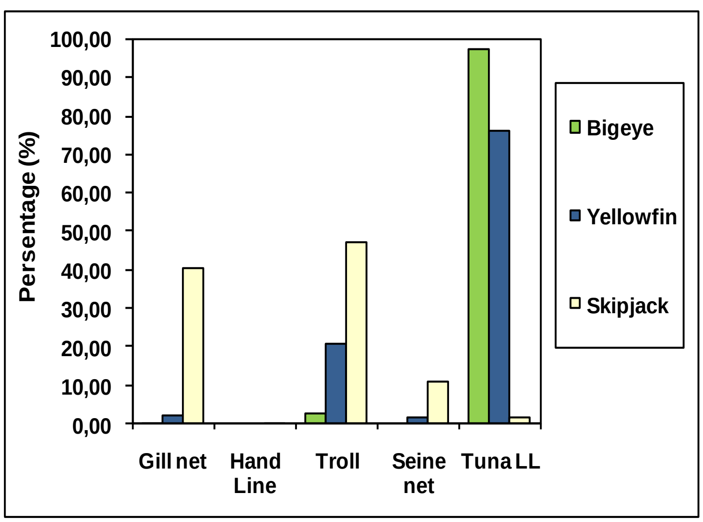

Figure 8. Dominant Fish Species Caught by Fishing Gears at Cilacap Fishing Port

Bigeye tuna catch production will become prospective in future. Catch production of bigeye tuna bigger than yellowfin tuna in Indian Ocean. This can be seen at the figure of the composition among bigeye and yellowfin which were reported by Cilacap and Pelabuhan Ratu fishing ports in 2008. Skipjack tuna was caught big in amount in Cilacap, however it was caugh t by gill net so it was lower quality. (Figure 9 and 10).

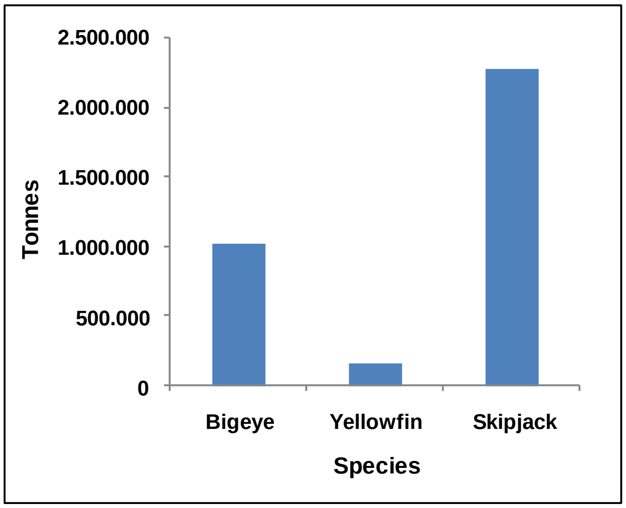

Fig.9. Catch production among BET, YFT, SKJ landed at Cilacap fishing port

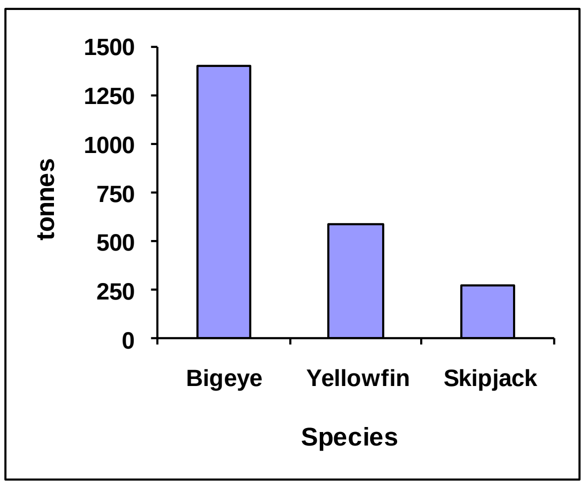

Fig.10. Catch production among BET, YFT, SKJ landed at Pelabuhan Ratu fishing port

- **Yellowfin tuna catch performance based on landing place from Indian Ocean**

Yellowfin tuna was the second position under bigeye tuna as the dominant species caught from Indian Ocean. In the same manner as the bigeye tuna that there are two important fishing ports of bigeye landing place such as : Benoa fishing port in Bali and Jakarta fishing port. Yellowfin tuna fish product was dominatly coming from these two fishing ports. Fishing fleets of these fisheries are consisted of big fishing vessels together with bigeye tuna fishing fleet, and others such as small scale fishing fleets consisting of troll liner, gill netter, and seine netter. As can be seen at Table 8, based on catch composition by type of fishing gear landed at Pelabuhan Ratu fishing port it was reported that the yellowfin in Indian Ocean was caught : by 76, 14 % by long line, 20,5% by troll line, 2 % by gill net, and 1,32 % by seine net (*payang*).

Table 8. Catch composition by type of fishing gear landed at Pelabuhan Ratu fishing port in 2008.

Species	Total (kg)	Gillnet		Hand line		Troll line		Seinenet		Tuna LL	
		kg	%	kg	%	kg	%	kg	%	kg	%
Bigeye	**140329**	**1582**	**0,11**			**35488**	**2,53**			**1366255**	**97,36**
YFT	**590557**	**11837**	**2**			**121302**	**20,5**	**7796**	**1,32**	**449662**	**76,14**
SKJ	**272557**	**110104**	**40,4**			**128786**	**47,2**	**29603**	**10,86**	**4018**	**1,474**

Yellowfin tuna is not the main target of gill net, *payang* (pelagic danish seine), and troll line. Those fishing methods except yellowfin tuna fishes their fishing purpose also catch seerfish, skipjack, and other big pelagic fishes. In case of bigeye and yellowfin tuna caught and landed at Pelabuhan Ratu fishing port in 2008 it had been reported that partly of bigeye and yellowfin catch composition were young fishes of 25 % and 12% respectively. Facing this, national and local goverment try to get the best way solution through fishery management as a point of view.

Concerning the catch production of yellowfin landed at Jakarta fishing port it was fluctuative. The catch reach the peak in 2004, afterwards the catch declined until 2006, then unhappily in 2007 it was not available data. (Figure 12). The catch of yellowfin tuna landed at Benoa tended to decline from 2001 until 2007 (Figure 13).

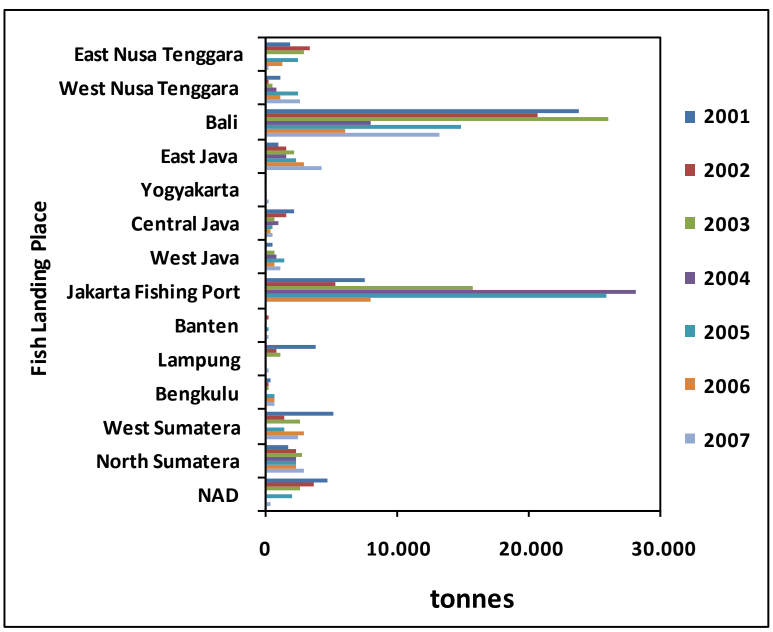

Figure 11. Graphics of Yellowfin tuna catch production by landing places from Indian Ocean

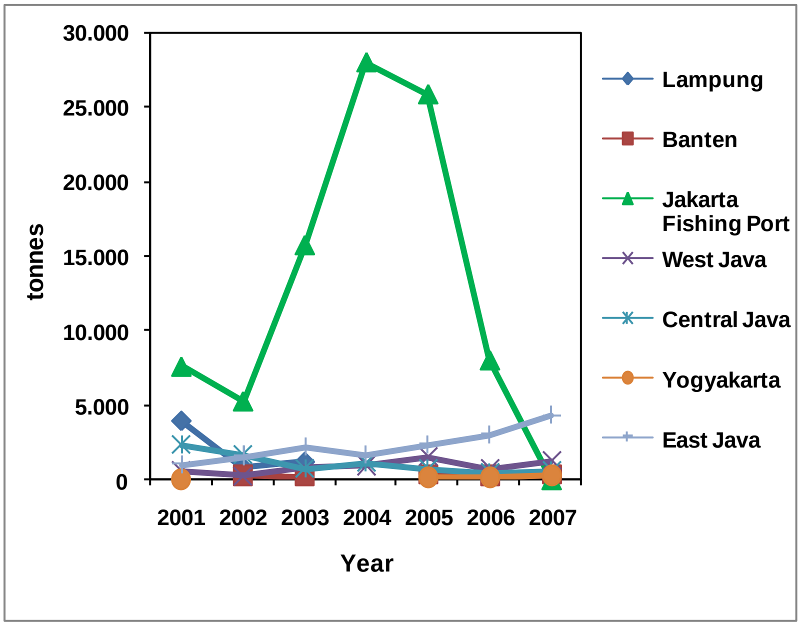

Figure 12. Yellowfin catch fluctuation landed at Jakarta fishing ports and at others

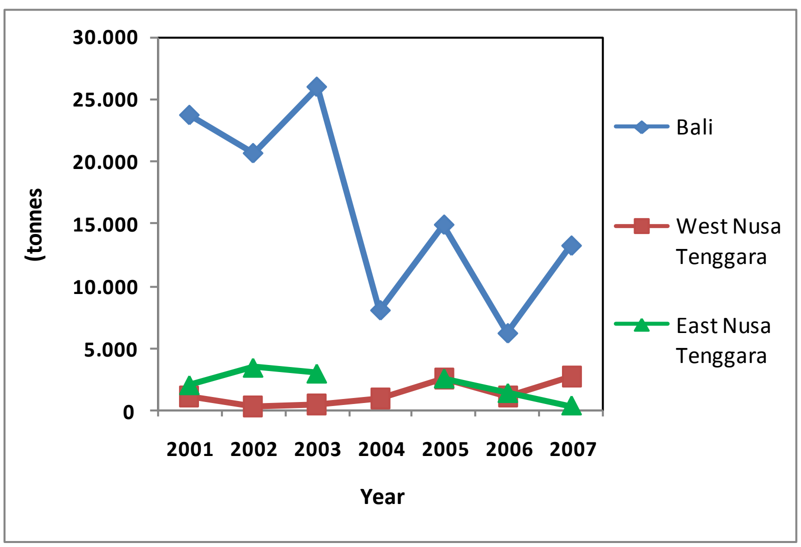

Figure 13. Yellowfin catch fluctuation landed at Benoa fishing ports and at others

- Skipjack tuna catch production based on landing place from Indian Ocean

It can be seen at Table 8, that skipjack tuna was mostly caught by troll line gear, gill net, *payang* (danish seine net), and long line proportionally were 47,2%, 40,4%, 10,86%, 1,47% respectively. Hand line was very rarely caught skipjack. Troll line fishing has been famous in west coast of Sumatera especially in west Sumatera, north Sumatera and Aceh. Nowdays, troll line become popular in west Java (Pelabuhan Ratu). At eastern waters spread from east NusaTenggara to east Java troll line is mainly used for catching skipjack. Skipjack' catch landed places from the biggest catch respectively were in south coast of east Nusa Tenggara, west coast of west Sumatera, east Java, west coat of Aceh, west Nusa Tenggara, Bali, west coast of north Sumatera, south coast of central Java. Skipjack gill net is very famous at all along coast of south Java, and some in west coast of Sumatera. Pelagic danish seine from south coast of central Java and west Java also catch skipjack in west Sumatera. (Figure 12)

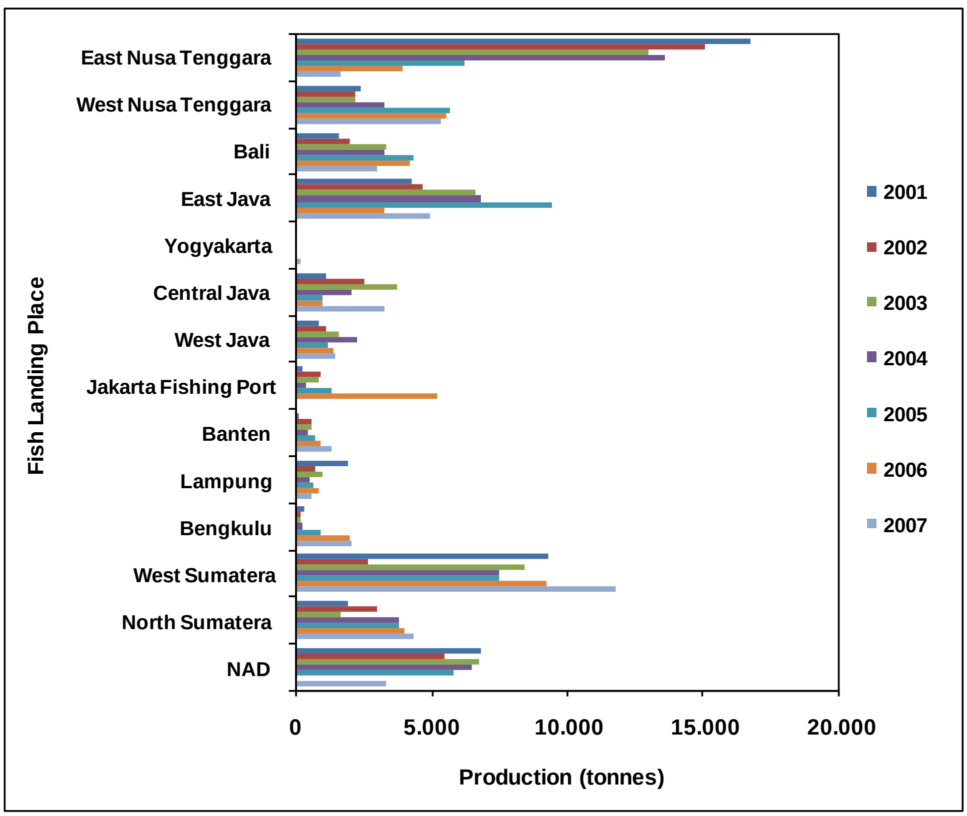

Figure 14. Graphics of skipjack tuna catch production by landing places from Indian Ocean

4. Advanced stage of Fisheries Management Measure

- Improved on Data Collection

One important issue corcerned with fisheries management is how about improving to collect data in a form to facilitate coming to a decision the measure to achieve sustainable fisheries. As a result of this, in such a manner so it can be fulfill every needs and pretension of community without teasing to a chance of younger generation to gain benefit arisen from ecosystem of the marine . The data collection would be prepared through three programmes : (1) enumerator, (2) observer on board, and (3) log book fishing. These programmes nowdays it has been becoming national issue regarding fisheries management area in Indonesian marine waters which is divided into 11 fisheries management areas. Three points can be highlighted from the management approach to fisheries biside fisheries management area itself those are : (1) improving to fisheries management approach based on resource and bio-physical environment, (2) improving coordination forum for fisheries management, and (3) marine protected area as conservation to aquatic resources.

One advancing stroke of fisheries management plan had resulted in the document on the fisheries management plan for fisheries management areas. Although up to now it is still not implemented yet, by the law it can be implemented at any time in point. From this plan it can implemented to all of those fisheries management areas including in Indian Ocean.

In case of Tuna Fisheries Management Area in Indian Ocean, the Indonesian government has been more working on implementation logbook fishing, enumerator as well as observer programmes espicially to the activity of tuna fisheries in Indonesian Ocean. Implementation or working plan of the observer programmes divided into on board observer and on port observer. On board observer focused on logbook data collection, on port observer become more focused on sampling method and analizing to fish biology. Logbook fishing data would be collected by crews of fishing vessel those are under controlled by ship's captain. By means of catchword or slogan "no logbook no license", in order to raise the motivation of the captain via the ship's owner become more responsible to logbook fishing data collection.The installation for monitoring of tuna fishes in Gondol, Bali it should take more observation to tuna fishes in Indian ocean. Enumerators for fish catch data collection at each region are nowdays paid more attention.

- Ecosystem Approach to Marine Fisheries

In a few last weeks ago there was national meeting on ecosystem approach to fisheries. This meeting was a kind inspiring agreement to compare perception on ecosystem approach to fisheries management. In this meeting it has been identified some crucial indicators of ecosystem it would be implemented. Some domain indicators already formulated such as : domain indicator on fish resources and its habitat, domain indicators on capture fisheries relating to fishing capacity and fisheries interaction, and so on. In the next year would be a pilot project implementation on ecosystem approach to fisheries.

On occasion of fisheries management in Indian Ocean it will be implemented some indicators like fishing capacity and interaction among tuna fisheries which is pertinent to some small scale tuna fisheries activity in this region as a fishing management area.

5. Recomendation

To the best of the existing real mutual collaboration among tuna fisheries in compact regional ecosystem of the same ocean waters such as in Indian Ocean fishing area, it should be confirmed and cummunicated to be implemented among stake holders in order to take care fisheries to improve their comfortable fisheries of each region. Realizing on the fact of such condition of highly migratory fishes like tunas, billfish, sharks and regionally migratory fishes like seerfishes that all of those tend to come close to continental, archipelagic or islands, that is also very close to the activities of small scale fisheries of each local fishers surroundings. Luckily, there is a local wisdom in each fishing villages concernedly which it needs to be more appreciated. This local wisdom of course there is in correlation to support fisheries management.

6. Acknowledgment

Firstly, could I express my deepest thanks fullness to the IOTC for the acceptance to attend the interesting working parties on three significantly issues regarding the Management on Tuna Fisheries in Indian Ocean in October 2010.

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Appendix 1A

Statistics of bigeye tuna production by fish landing places from Indian Ocean, 2004-2007

No		2004	2005	2006	2007
1	NAD	1467	1249		2628
2	North Sumatera	482	482	506	642
3	West Sumatera	1280			645
4	Bengkulu	320			
5	Lampung	1259	1424	872	61
6	Banten	270			
7	Jakarta Fishing Port	9380	4575	2327	
8	West Java		274	562	1920
9	Central Java	1118	1207	842	1088
10	Yogyakarta	14			
11	East Java	449		548	
12	Bali	5727	4126	6079	8749
13	West Nusa Tenggara			326	22
14	East Nusa Tenggara	2367			782
		24133	13337	12062	16537

Appendix 1B

Statistics of yellowfin tuna production by fish landing places from Indian Ocean, 2001-2007

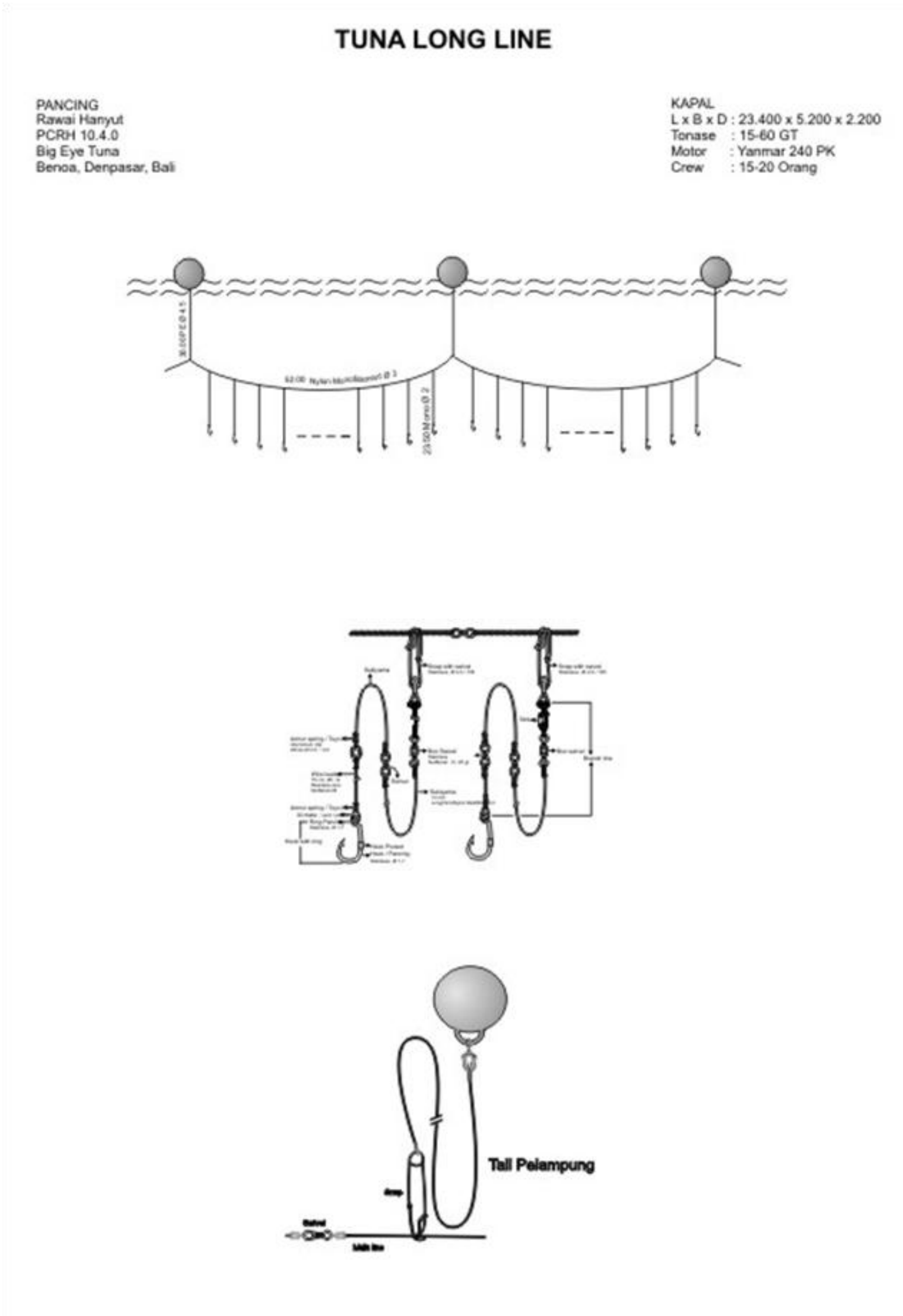
No		2001	2002	2003	2004	2005	2006	2007
1	NAD	4730	3713	2616		2111		376
2	North Sumatera	1848	2416	2799	2305	2305	2421	3018
3	West Sumatera	5227	1537	2619		1468	2961	2569
4	Bengkulu	490	298	311		728	699	767
5	Lampung	3935	818	1190				253
6	Banten		242	177		260	222	274
7	Jakarta Fishing Port	7611	5283	15770	28047	25899	8039	?
8	West Java	556	200	724	926	1503	678	1229
9	Central Java	2286	1666	676	1052	653	437	526
10	Yogyakarta	2				158	122	274
11	East Java	986	1560	2166	1620	2322	2999	4312
12	Bali	23747	20672	26018	8010	14908	6159	13222
13	West Nusa Tenggara	1146	298	524	902	2454	1134	2681
14	East Nusa Tenggara	2004	3444	2962		2559	1358	330
		56569	44149	60555	44866	59333	29235	31838

Appendix 2

Statistics of skipjack tuna production by fish landing places from Indian Ocean, 2001-2007

No		2001	2002	2003	2004	2005	2006	2007
1	NAD	6841	5516	6742	6512	5791		3351
2	North Sumatera	1914	3017	1656	3826	3826	4019	4333
3	West Sumatera	9320	2690	8429	7475	7515	9244	11806
4	Bengkulu	332	221	230	237	918	1984	2061
5	Lampung	1962	748	1027	559	642	893	588
6	Banten	146	594	596	493	715	923	1326
7	Jakarta Fishing Port	238	965	901	396	1362	5201	
8	West Java	852	1114	1598	2303	1215	1413	1481
9	Central Java	1139	2524	3761	2069	985	985	3272
10	Yogyakarta		1		5	1		168
11	East Java	4273	4670	6613	6824	9423	3266	4928
12	Bali	1580	1974	3321	3295	4331	4187	3022
13	West Nusa Tenggara	2422	2209	2230	3290	5716	5544	5361
14	East Nusa Tenggara	16749	15028	12961	13559	6228	3960	1648
	Total (in Ton)	47768	41271	50065	50843	48668	41619	43345

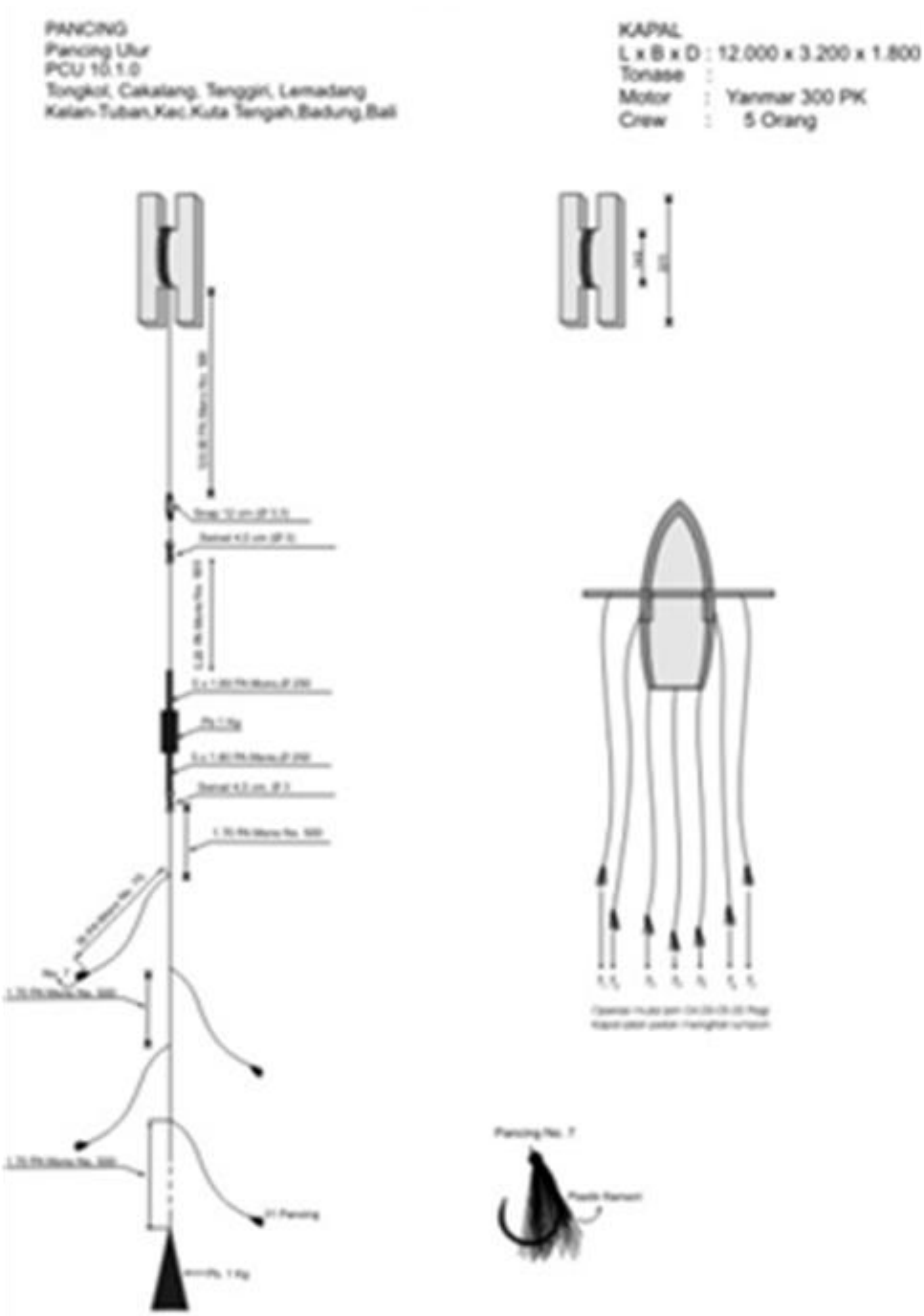
Appendix 3



Zarochman, WPTT- IOTC meeting,in Seychelles, Oct.. 2010

Appendix 4

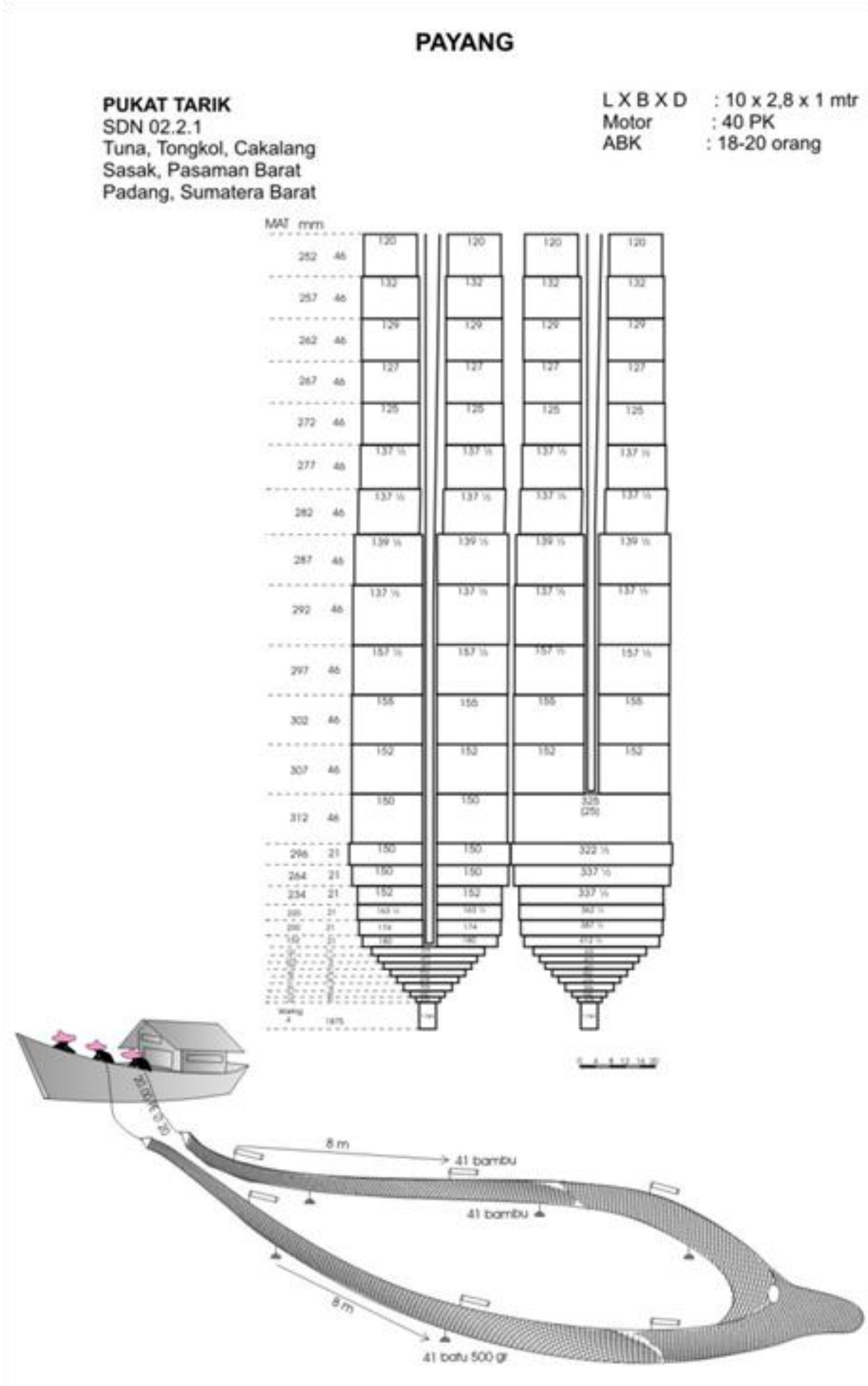
Troll Line



Zarochman, WPTT- IOTC meeting,in Seychelles, Oct.. 2010

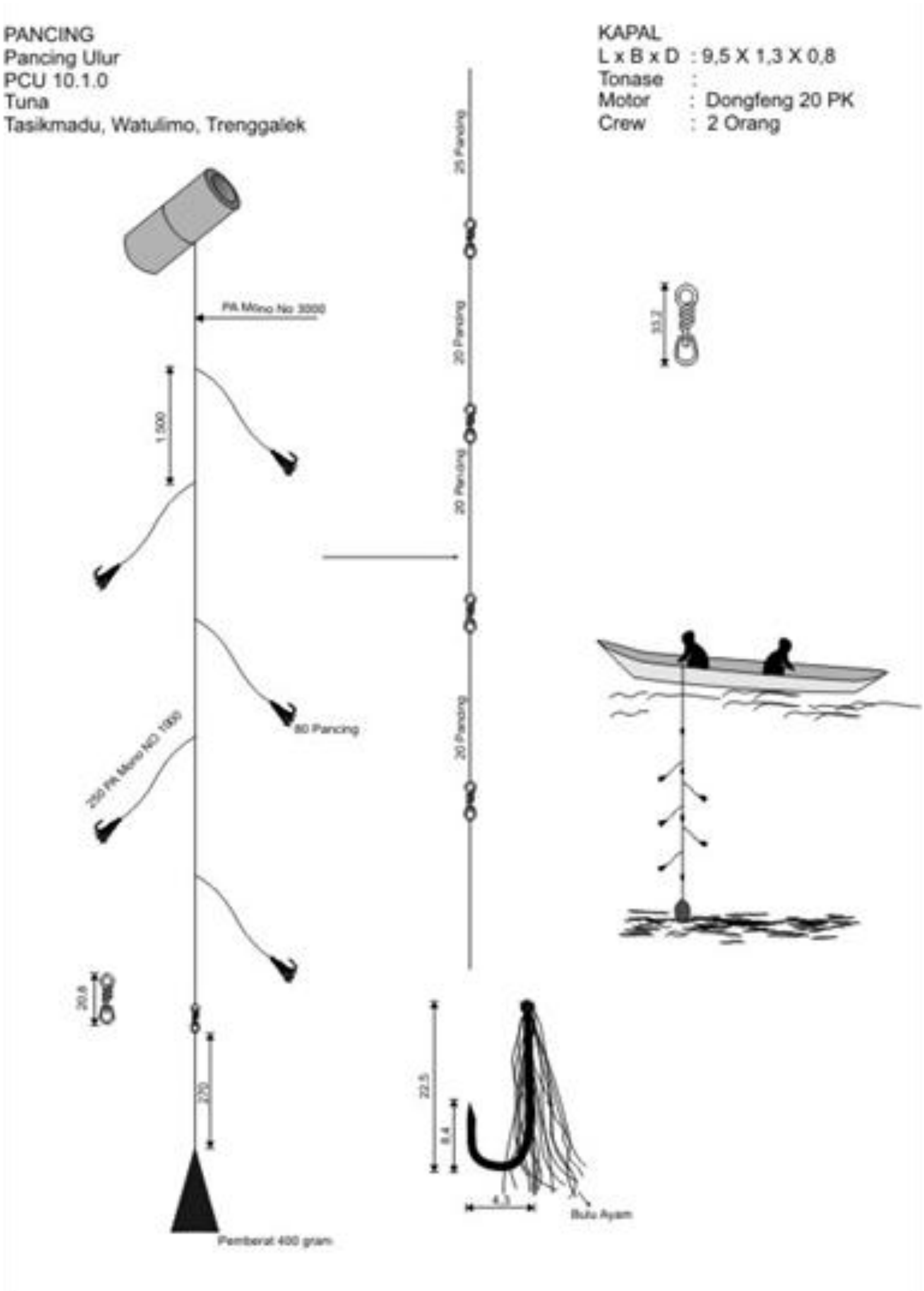
Appendix 5.

Pelagic Danish Seine



Appendix 6

Hand Line



Zarochman, WPTT- IOTC meeting,in Seychelles, Oct.. 2010

Appendix 7.

Mackerel Purseine

JARING LINGKAR
Jaring Lingkar Bertali Kerut
(Pukat Cincin Satu Kapal)
JLPC-1k
Layang, Kembung, Tongkol
Pasaman Barat, Padang, Sumatera Barat

KAPAL
L x B x D : 16,0 x 3,5 x 1,5 m
Tonase : 21 GT
Mesin : Fuso 180 PK
ABK : 10 Orang