THE STATUS OF INDONESIAN TUNA FISHERIES IN THE INDIAN OCEAN

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INTRODUCTION

Indonesia's total marine production in 1992 amounted to some 2,436,200 t, compared to 1,922,780 t in 1986, with an average growth rate of 5.9 percent per annum (DGF, 1993). The annual growth rate for tuna production in the same period was 6.0 percent, from 238,985 t in 1986 to 319,152 t in 1991, of which 265,700 t, or 83.0 percent, was landed in East Indonesia.

The volume and export value of tuna rose from 26,059 t and US$ 21,677,000 in 1986 to 103,369 t and US$ 184,426,000 in 1991, with annual growth rates of 31.7 percent and 53.4 percent, respectively.

The rapid development of the Indonesian tuna industry is due to the support by the government of such as:

- Encouraging the export of non-fuel and natural gas commodities such as shrimp, tuna, and skipjack.
- Providing loans to the fishermen.
- Creation of non-physical infrastructure, such as programs for training and education, marine fisheries research, administration, management, and extension services.
- 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).
- Establishment of the Nucleus Estate for Smallholders (NES) System or joint tuna-fishing operation between state enterprises and the artisanal fishery.
- Subsidizing air cargo for the export of fresh tuna.

TUNA FISHERIES

The Indonesian tuna fisheries can be divided into industrial fisheries and artisanal fisheries. The former are mostly longline and pole-and-line fisheries, while the artisanal fisheries use trolling gear, small purse seines, gillnets, and Danish seine. The major tuna fisheries in the Indian Ocean are concentrated along the west coast of Sumatra (Banda Aceh, Padang) and the south coast of Java (Pelabuhan Ratu, Cilacap, Prigi, Sendang Biru and Benoa in Bali).

Typical gears used in the artisanal fisheries are troll lines and Danish seines in Padang, small purse seines and troll lines in Banda Aceh, purse seines and gillnets in Prigi and Sendang Biru (east Java), and Danish seines (locally called *payang*) and gillnets at Pelabuhan Ratu.

The distribution of the above fishing areas is shown in Figure 1.

Purse seines

The artisanal purse-seine fisheries are based in Aceh province and in Prigi in east Java, with about 250 and 40 vessels, respectively. The boats at Aceh are of 20 to 105 GT, with 45 hp inboard motors and nets ranging from 700 to 1,200 m long and 20 to 40 m deep.

At Prigi purse-seine fishing operations are done with two boats, each of 4 to 5 GT; the seine boat (boat 1) has a 40-50 hp engine and the other (boat 2) a 11-12 hp engine. The size of the nets ranges from 400 to 500 m long and 40 to 50 m deep. Fishing is done during the day, from 6 a.m. to 6 p.m.

The production of tuna species at Prigi is listed in Table 1. The composition of the catch of tuna species in this area is skipjack 14.9%, yellowfin 5.6%, and bullet tuna 79,5%. Tuna production accounted for nearly 30% of the total landings of fish in this area.

Troll lines

Fishing with troll lines is well developed in West Sumatra, with more than 400 trollers ranging from 4 to 25 GT, with 16 to 55 hp engines, using seven lines each and manned by four to six fishermen. Duration of fishing trips is 10 to 14 days. About 80 percent of the boats use 33 hp engines, and the catch is preserved with ice in fish holds of 2.5-3 t.

The production from Padang is listed in Table 2. The catch of tuna species per trip for this area during the 1988-1994 period ranged from 267 to 1,022 kg, with an average of 616 kg. Skipjack tuna is the dominant species in the catch (62.7%), followed by yellowfin tuna (24.5%) and bullet tuna (12.8%).

***Table 1**. Landings of tuna species (t) in Prigi, East Java, 1986-1990.*

Year	*SKJ*	*YFT*	*BLT*	*Total*
1986	3.1	20.4	340.0	363.5
1987	20.0	3.3	449.0	472.3
1988	112.0	17.0	767.4	896.4
1989	249.2	110.2	549.6	909.0
1990	100.5	31.0	485.7	617.2
Total	484.8	181.9	2,591.7	3,258.4
%	14.9	5.6	79.5	100

***Table 2.** Catches (t), effort, and catch per unit of effort (kg) by trolling gear at Padang, 1988-1994*

Year	*Trip (F)*	*SKJ*	*YFT*	*BLT*	*Total (C)*	*C/F*
1988	4,045	123.5	920.7	190.6	1,234.8	305
1989	4,678	422.6	548.6	278.3	1,249,5	267
1990	4,682	2,071.3	410.4	565.1	3,046.8	651
1991	4,070	2,138.4	490.9	412.8	3,042.1	747
1992	4,012	2,666.8	530.0	355.5	3,552.3	885
1993	2,902	2,097.8	775.5	91.3	2,964.6	1,022
1994	4,684	1,707.2	706.2	394.4	2,807.8	599
Total	-	11,227.6	4,382.3	2,288.0	17,897.9	4,477
%	-	62.7	24.5	12.8	100.0	-

Gill nets

Gillnetting for tuna is well developed in Pelabuhan Ratu, Prigi, and Sendang Biru, with about 180, 60, and 77 vessels, respectively. The size of the boats ranges from 3 to 6 GT, with 40-hp engines. One section of net is 60 m long (100 m stretched) and 14 m deep, with a mesh size of 4 to 5 inches. One unit of the gear usually consist of 20 pieces of net (1,200 m long). Fishing is done at night, from 6 p.m. to 6 a.m., by three to four fishermen. Fishing trips last form 3 to 7 days. Skipjack tuna contributes about 79.7% of the tuna landings in Pelabuhan Ratu. Catch per trip for the gillnet fishery in Pelabuhan Ratu ranges from 83 to 363 kg, with an average of 170 kg.

Table 3 and Table 4 show the annual catch, effort, and catch per unit of effort by gillnetters at Pelabuhan Ratu and Sendang Biru.

Seine nets

This gear is used for catching tuna by about 180 boats in Pelabuhan Ratu. The size of the boats ranges from 4 to 7 GT, with 40 hp outboard motors,, and manned by 14 to 20 fishermen. The length of the net is 300 to 500 m. Fishing is done by day, from 5 am to 5 p.m. Trip duration is one day. The catch/day-year for the 1981-1990 period ranges from 145 to 975 kg, averaging 345 kg/day. The production of the *payang* in Pelabuhan Ratu for the 1981-1990 period is shown in Table 5.

Longlines

The longline fishery for tunas has developed rapidly since 1985 due to the high demand for fresh tuna, particularly in Japan. This is manifested by the remarkable increase in the number of longliners, from 38 in 1986 to 931 in 1993, of which 783 operate on the Indian Ocean side. Besides, the government of Indonesia encourages foreign investors to develop the tuna fishery in the Indonesian EEZ. The number of foreign longliners increased from 2 vessels in 1986 to 508 in 1993.

***Table 3.** Annual catches (t), effort (days), and catch per unit of effort (kg) by gillnetters (3-4 gt) in Pelabuhan Ratu, West Java*

Year	*Fishing days (F)*	*SKJ*	*YFT*	*BLT*	*Total catch (C)*	*C/F*
1981	9,380	667.8	79.6	33.1	780.5	83
1982	6,653	710.0	119.6	169.0	998.6	150
1983	5,598	793.0	85.1	316.0	1,194.1	213
1984	4,196	468.8	46.5	15.9	531.2	127
1985	2,914	402.2	33.9	31.0	467.1	160
1986	2,586	285.4	31.6	21.3	338.3	131
1987	2,827	750.6	88.0	85.1	923.7	327
1988	3,454	1.038.9	139.9	76.5	1,255.3	363
1989	2,402	266.3	37.3	10.6	314.2	131
1990	1,637	275.9	10.9	10.5	297.3	182
Total	41,647	5.658.9	672.4	769.0	7,100.3	1,867
%	-	79.7	9.5	10.8	100.0	-

***Table 4.** Landings of tuna species (t) at Sendang Biru, East Java, 1990-1994*

Year	*SKH*	*YFT*	*BLT*	*Total*
1990	728.3	83.5	279.4	1,091.2
1991	1,286.0	362.5	795.1	2,443.6
1992	530.1	500.0	381.8	1,411.9
1993	913.2	125.9	383.7	1,422.8
1994	252.1	116.5	638.5	1,007.1
Total	3,709.7	1,188.4	2,478.5	7,376.6
%	50.3	16.1	33.6	100.0

Table 5. *Annual catches (t), effort (days), and catch per unit of effort by Danish seines (*payang*) (4-5 gt) at Pelabuhan Ratu, West Java*

Year	*Fishing days (F)*	*SKJ*	*YFT*	*BLT*	*Total (C)*	*C/F*
1981	1,920	45.8	55.4	813.0	914.2	476
1982	2,966	143.8	26.3	2,721.5	2,891.6	975
1983	5,138	388.8	82.3	1,078.1	1,549.2	302
1984	4,147	234.1	48.6	352.6	635.3	153
1985	5,955	366.7	7.0	1,340.20	1,713.9	288
1986	2,848	350.3	4.0	307.5	661.8	232
1987	1,816	291.4	80.4	593.9	965.7	532
1988	6,033	700.1	19.5	1,929.8	2,649.4	439
1989	4,397	707.4	46.0	148.0	901.4	205
1990	3,631	350.3	13.7	162.5	526.5	145
Total	38,851	3,578.7	383.2	9,447.10	13,409.0	3,747
%	-	26.7	2.9	70.4	100.0	-

Table 6. *Japanese catches of tuna species (t) in the Indian Ocean, 1993-1995*

Month	*YFT*	*BET*	*ALB*	*BM*	*WM*	*SM*	*SWF*
1993							
Apr	27.9	91.6	-	3.3	0.3	1.4	2.7
May	8.1	40.0	-	1.7	-	0.3	0.3
Jun	10.5	13.9	1.4	0.6	0.3	0.4	0.9
Jul	1.7	10.2	1.1	0.2	-	0.3	0.4
Aug	0.7	11.5	1.8	-	-	0.1	2.3
Sep	1.0	7.0	0.1	-	-	0.0	1.6
Oct	2.5	17.4	1.4	1.0	-	0.2	0.4
Nov	-	11.1	-	-	-	-	-
1994							
Oct	4.0	10.5	4.4	0.2	0.2	0.2	0.1
Nov	1.4	19.0	3.2	-	-	0.1	0.8
Dec	0.1	3.6	0.5	-	-	0.2	-
1995							
Mar	1.7	3.1	0.8	-	-	0.1	0.1
Apr	0.5	22.3	-	-	-	-	-
May	0.3	9.6	-	0.1	0.2	0.0	0.2

Table 6 shows the production of Japanese longliners in the 1993-1995 period. Most of the catch is exported to Japan, the USA, and Taiwan in fresh and frozen form.

Both Indonesian and foreign longliners usually use the fishing bases in Jakarta or Benoa in Bali, depending on the fishing season. If the tuna-fishing season occurs along the west coast of Sumatra and the south coast of Java they use Jakarta. The production of these longliners is shown in Tables 7 and 8. If the fishing season changes to the south coast of Bali and Nusa Tenggara they use Benoa. The tuna production of these vessels during the 1988-1994 period is shown in Table 9.

Table 7. *Exports of tuna (t) caught by longliners from Muara Baru, Jakarta, 1985-1994*

Year	*Fresh Tuna*	*Frozen Tuna*	*Total*
1985	-	430.0	430.0
1986	-	1,520.0	1,520.0
1987	57.5	2,446.0	2,503.5
1988	2,024.7	5,324.0	7,348.7
1989	data not available		
1990	4,075.0	6,597.8	10.672.8
1991	6,124.2	6,468.1	12,592.3
1992	3,603.0	3,895.2	7,498.2
1993	5,056.6	4,969.1	10,025.7
1994	5,821.7	4,882.4	10,704.1

Source: Jakarta Fishing Port, D.G.F., 1995

RESEARCH ACTIVITIES

The *Balai Penelitian Perikanan Laut,* or Research Institute for Marine Fisheries (RIMFRI) in Jakarta has the national mandate to conduct research and development of marine fisheries and fish resources, and is responsible for providing data and information for fisheries management and development. The Institute is under the auspices of the Agency for Agricultural Research and Development (AARD) of the Ministry of Agriculture. Within the RIMFRI, the Indonesian Program for Tuna Research has collected data routinely from several sampling sites scattered on the eastern and western sides of Indonesia since 1978.

The data are collected basically according to procedures of Holden and Rait (1974) and the ICCAT Port Sampler's Manual. Other biological data, such as gonad and morphometric measurements, are collected incidentally by the scientists during trips to the field. At the sampling sites, two persons from the local staff and employed to collect data on landings.

The data for longline fisheries are collected from the state enterprise, while a logbook system is in preparation or private companies. These logbooks will be distributed to the longline vessels operating in Indonesian waters.

The following data were obtained:

- Vessel name
- Duration of fishing trip
- Fishing area/Fishing ground
- Catch by species in number and weight
- Total baskets
- Fork length (FL), cm
- Length and weight

Table 8. *Exports of tuna from Jakarta, 1994 (t)*

Month	*Fresh Tuna*	*Fillet/Loin/Steak*	*Frozen Tuna*	*Reject*	*Total*
Jan	533.4	32.7	55.2	554.8	1,176.1
Feb	-	-	-	-	-
Mar	409.6	49.4	888.9	693.7	2,041.6
Apr	424.4	63.2	251.0	872.5	1,611.1
May	349.6	90.6	10.1	825.9	1,276.2
Jun	397.7	97.3	118.3	1,215.8	1,829.1
Jul	484.3	128.1	396.2	1,691.0	2,699.6
Aug	622.9	111.0	85.8	1,195.9	2,015.6
Sep	615.9	107.7	506.1	1,225.9	2,455.6
Oct	517.7	83.9	213.3	1,007.6	1,822.5
Nov	684.6	65.2	318.0	1,314.2	2,382.0
Dec	781.6	52.2	24.6	1,338.6	2,197.0
Total	5,821.7	881.3	2,867.5	11,.935.9	21,506.4
Mean	529.2	80.1	260.7	1,085.1	1,955.1

Table 9*. Exports of tuna from Bali province, 1988-1994 (t)*

Year	*Fresh Tuna*	*Frozen Tuna*	*Total*
1988	1,248.9	881.1	2,166.0
1989	3,796.0	3,041.9	6,837.9
1990	3,636.6	2,585.6	6,222.2
1991	7,739.3	1,387.8	9,127.1
1992	12,064.4	2,740.5	14,804.9
1993	12,582.1	4,129.2	16,711.3
1994	13,228.2	5,766.0	18,994.2

Sampling sites for the Indian Ocean are located at Pelabuhan Ratu and at Benoa, Bali.

Current research on the tuna resources is as follows:

- Research on the distribution, species composition and catch rate of live bait for the pole-and-line fisheries for skipjack in the waters adjacent to north Celebes, north Moluccas, and Irian Jaya.
- Research on the stock density of live bait for the pole-and-line fisheries for skipjack in north Celebes and Irian Jaya.
- Research on diurnal habits of tuna and skipjack around FADs in waters adjacent to Sorong, Irian Jaya, and Labuha through the use of ultrasonic tags.
- Research on the growth rate of yellowfin tuna in the north Moluccas, based on otolith analysis.
- Research on food and feeding habits of skipjack tuna around FADs in Bitung and Kendari. Research on morphometric and genetic variation for identifying types of enzyme for skipjack tuna in the waters adjacent to Padang and Pelabuhan Ratu.

Figure 1. *Distribution of major fishing sites for skipjack and other tuna fisheries in the Indonesian waters of the Indian Ocean.*