

Development of Fisheries for Tuna and Tuna-Like Fish in Indonesia with Particular Reference to the Jakarta-Based Tuna Longline Fishery

by

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Table of Contents

Explanatory notes	iii
Fishery statistics used in the present paper	iii
Species classification	iii
Fishing gear classification	iii
Coastal classification	iii
Abbreviations	iii
Standard symbols	iii
Introduction	1
Indonesia	1
Historical perspective in marine fisheries	1
Oceanic pelagic resources and their exploitation	1
Development of a national fisheries statistical system	1
Assistance provided by IPTP	1
Development of tuna fisheries in Indonesia	2
Place of the catch of tunas and tuna-like fishes out of total marine catch	2
Catch of tunas and tuna-like fishes by species, 1977 - 1989	2
Catch of tunas and skipjack by gears	3
"Tunas"	3
Skipjack	3
Geographical distribution of tuna and tuna-like fish	4
"Tunas"	4
Skipjack Tuna	4
Tongkol	4
Indo-Pacific king mackerel	5
Narrow barred king mackerel	5
Development of skipjack pole-and-line and tuna longline fisheries	5
Adjustment of catch and fishing effort data	5
Development of the skipjack pole-and-line fishery	5
Development of the tuna longline fishery	7
Development of the Jakarta-based tuna longline fishery	9
Size composition of tuna by weight	20
Concluding remarks	27
The licensing system.	27
National fishery statistical system	27
Collection of tuna weight data	27
Acknowledgement	28
References	28
Appendix	29
Appendix 1	29
Appendix 2	29
Appendix 3	30
Appendix 4	32
Appendix 5	33
Appendix 6	35

ABSTRACT

During the period from 1977 to 1989, the production of tuna and tuna like fishes increased from 136,000 t to 381,000 t. The relative importance of the catch of tuna and tuna like fishes to the total marine catch increased from 12 % in 1977 to 17 % in 1989.

The traditional fishery for skipjack tuna is by trolling under sail. These vessels were motorised in 1981. The pole and line fishery using inboard powered boats was introduced into Manado and spread to Ternate and Ambon. Since 1972, the Government has promoted the skipjack pole-and-line fishery by establishing state fishing companies at Ambon, Bitung and Sorong. The 1989 catch was 114,000 t. Neritic tunas are mainly distributed in West Indonesian waters. They are caught by various gears. The 1989 catch was 135,000 t.

The large "tunas" have been caught by Indonesian fishermen in limited quantity by means of trolling or angling. After World War II, tuna resources in Indonesian waters were first exploited mainly by Japanese tuna longline boats. In 1973, a state fishing company began to operate a tuna longline fishery based on Benoa in Bali. Jakarta Fishing Port (JFP) was inaugurated in 1984. This stimulated the development of the tuna longline fishery aiming at exporting fresh tuna to Japan. The catch in 1989 was 66,000 t.

The export of fresh tuna landed by local tuna boats at JFP began in late 1987. With the arrival of Taiwanese tuna longline boats in the latter half of the 1980s, the tuna longline fishery based at JFP became very active. The total number of tuna boats based at JFP reached 204 by May 1990. JFP based tuna longline boats fish in the Indian Ocean outside the Sunda Strait, which can be reached in two to three days running. A trip lasts for about 13 days, of which about 5 days are spent for running and 8 days for fishing. The exports of fresh tunas from JFP in 1989 and 1990 were 4,929 t and 5,395 t respectively, equivalent to 65 % of the total export of fresh tuna of Indonesia. The remaining 35 % is mostly exported through Benoa on Bali Island. Japanese or Taiwanese agents at JFP handle fresh tuna exports. The price of tuna is determined by auction.

Fresh tuna for air export are weighed individually at a tuna processing room in JFP. Based on such tuna weight records for two years from August 1988 to July 1990, it was noted that yellowfin tunas are mainly 2 to 4 year old fish, whereas bigeye tunas are 3 to 5 year old fish. Benoa based tuna longline boats operate in the Indian Ocean off Lesser Sunda Islands, which is located far East of the fishing grounds used by JFP based tuna longline boats. The average weight of yellowfin caught by JFP-based boats for the years of 1988/1990 was 43 kg. The average weight for yellowfin tuna caught by Benoa-based tuna longline boats for the period from 1980 to 1990 was 32.6 kg.

The designations employed and the presentation of material in this publication do not imply the expression of any opinion whatsoever on the part of the Food and Agriculture Organization of the United Nations concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

Explanatory notes

Fishery statistics used in the present paper

Species classification

Fish species covered by the Indo-Pacific Tuna Development and Management Program (IPTP) are tunas, billfish and seerfish, which fall under the FAO International Standard Statistical Classification of Aquatic Animals and Plants (ISSCAAP) Group 36. In a fishery production survey inaugurated in Indonesia in 1976, tuna and tuna like fishes are classified as follows:

English Name	Scientific Name	Indonesian Name
Skipjack tuna	<i>Katsuwonus pelamis</i>	Cakalang

The three species below are grouped as "Tongkol"¹

Kawakawa	<i>Euthynnus affinis</i>	Grouped as "Tongkol"
Frigate tuna and Bullet tuna	<i>Auxis thazard</i> and <i>A. rochei</i>	Grouped as "Tongkol"
Longtail tuna	<i>Thunnus tonggol</i>	Grouped as "Tongkol"

"tunas" include the species grouped below.

Yellowfin tuna	<i>Thunnus albacares</i>	Madidihang
Bigeye tuna	<i>T. obesus</i>	Mata besar
Albacore	<i>T. alalunga</i>	
Southern bluefin tuna	<i>T. maccoyii</i>	Bluefin
Billfish	Istiphoridae & Xiphiidae	Marlins, spearfish

Indo-Pacific king mackerel	<i>Scomberomorus guttatus</i>	Tenggiri papan
Narrow barred king mackerel	<i>Scomberomorus commerson</i>	Tenggiri

1. Of the four species classed as "Tongkol", frigate and bullet tunas are most abundant in Indonesian waters, followed by kawakawa.

Fishing gear classification

The fishery production survey has two gear categories relating to tuna and tuna-like fishes, i.e., skipjack pole-and-line and tuna longline. In Indonesia, however, tuna and tuna-like fishes are also caught by many other gears.

Coastal classification

The fishery production survey has a coastal classification, such as the North coast of Java, the South coast of Java, the West coast of Sumatra, etc., by which fishery statistics are compiled.

Abbreviations

ISSCAAP	:	International Standard Statistical Classification of Aquatic Animals and Plants
UNDP	:	United Nations Development Programme
FAO	:	Food and Agriculture Organization
IPTP	:	Indo-Pacific Tuna Development and Management Programme
AARD	:	Agency for Agricultural Research and Development, Indonesia
DGF	:	Directorate General of Fisheries, Jakarta, Indonesia
DP	:	Dinas Perikanan/Office of Provincial Fisheries Service
JFP	:	Jakarta Fishing Port
OECD	:	Overseas Economic Corporation Foundation, Japan
EEZ	:	Exclusive Economic Zone
NRIFSF	:	National Research Institute of Far Seas Fisheries, Japan

Standard symbols

...	:	Data are not available, unobtainable or are not separately available but included in another category.
-	:	None or magnitude known to be nil or zero.

Introduction

Indonesia

Indonesia is an archipelagic country with more than 13,000 islands, of which Java, Sumatra, Kalimantan, Sulawesi and West Irian are the largest. The country has very extensive land and sea areas. The total sea area of 5.8 million square km is composed of 3.1 million square km of territorial waters and 2.7 million square km of Exclusive Economic Zone (EEZ), both of which have potential for further fisheries exploitation, particularly of oceanic pelagic resources.

After China and India, Indonesia is the third most populous country in Asia with 177 million inhabitants in 1989. The population is unevenly distributed, with nearly 65% being on Java. Thus, the marine fisheries have been developed intensively on the North coast of Java and also on the Malacca Strait coast of Sumatra. In East Indonesia, i.e. Nusa Tenggara, Sulawesi, Maluku and West Irian, however, the marine fisheries have developed less due to the scarcity of inhabitants and the remoteness from fish consuming areas.

Historical perspective in marine fisheries

In the decade following 1970, joint venture shrimp trawl fisheries developed in West Irian waters and state fishing companies were established to develop skipjack and tuna fisheries, aimed at increasing foreign exchanging earnings. During this decade, local trawl fisheries developed in the Malacca Straits and later extended activities to Java, resulting in conflict with coastal fisheries.

The 1980s began with a total ban of trawl fishing under a Presidential Decree. In connection with this drastic measure, however, the Government fisheries loan scheme was, to a large extent, expanded. This fishery loan scheme enhanced the mechanisation of fishing boats, resulting in a steady increase in marine fishery production. Two further events marked Indonesian fisheries in the 1980s, the distinct development of shrimp culture with the use of milkfish ponds and a sudden development of the tuna longline fishery based at Jakarta Fishing Port for the export of fresh tuna.

Very few papers deal with the current status of Indonesian tuna fisheries. The present paper aims to remedy such deficiencies, giving a focus to the recent development of the tuna longline fishery based at Jakarta Fishing Port (JFP). However, some of the findings were presented by Ishida at the 4th Southeast Asia Tuna Conference in Bangkok in November 1990.

Oceanic pelagic resources and their exploitation

Oceanic pelagic resources, of which tunas, *Thunnus* spp. and skipjack tuna, *Katsuwonus pelamis* are the main components, are particularly rich in eastern Indonesian waters. A skipjack pole-and-line fishery had already developed before World War II, while the tuna longline fishery has developed only in recent years. Since the late 1960s, the exploitation of tuna resources in Indonesian waters has been promoted to create export oriented fisheries.

Development of a national fisheries statistical system

Until 1975, fishery statistics for Indonesia were limited to total catch data. The first fishery census was taken in 1973. A fishery production survey has been implemented since 1977 through the provincial fisheries administrative system (Yamamoto¹).

The fishery production survey is designed to provide annual catch data by species and fishing gear, as well as the number of fishing establishments, fishing boats and fishermen. Classification of species, fishing gears, provinces, and coasts were established so as to make fishery statistics comparable throughout the country. Fishery statistics collected by standard survey methods with well defined fisheries statistical standards are now available for 13 years since 1977. However, "tunas" were treated as a single species category in the national statistical species classification.

Assistance provided by IPTP

In view of the great importance of tuna and tuna-like resources to Indonesia, IPTP outposted four successive staff members to Indonesia between 1983 and 1990. During the course of their preparatory work for the tuna

¹ Tadashi Yamamoto, FAO/UNDP Fisheries Development and Management Project, Indonesia, FI:DP/INS/72/064

statistical system, data and information were collected with respect to the Indonesian tuna fisheries. These data will also be analysed in the present paper.

Development of tuna fisheries in Indonesia

Place of the catch of tunas and tuna-like fishes out of total marine catch

Since 1977, there has been a tremendous increase in the total marine catch of Indonesia (Appendix 1). During the period from 1977 to 1989, the total marine catch doubled, from 1.1 million tonnes in 1977 to 2.2 million tonnes in 1989, with an annual rate of increase of 4.9 %. In the meantime, the catch of tunas and tuna-like fishes increased sharply from 136,000 t in 1977 to 381,000 t in 1989, at an annual rate of 8.2 %. Thus, during the period under review, the growth of the tuna fishery in Indonesia was two times as fast as that of the marine fishery as a whole (Fig. 1 and Appendix 1).

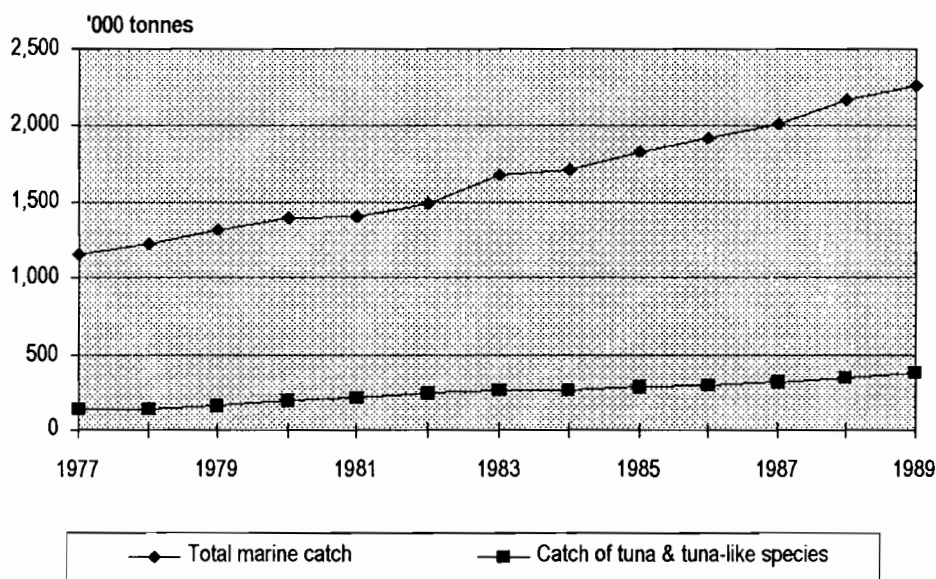


Figure 1: Catch of tuna and tuna-like species compared to the total marine catch

In the late 1970s the share of the catch of tuna and tuna-like fishes out of the total marine catch was around 10 %. Owing to its marked growth in recent years, however, the share of tuna production to the total marine catch has exceeded 16 % since 1988.

Catch of tunas and tuna-like fishes by species, 1977 - 1989

Figure 2 and Appendix 2 show changes in annual catch of tuna and tuna-like species for the past 13 years from 1977 to 1989. The total for 1977 was 136,000 t, of which Tongkol was most important, amounting to 62,400 t or 46 % of the total. This was followed by skipjack tuna, narrow-barred king mackerel, "tunas" and Indo-Pacific king mackerel.

Yellowfin, bigeye, albacore and southern bluefin tuna are caught in Indonesian waters. Unfortunately, the national fishery statistical system groups all these species and also includes billfish in the "tunas" grouping. However, as shown in Table 8, the main components of "tunas" are yellowfin and bigeye tuna, of which yellowfin is the larger component.

The catch of "tunas" increased by 502 % from 13,200 t in 1977 to 66,300 t in 1989 with an annual growth rate of 13.2 %. The catch of skipjack tuna increased by 374 % from 30,400 t in 1977 to 113,800 t in 1989 with an annual growth rate of 10.6 %. Tongkol landings increased by 217 % from 62,400 t in 1977 to 135,300 t in 1989 with an annual growth rate of 6.1 %. The catches of Indo-Pacific king mackerel and narrow-barred king mackerel were rather lower, amounting to 22,400 t and 43,400 t in 1989 or 5.1 and 11.4 % of the total. The proportion of "tunas" increased from 9.7 % of the total catch in 1977 to 17.4 % in 1989. The proportion of skipjack tuna also increased

from 22.4 % in 1977 to 29.9 % in 1989. However, the proportion of Tongkol decreased from 46 % in 1977 to 36 % in 1989.

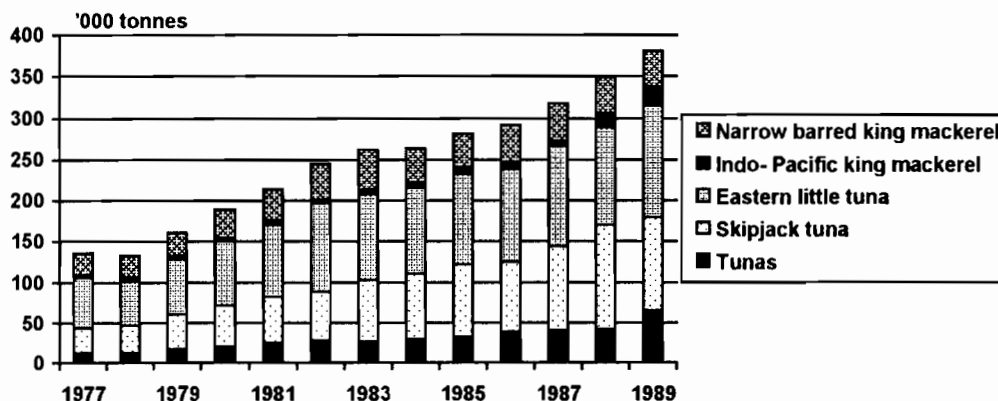


Figure 2: Catch of tuna and tuna-like fish by species in Indonesia

Catch of tunas and skipjack by gears

Catch data of "tunas" and skipjack compiled by type of fishing gear are not available. However, based on 1986 data, McElroy (1989) made the following estimates:

"Tunas"

1986 Tuna catch by types of fishing gear (estimates)

Gear	Weight (t)	Percentage
Tuna Longline	9,504	24
Other Longline	5,148	13
Handline	8,316	21
Trolling	7,524	19
Pole-and-line	4,752	12
Nets	1,980	5
Others	2,736	6
Total	39,600	100

Due to the marked development of the tuna longline fishery since 1987 and the introduction of the nucleus estate payao system by PT. Usaha Mina which stimulated the development of the tuna handline fishery (Soepanto, 1989), it is assumed that the composition of tuna catch by types of fishing gears has now changed.

Skipjack

1986 Catch of skipjack tuna by types of fishing gear

Gear	Weight (t)	Percentage
Pole-and-line	46,008	54
Trolling	16,188	19
Other line	11,076	13
Purse Seine	5,964	7
Gill nets	4,260	5
Other Gears	1,704	2
Total	85,200	100

More than half the total skipjack tuna catch is assumed to have been caught by the pole-and-line fishery. During the same period, more or less the same catch trend as was noted for "tunas" can be seen for the skipjack catch (Appendix 3 (2)).

Geographical distribution of tuna and tuna-like fish

Since 1977, catch data on tunas have been compiled for eleven coastal areas. This has shown a difference in the geographical distribution of tuna and tuna-like fishes in Indonesian waters over the period from 1977 to 1989. Of the eleven coasts identified, Bali Nusa Tenggara, South Sulawesi, North Sulawesi and Maluku and Irian Jaya are treated as East Indonesia, and the rest as West Indonesia (Appendix 3).

"Tunas"

In 1977, the catch of "tunas" exceeded 10 % of the national total on the North coast of Sulawesi (26.5 %), Bali Nusa Tenggara (18.2 %), the West coast of Sumatra (16.7 %), Maluku and Irian Jaya (15.2 %) and South coast of Sulawesi (13.6 %). As most of these coasts are located in Eastern Indonesia, this area produced 73.5 % of the total catch of "tunas" in 1977.

During the period from 1977 to 1989 the tuna catch increased on every coast. By 1989, the catch of "tunas" exceeded 10 % of the national total in Maluku and Irian Jaya (32.1 %), the South coast of Sulawesi (18.1 %), Bali Nusa Tenggara (14.9 %), the North coast of Sulawesi (13.1 %) and West coast of Sumatra (11.0 %), amounting to 78.2 % of the total production of "tunas".

The catch of "tunas" from the Java Sea is extremely limited, amounting to only 4.5 % of the national total in 1989.

In recent years there has been a sharp increase in the catch of "tunas" in Maluku and Irian Jaya, due most probably to an increase in tuna longline, purse seine and handline fishing fleets in these waters. The same can be seen on the South coast of Sulawesi due to an increase in the tuna longline fleet. In 1989, a catch of "tunas" of 1,700 t appeared on the North coast of Java, due to the development of the tuna longline fishing fleet based at JFP which operates in the Indian Ocean.

Skipjack Tuna

In 1977, the catch of skipjack tuna exceeded 10 % of the national total catch in Maluku and Irian Jaya (35.9 %) and the South (22.7 %) and North (18.1 %) coasts of Sulawesi. Unlike "tunas" the geographical distribution of skipjack tuna catch is more biased to the north-eastern part of Indonesia. As a result, in 1977 East Indonesia produced 83.3 % of the total skipjack tuna catch.

In 1989, the catch of skipjack tuna exceeded 10 % of the total catch in Maluku and Irian Jaya (38.9 %), the South coast of Sulawesi (26.5 %) and West coast of Sumatra (12.0 %). East Indonesia was again the major fishing area for skipjack tuna, producing 80.5 % of the total skipjack catch.

During the period from 1977 to 1989, the catch of skipjack tuna increased, particularly in Maluku, Irian Jaya and the South coast of Sulawesi. By 1989, the catch of skipjack tuna in the provinces of Maluku and Irian Jaya were 23,000 t and 21,400 t respectively, and that of South Sulawesi province was 21,600 t. On the West coast of Sumatra, the skipjack tuna catch was highest in the province of West Sumatra which produced 7,100 t (Appendix 4). As is the case for the "tunas", the skipjack tuna catch from the Java Sea is extremely limited, amounting to only 2.6 % of the national total in 1989.

Tongkol

In 1977, the catch of Tongkol exceeded 10 % of the national total on the North coast of Java (16.8 %), the coast of the Malacca Straits (13.8 %), the West coast of Sumatra (13.1 %) and South coast of Sulawesi (10.9 %). Thus, 65.9 % of the total catch of Tongkol was landed in West Indonesia and the remaining 34.1 % in East Indonesia. This geographical distribution of the Tongkol catch is quite different from those of "tunas" and skipjack.

In 1989, the catch of this species exceeded 10 % of the national total on the North coast of Java (23.4 %), the West coast of Sumatra (15.9 %), the coast of the Malacca Strait (13.3 %) and the South coast of Sulawesi (12.0 %). Thus, 68.3 % of the total catch of Tongkol was from West Indonesia, and the remaining 31.7 % from East Indonesia. In the provinces of Aceh, East Java and South Sulawesi the catch of Tongkol in 1989 exceeded 10,000 t (Appendix 4).

During the period under review, the increase in catches was particularly high on the North coast of Java, followed by the West coast of Sumatra and South coast of Sulawesi. In the Java Sea, after a trawl ban in 1980, the number of fishing units engaged in purse seine and drift gill net fisheries increased considerably, resulting in an increase in the catch of Tongkol.

Indo-Pacific king mackerel

The distribution of both Indo-Pacific king mackerel and narrow-barred king mackerel is more coastal than that of Tongkol. In 1977, the catch of the former species exceeded 10 % of the national total on the East coast of Kalimantan (36.1 %), South coast of Sulawesi (16.7 %), the coast of the Malacca Strait (13.9 %), the East coast of Sumatra (11.1 %) and South-west coast of Kalimantan (11.1 %). Thus, 75 % of the total landings were from West Indonesia and only 25 % from East Indonesia.

In 1988 and 1989, there was marked increase in the catch of this species on the coast of the Malacca Strait, amounting to 53.6 % of the national total in the latter year, 9,800 t and 2,100 t coming from the provinces of Aceh and Riau. In the same years, a similar increase was observed on the West coast of Sumatra, North coast of Java, Maluku and Irian Jaya, although the extent of the increase was not so high as that for the Malacca Strait. In 1989, 87.9 % of the total catch was from West Indonesia, and the remaining 22.1 % from East Indonesia.

Narrow barred king mackerel

In 1977, the catch exceeded 10 % of the national total on the coasts of the Malacca Strait (24.6 %), North of Java (16.7 %) and East of Sumatra (12.1 %). West Indonesia produced 83 % of the total national catch and 17.0 % came from East Indonesia.

In 1989, the catch exceeded 10 %, of the national total on the coasts of the Malacca Strait (24.6 %), North Java (27.9 %), East Sumatra (13.1 %), South-west Kalimantan (11.5 %) and South Sulawesi (10.6 %). As a result, 78.6 % of the total catch was from West Indonesia, and the remaining 21.4 % from East Indonesia.

Development of skipjack pole-and-line and tuna longline fisheries

Adjustment of catch and fishing effort data

The catch and number of fishing units were compiled by coast based on the Yearbook of Fishery Statistics of Indonesia for 13 years from 1977 to 1989 (N1 and C1 in Appendix 5 and 6). This was used for the analyses of the development of both the skipjack pole-and-line and the tuna longline fisheries in Indonesia. Many unrealistic figures were found on certain coasts, due probably to the unfamiliarity of these two fisheries to field enumerators. Both the skipjack pole-and-line fishery and the tuna longline fishery have developed in particular areas of Indonesia. On the other hand, both "tunas" and skipjack tuna are caught in almost all areas of Indonesia by many other gears. This situation opens possibilities for field enumerators to misidentify fishing gears.

Trolling for skipjack is a traditional fishery, practised by many fishermen in Indonesia. Originally, non-powered sailing craft were used. The fishing gear is quite simple, being composed of three troll lines with artificial lures. As in many other traditional fisheries in Indonesia, many skipjack trolling boats were mechanised with outboard engines after 1980, and this resulted in a marked increase in the production of skipjack. Troll catches were sometimes recorded as pole-and-line catches during the course of statistical data collection. An attempt was made to eliminate such errors in Appendix 5 but only a partial correction may have been achieved.

Development of the skipjack pole-and-line fishery

In 1927, Kou Hara and some other Japanese, mostly from Kagoshima Prefecture of Japan, began to operate in the skipjack fishery based at Bitung, Ternate and Ambon. By 1928, there were some 130 local non-powered boats, based on Bitung and Ternate, operating in the skipjack fishery using livebait. Data and information on the activities of the skipjack fishery in those days are very limited. There is a record that, by 1941, there were three skipjack boats and one tuna longline boat from Japan based on Ambon (Kataoka, 1991).

In line with the policy of the Government to develop an export oriented fishery, the development of the skipjack pole-and-line fishery was promoted through the creation of a state fishing company, P. N. Perikani, using loans from the World Bank and Asian Development Bank. State fishing companies for this fishery were founded around 1973 at Bitung in North Sulawesi, Ambon in Maluku and Sorong in Irian Jaya. A joint venture skipjack pole-and-line fishing company was also founded at Ternate.

Table 1 was compiled from the estimates made in N2 and C2 in Appendix 5 and 6. This table reveals an increasing trend in the number of skipjack pole-and-line fishing units. Nevertheless, after 1984 there were some irregularities in this trend. During the period under review, the catch increased steadily, but after 1985 the increase in

annual catch did not always correspond to an increase in the number of fishing units. The average catch per fishing unit was obtained as a crude CPUE by dividing catch by the number of fishing units. These figures are unreliable due to uncertainty, particularly in the number of fishing units. By 1989, the catch of skipjack tuna amounted to 113,800 t, of which that taken by the skipjack pole-and-line fishery was 71,300, or 62.7 % of the total.

Table 1 Number of fishing units and catch by skipjack pole and line and tuna longline, 1977 - 1990

Year	Skipjack Pole and Line			Tuna Long Line		
	Number of Fishing Units*(a)	Catch(1,000 t) (b)	Average Catch (t) (b)/(a)	Number of Fishing Units**(a)	Catch(1,000 t) (b)	Average Catch (t) (b)/(a)
1977	513	15.4	30	18	1.9	106
1978	660	18.8	28	18	2.3	127
1979	575	21.7	38	18	2.1	117
1980	673	25.6	38	17	2.5	147
1981	646	28.9	45	20	3.6	180
1982	541	30.6	56	20	3.6	180
1983	595	32.9	55	23	3.7	161
1984	683	45.6	67	20	1.7	85
1985	1,159	52.6	45	21	2.4	114
1986	1,307	49.8	38	12	0.4	33
1987	1,267	56.4	45	36	2.5	69
1988	1,720	73.2	43	103	2.5	37
1989	1,009	71.3	71	139	10.0	72

Data Source : This table has been compiled based on number of fishing units (N2) and catch (C2) as adjusted in Appendix 5 and 6.

* : Number of fishing units engaged in skipjack pole and line fishery is likely to have included those which use either non-powered boat or outboard powered boat.

** : Only Indonesian tuna long line boats are included.

Based on the revised data in Appendix 5, Table 2 was prepared for the period from 1977 to 1989. This table is composed of three sub-tables, (1) Number of Fishing Units (N), (2) Annual Catch (C) and (3) Average Catch per Fishing Unit (C/N). Since landings for pole-and-line include some troll catch, the annual pole line catch in Table 2 (2) is inflated. McElroy (1989) estimated that, in 1986, 54 % of the total skipjack catch was taken by pole-and-line. Based on the data in Appendix 3 (2) and Table 4 (2), the proportions of skipjack caught by pole-and-line against total skipjack catch for 1986 to 1989 were 58.5 %, 54.9 %, 57.4 % and 62.6 % respectively.

The CPUE by coast (Table 2 (3)) ranges from 15 to 500 t boat/year, the average being around 50 t. As the number of fishing units for pole-and-line probably included troll units, the average catch per fishing unit is likely to have been underestimated. How far the raw data are biased may vary from year to year and also from area to area. For this reason, further analyses were suspended². However, around 1975, the annual catch of 20 to 40 GT skipjack pole-and-line boats was reported to range from 150 t to 400 t, the average being around 230 t (Zenkuro Kawakami³, pers. comm.). For boats of around 18 GT, the annual catch was 280 t for 220 fishing days and 100 t for 100 fishing days.

Table 2. Annual statistics of the skipjack pole-and-line fishery by coast, 1977 - 89

(1) Number of Fishing Units (N)

Year	Total	Bali & Nusa Tenggara	South coast of Sulawesi	North coast of Sulawesi	Maluku & Irian Jaya
1977	513	-	7	68	438
78	660	-	26	129	506
79	575	1	24	69	481
80	673	1	57	123	492
81	646	1	65	80	500
82	541	1	67	174	299
83	595	17	69	159	350
84	683	21	75	148	439
85	1,159	29	74	128	928
86	1,307	...	84	137	1,086

² A similar analysis for tuna longline fishery was abandoned because of the inadequacy in fishery statistics currently available.

³ FAO Skipjack Master Fisherman.

Year	Total	Bali & Nusa Tenggara	South coast of Sulawesi	North coast of Sulawesi	Maluku & Irian Jaya
87	1,267	36	110	140	981
88	1,720	86	119	141	1,374
89	1,009	87	160	151	611

Source : Based on Number of Fishing Units adjusted (N2) on Appendix 5.

(2) Annual catch (C)

Year	Total	Bali & Nusa Tenggara	South coast of Sulawesi	North coast of Sulawesi	Maluku & Irian Jaya
1977	15.4	-	0.1	3.6	11.7
78	18.8	-	1.0	3.3	14.5
79	21.7	0	1.7	5.5	14.5
80	25.6	0	2.7	7.4	15.5
81	28.9	-	6.0	6.0	17.1
82	30.6	0.5	6.1	7.7	16.3
83	32.9	2.7	6.3	7.1	16.8
84	45.6	1.5	5.8	4.7	33.6
85	52.6	2.8	8.7	4.9	36.2
86	49.8	...	7.0	5.1	37.7
87	56.4	1.3	10.7	6.3	38.2
88	73.2	3.9	14.9	7.8	46.5
89	71.3	3.4	18.5	6.2	43.2

Source : Based on Catch adjusted (C2) on Appendix 5.

(3) Average Catch per Fishing Unit (C/N)

Year	All	Bali & Nusa Tenggara	South coast of Sulawesi	North coast of Sulawesi	Maluku & Irian Jaya
1977	30.0	-	14.4	52.9	26.7
78	28.5	-	38.5	25.6	28.7
79	37.7	...	70.8	79.7	30.1
80	38.0	...	47.4	60.2	31.5
81	28.9	...	92.3	75.0	34.2
82	56.6	500.0	91.0	44.3	54.5
83	55.3	158.8	91.3	44.7	48.0
84	66.8	71.4	77.3	31.8	76.5
85	45.4	96.6	117.6	38.3	39.0
86	38.1	...	83.3	37.2	34.7
87	44.5	36.1	97.3	45.0	38.9
88	42.6	45.3	125.2	55.3	33.8
89	70.7	39.0	115.6	41.1	70.7

Development of the tuna longline fishery

The tuna longline fishery is new to Indonesia. Before World War II, there was only one Japanese tuna longline boat based on Ambon. Longline test fishing operations in the Indian Ocean off the Indonesian Archipelago were made by the Japanese fishing authorities in the 1930s. However, commercial full-scale tuna longline fishing in this area commenced only in October 1952 (Nankai Reg. Fish. Res. Lab., 1959).

Japanese tuna longline boats began to operate in the Banda Sea around 1960 (Shunichi Hozumi⁴, pers. comm.) By 1964, this fishery reached a peak, totalling some 50 boats of the 50 GT class. In September 1969, an agreement was made between Indonesia and Japan regarding the operation of Japanese tuna longline boats in the Banda Sea with the payment of a fishing fee. However, this agreement was discontinued in 1980 when Indonesia declared a 200 miles EEZ. The annual catch taken by Japanese tuna boats in the Banda Sea was about 2,900 t around 1976. Although "tunas" are caught in the Banda Sea throughout the year, the good fishing season is in July, August and September.

The P. N. Perikani Samudra Besar, a state tuna longline fishing company, was founded in the early 1970s, with a loan from Japan Overseas Economic Corporation Foundation (OECF). Two fishing bases were constructed at Benoa in Bali Province and Sabang in Aceh Province. The base at Benoa was constructed by making use of part of the commercial harbour. The company began to operate there in 1972. Owing to its remoteness, the fishing base at

Sabang has hardly been used. Its fishing activity became stagnant in 1986 due to shortage of operational capital. However, after 1987, the catch of the tuna longline fishery began to increase with an expansion in the number of small sized tuna longline boats.

National commercial tuna longline fishing companies emerged in the latter half of the 1980s based at Ujung Pandang and Kendari in Sulawesi and operating in the Banda Sea. The inauguration of Jakarta Fishing Port in 1984 stimulated the creation of commercial tuna longline fishing companies. Both JFP and Bena fishing base have good access to international airports for air-lifting fresh tunas to Japan. This gave an incentive to foreign tuna boats, particularly from Taiwan, to operate in the Indian Ocean, based at Jakarta. Following the start of export of fresh tuna to Japan the rate of increase accelerated after 1987.

For the tuna longline fisheries, a crude CPUE was again obtained by dividing the catch by the number of fishing units. In this case also, the figures are unreliable due to uncertainty, particularly in the number of fishing units. A declining trend in the CPUE of the tuna longline fishery is attributed to an increase in number of small sized boats.

In 1989, the total longline catch of "tunas" was 10,000 t or 15 % of the total for these species.

A brief review of the recent development of tuna longline fishery in Indonesia is based on the Directorate General of Fisheries (DGF) fishing license records, which cover both national and foreign tuna boats. The fishing license system is new to the DGF. As a result, the system is unlikely to have been strictly implemented, various conditions and restrictions to be followed by licensees being missing. The provincial fisheries service may have been allowed to issue fishing licenses to small tuna longline boats. This might have resulted in incomplete DGF fishing license records.

Tuna resources in Indonesian waters are not thought to be fully utilised. Foreign tuna longline boats are therefore allowed to operate in Indonesian waters with the payment of fishing fees or through joint ventures. Foreign tuna boat owners, however, may not wish to limit their fishing grounds to those in Indonesian waters as is required by the current licensing system. This might have resulted in fluctuations in the number of foreign tuna longline boats in the DGF fishing license records.

Table 3 gives the number of tuna longline boats. In recent years, the number of tuna longline boats operating in Indonesian waters has increased sharply, due mainly to a rapid increase in the count of Indonesian and Taiwanese tuna boats. This is attributed to the inauguration of JFP (Tables 3 (1) and 4 (1)). By the end of 1990, 222 licensed tuna boats were operating in Indonesian waters, including 132 Indonesian and 70 Taiwan vessels (60 and 32 % of the total respectively).

Table 3 Number of licensed tuna longline boats based on license records kept by the DGF

(1) No. of licensed tuna longline boats by nationality

Year	Total	Indonesia	Thailand	Taiwan	Japan	Korean Republic	Panama*	Honduras *
April 1988	91	70	7	8	-	1	-	5
July 1988	97	68	11	8	2	1	-	7
Dec. 1990	222	132	-	70	9	6	2	3

*1 These boats are registered at Panama or Honduras, but are not from these countries. These boats are operated by Filipino boat owners with Taiwanese skippers.

(2) No. of licensed tuna longline boats by gross tonnage class

Year	Total	20-30	30-50	50-100	100-200	>200	Not known
April 1988	91	2	13	9	21	30	16
July 1988	97						
Dec. 1990	222	5	142	3	48	24	-

(3) No. of licensed tuna longline boats by gross tonnage class and nationality as of December 1990

GT class	Total	Indonesia	Thailand	Taiwan	Japan	Korean Republic	Panama*	Honduras *
Total	222	132	-	70	9	6	2	3
20-30	5	5	-	-	-	-	-	-
30-50	142	72	-	70	-	-	-	-
50-100	3	3	-	-	-	-	-	-
100-200	48	28	-	-	9	6	2	3
>200	24	24	-	-	-	-	-	-

4) No. of licensed tuna longline boats by nationality and by fishing port as of July, 1988

Nationality	Total	Air Tembaga, Ambon, Jajapura, Tarakan or Kupang		
		Jakarta, Benoa or both	Tanjong Pinang or Sabang	
Total	97	74	7	16
Indonesia	68	61	7	-
Foreign countries	29	13	-	16

Data Source : DGF fishing license record

Due to the short distance to the fishing grounds, the boats operating in Indonesian waters are generally small. By the end of 1990, there were 147 tuna boats of less than 50 GT (66 % of the total), whereas there were 48 of 100 to 200 GT and 24 of 200 GT and above (22 and 11 % of the total respectively) (Table 3 (2)). The national longline fleet is a mixture of small and large tuna boats. The Taiwan fleet is composed of small boats only. All other foreign tuna boats are of large size and are, in many instances, second hand boats once used in Japan (Table 3 (3)).

Judging from the fishing license records for July 1988, there seem to be three operational areas. Some vessels use either Jakarta or Benoa or both and operate in the Indian Ocean off the South coast of Bali and Nusa Tenggara and outside the Sunda Strait (the P. N. Perikani Samudra Besar boats). A number used Tanjong Penang and Sabang and operated in the Indian Ocean off the West coast of Sumatra but are thought not to be active at this time. Finally, some vessels use fishing ports located in East Indonesia and operate in the Banda Sea and/or Celebes Sea, the fishing grounds formerly utilised by Japanese medium size tuna longline boats. However, in 1988 the majority of tuna boats were based at Jakarta and Benoa (Fig. 3).

Development of the Jakarta-based tuna longline fishery

Jakarta Fishing Port

Until recent years, Indonesia did not have any fishing port which could accommodate large fishing boats like tuna longliners. JFP was constructed with funds provided by the Overseas Economic Corporation Foundation (OECF) of Japan and was inaugurated in July 1984. It is the first port of its kind in Indonesia with a complete set of facilities such as fish landing piers, ample fish marketing shelters, moorings, fresh water and ice supply facilities, storage, ample hinterland for the construction of fish processing factories etc. JFP is now regarded as a national fishing port, which will link with regional and provincial fishing ports to be constructed in the future (Figs. 4 and 5).

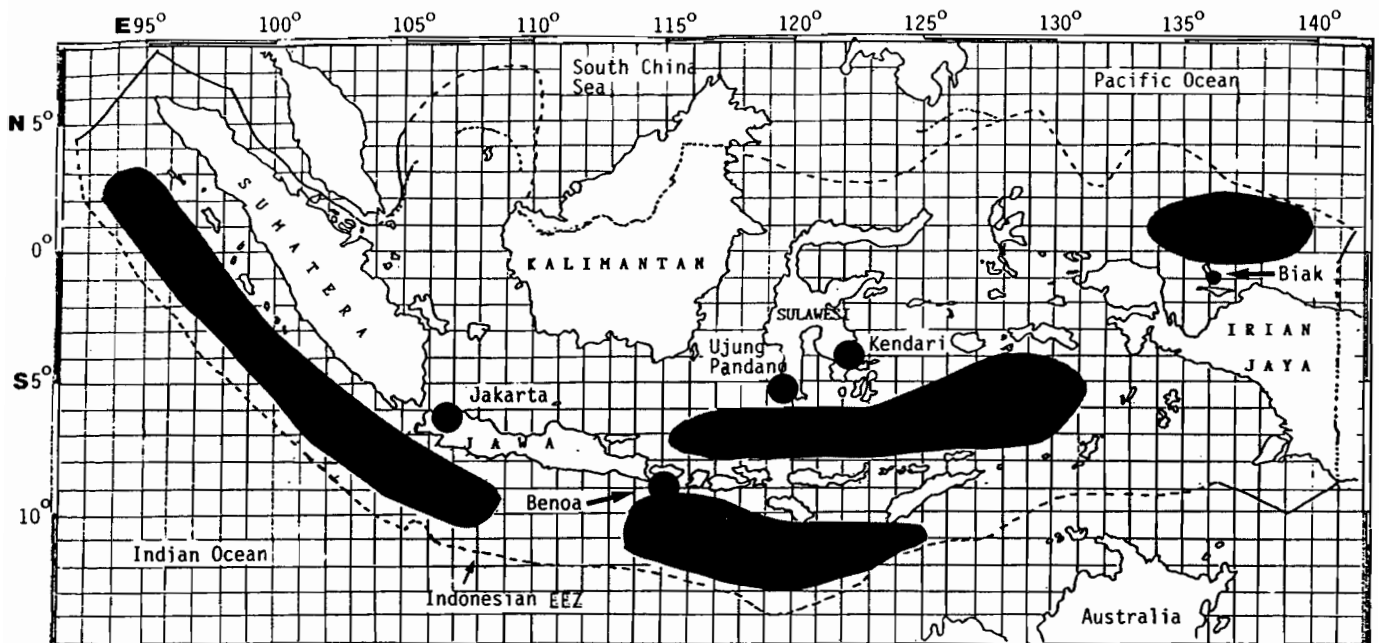


Figure 3 Approximate fishing grounds and fishing bases of the tuna longline fishery

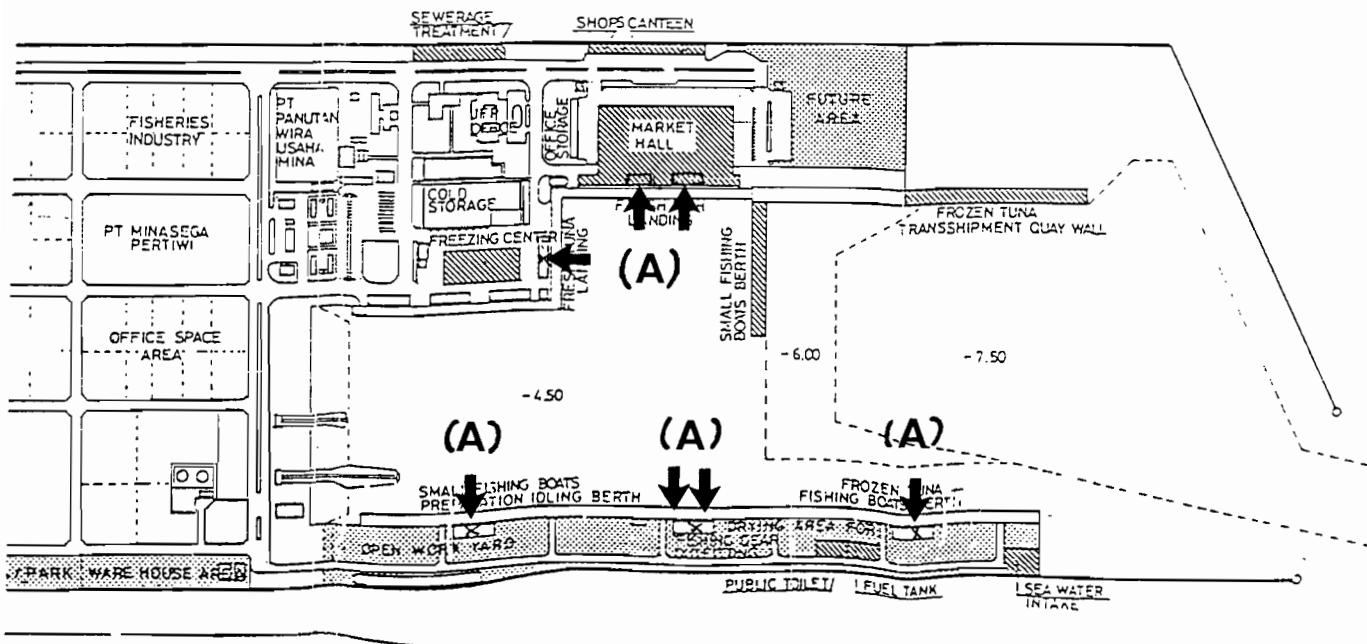


Figure 4: Layout of Jakarta fishing port. (A) indicates processing room.

JFP has contributed to a great extent to the development of the tuna longline fishery in Indonesia. It is located close to the fishing grounds for the tuna longline fishery in the Indian Ocean outside the Sunda Strait. It is also close to Jakarta Soekarno Hatta International Airport for the airlift of fresh tuna. Initially, JFP was utilised by large sized tuna longline boats and reefers for the transhipment of frozen tuna.

In October 1987, the export of fresh tuna landed by Indonesian tuna longline boats began with international flights through Jakarta airport. In the first half of 1988, some foreign tuna longline boats began to join this business. Thereafter, the volume of fresh tuna exported by air increased successively to 1,875 t in 1988, 4,927 t in 1989 and 5,395 t in 1990 (Pacific Consultant International, 1988).

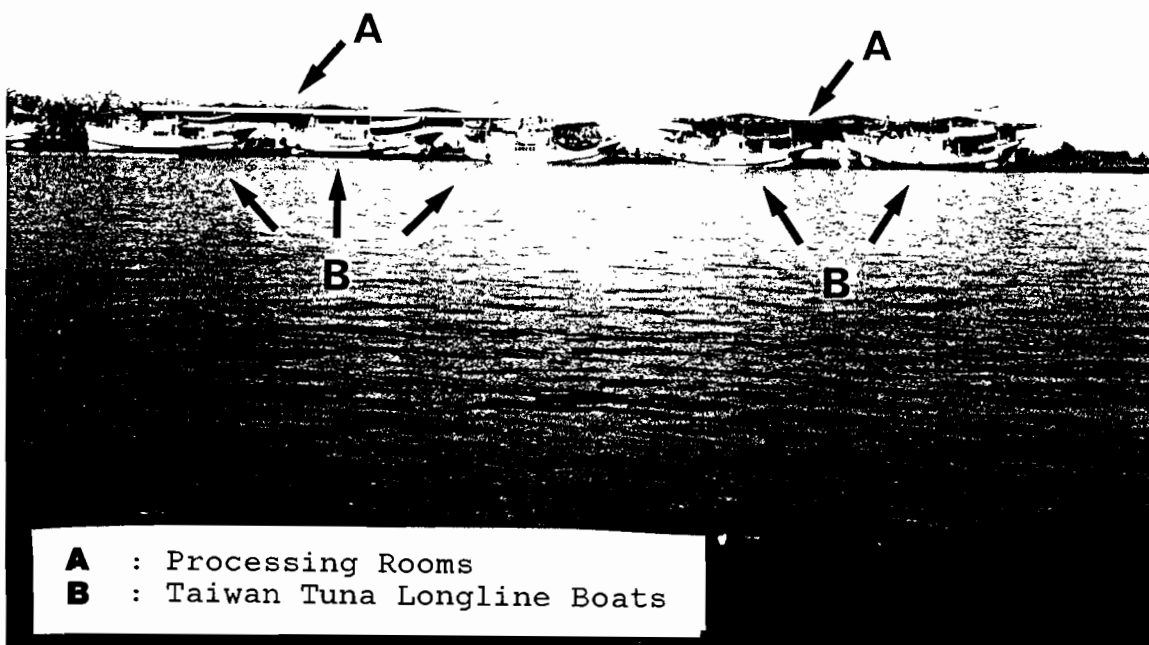


Figure 5: View of Jakarta fishing harbour

Table 4: Number of tuna longline boats based at Jakarta Fishing Port**(1) 1989-90***

Year	Total	Indonesia	Taiwan	Japan	Korean Republic	Philippines**	Honduras
June 1989	213	48	156	1	1	2	5
January 1990	141	41	92	1	7	-	-
May 1990	204	105	77	15	5	-	2

Source: Jakarta Fishing Port Authority

* This is a summary table based on (2) and (3) below

** Two boats are registered in Honduras but are actually operated by Philippine owners, generally with Taiwanese skippers

(2) Taiwan tuna boats, June 1989

Total	10-20	20-30	30-50	50-100	100-200	>200
April 1988	45	41	62	8	-	-

Data source: Jakarta Fishing Port Authority

(3) January 1990

GT class	Total	Indonesia	Taiwan	Japan	Korean Republic
Total	141	41	92	1	7
10-20	34	1	32	1	-
20-30	33	3	30	-	-
30-50	42	17	25	-	-
50-100	19	16	3	-	-
100-200	1	-	-	-	1
>200	7	1	-	-	6
Unknown	5	3	2	-	-

Data source: Jakarta Fishing Port Authority

In early 1988, tuna longline boats originally based at Bali began to migrate seasonally to JFP. In late August 1988, the first group of Taiwan tuna longline boats arrived at JFP. Table 4 (1) gives a historical series on the number of tuna longline boats based at JFP. Although data in the table are not very complete, at least the following can be mentioned:

- i. The number of tuna longline boats based at JFP fluctuated between 213 in 1989 and 204 in May 1990. Of these, 105 were Indonesian and 77 were from Taiwan (51 % and 38 % of the total respectively). There were in addition 15 vessels from Japan, 5 from Korea and 2 from Honduras (Table 4 (1)).
- ii. The number of Indonesian boats based at JFP increased steadily from 48 in 1989 to 105 in 1990. The majority of Indonesian boats are small in size, at less than 100 GT. (Table 4 (3))
- iii. In late August 1988, some 20 small Taiwanese tuna boats suddenly appeared in JFP. By June 1989, this fleet increased to a maximum of 156. Thereafter, however, some of them left JFP for other countries. As a result, by May 1990 the number of Taiwanese tuna boats had dropped to 77, half of the peak period.
- iv. The majority of tuna longline boats from Taiwan are small in size, ranging from 10 to 50 GT (Table 4 (2) and (3)⁵).
- v. Tuna boats of more than 100 GT are mostly from the Republic of Korea. (Table 4 (3))

JFP-based Taiwanese tuna boats***Local agents***

According to the records of the JFP Authority, there are ten agents through whom Taiwanese tuna boats obtain fishing licenses from the DGF.

Specification of Boats and gear

Taiwanese tuna boats are made of either wood or FRP. The followings are the dimensions of some typical boats :

⁵ According to the Fishery Statistics of Taiwan, the total number of tuna longline boats in 1988 was 2,995, of which 1,788 or 60 % of the total were 20 to 50 GT. Of these, 439 and 1,173 were based at Kaohsiung Harbour and Tung Kang fishing port respectively.

	Wooden	FRP
Length	22.9 m.	19.7 m.
Width	4.3 m	4.8 m.
Depth	1.9 m.	1.7 m.
Tonnage	59.8 GT	65.0 GT
Fish Hold	58.8m ³	25.0m ³
Engine Power	500 Hp	240 Hp
Brand of Engine	Yanmar, Mitsubishi, Isuzu, Fuso	

The boats are normally equipped with a satellite navigator, direction finder, SSB, magnetic compass and sometimes radar.

The tuna longlines are constructed as follows:

Mainline length	70 m
Branch line length	20 m
Float line length	20 m
Total length of line	9 miles
Material for line	Monofilament polyamide (nylon)
Type of bait	Squid or milkfish
Species mainly caught	Yellowfin tuna, Bigeye tuna and billfish

Crewing

Crew normally number eight to nine. The captain, fishing master, chief engineer and cook are normally from Taiwan and the remaining crew are Indonesian. Payment of the crew from Taiwan is on a fixed salary basis.

Fishing operations

The boats normally operate in pairs.

Annual operational plan

Assuming that a tuna boat makes two trips a month and spends a month for docking every year, the annual plan of fishing operations is as follows :

Average time absent per trip	13 days
Average transit between JFP and fishing ground	5 days
Average fishing operation	8 days
Average number of trips per year	22 trips
Number of days at JFP between trips	3 days

Daily fishing schedule

Fishing operations are carried out once a day during daytime. However, during the full moon period, an additional set is made at night.

Average number of baskets per haul	200 baskets
Number of hooks per basket	4 hooks
Average number of hooks per haul	800 hooks

Survey of fishing patterns

A survey was conducted on Taiwan tuna longline boats which completed fishing and returned to JFP in July and August, 1989. For this survey, a Taiwanese, who had been a skipper of tuna boat, was hired as an enumerator. A sample of 20 Taiwanese tuna boats plus one large Honduran tuna boat with a Taiwanese skipper were selected for interview. During the course of this interview, the number of days fished, number of exportable size tunas caught and the position of fishing operations were determined. The positions of fishing operations were then plotted on a chart (Fig. 6)

The fishing locations of the Taiwan tuna longline boats were mainly outside the Sunda Strait between Java and Sumatra Islands and in the Indian Ocean off the West coast in proximity to the southern part of Sumatra Island. These fishing locations are almost completely located within the 200 mile Indonesian EEZ and can be reached within one or two nights' cruise from JFP.

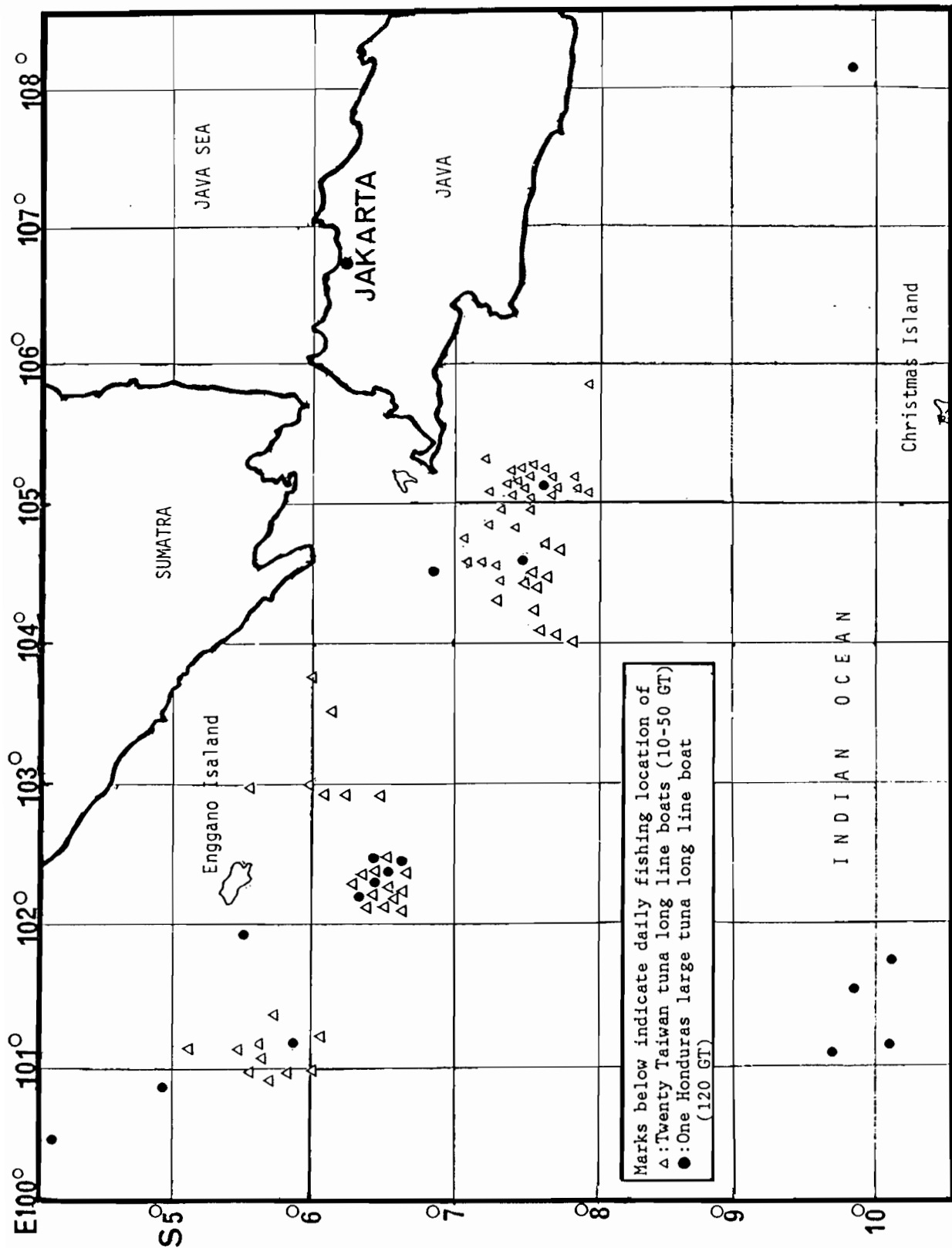


Fig. 6: Fishing locations of longline boats based on Jakarta, July and August, 1989

Fishing is said to extend further North along the West coast of Sumatra and East along the South coast of Java. Fishing locations of the 120 GT Honduras boat were sometimes far from those of the Taiwan tuna boats. Nevertheless, it is very likely that the majority of tuna longline boats based at JFP operate on the fishing grounds studied by this survey.

Catch and fishing effort data analysis

In this particular survey, the number of tuna caught refers to yellowfin, bigeye and southern bluefin tuna of exportable size for air lifting to the fresh Sashimi market abroad. Therefore, this catch data excludes the non-exportable sizes, billfishes, sharks and any other species.

The number of days fished and number of tunas caught for each trip are given in Table 5. The average number of tunas caught per day fished and hook rate are also given in this table. Based on these data, the following can be mentioned :

- i. The number of days fished per trip varied from 5 to 11 days, the average being 7.4 days.
- ii. The number of exportable tuna caught per trip varied from 36 to 196 fishes, the average being 95 fishes per trip. Assuming that the average weight per fish was 42 kg, this would be equivalent to 4,000 kg.
- iii. The coefficient of variation of catch per trip was quite small, at 0.42. The catch per trip of Taiwanese tuna boats thus seems to be quite stable.
- iv. The number of tuna caught per day also varied from 5 to 30 fishes, the average being 13 fishes.
- v. The average hook rate was 1.7 fish (yellowfin and bigeye tunas) per 100 hooks. This may be compared to average hook rates of 0.94 for yellowfin tuna, based on catch and effort data of PT Samudra Besar for the period from 1980 to 1990 (Naamin and Bahar, 1991).

Table 5. Catch and Effort of Twenty Sample Trips Made by Taiwan Tuna Longline Boats, July and August, 1989

Serial Number of Sample Trips	Number of Days fished per trip	Number of tunas caught per trip	Average number of tunas caught per day	Hook rate per 100 hooks
	(1)	(2)	(3)=(2)/(1)	(4)
Average	7	95	12.9	1.7
1	8	36	4.5	0.6
2	11	42	3.8	0.5
3	7	60	8.6	1.0
4	7	65	9.3	1.2
5	7	70	10.0	1.3
6	8	70	8.8	1.1
7	8	80	10.0	1.3
8	5	80	16.0	2.0
9	5	82	16.4	1.6
10	8	85	10.6	1.1
11	9	85	9.4	1.3
12	8	90	11.3	1.4
13	7	95	13.6	1.7
14	8	95	11.9	1.5
15	7	102	14.6	1.8
16	7	104	14.9	1.9
17	8	150	18.8	2.3
18	5	152	30.4	3.8
19	7	160	22.9	2.9
20	7	196	28.0	3.5

Data Source : Interview with the skippers of 20 Taiwan tuna boats which completed trips during the course of July and August 1989.

(1) While a tuna long line boat is fishing, a set is usually made once a day. Therefore, the number of days fished can be regarded as the number of fishing operations.

(2) "Number of tunas caught" refers to that of yellowfin and bigeye tuna of more than 25 kg and 30 kg respectively, which are exportable as fresh tuna

(4) Hook rate was obtained by the following formula, assuming that every sample boat used 800 hooks per day fished.

$$\text{Hook rate} = \frac{\text{No. of tunas caught per trip}}{\text{No. of days fished} \times 800 \text{ hooks}}$$

Seasonal variation in tuna landings at JFP

For the collection of fishery data, the JFP Authority has established two offices. One is responsible for the collection of numbers of fishing boats entering and departing, recorded by type of fishing gear. The other is for the collection of quantity of fish landed. Table 6 gives the number of landings monthly by nationality from August 1988 to September 1990. Table 7 gives monthly tuna landings from January 1989 to December 1990.

Table 6 Monthly Arrival of Tuna Longline Boat at Jakarta Fishing Port, August 1988 through September 1990

Month	Total	Indonesia	Taiwan	Japan ¹	Korean Rep.	Honduras	Philippines
1988 Aug.	40	32	2 ²		2	3	3
Sep.	72	50	15			4	3
Oct.	92	37	52		1	2	
Nov.	130	41	88			1	
Dec.	167	84	79	1		2	1
1989 Jan.	174	126 ³	47			1	
Feb.	179	117	53	1			8
Mar.	211	72	138		1		
Apr.	140	31	106	2	1		
May	112	47	65				
June	80	33	44	3			
July	82	31	50	1			
Aug.	95	25	66	4			
Sep.	115	20	86	7	2		
Oct.	133	35	94	4			
Nov.	122	23	98	1			
Dec.	133	30	102	1			
1990 Jan.	117	34 ⁴	81	1	1		
Feb.	113	44	68	1			
Mar.	103	56	44	3			
Apr.	61	35	22	3	1		
May	65	32	32	1			
June	76	39	34	3			
July	91	43	45	2	1		
Aug.	124	47	74	3			
Sep.	130	57	71	2			

Source : Jakarta Fishing Port Authority

1 :From Okinawa of Japan.

2 :The first 21 small Taiwanese tuna long line boats arrived in Jakarta in late August 1988.

3 :Includes 14 arrivals of large sized boats during the course of 1989

4 :Includes 8 arrivals of large sized boats during the course of 1989

Table 7 Tuna landings at Jakarta fishing port, 1989 and 1990¹

Year & Month	Total	Air Lifted ²		Not Air Lifted		Unit : t	
		Sub Total	Yellowfin Tuna	Bigeye Tuna	Sub Total	a	b
1989 Total	5,275	3,834	1,989	1,845	1,442	1,313	129
%	(100)	(72.7)			(27.3)		
		(100)	(51.9)	(48.1)	(100)	(91.1)	(8.9)
Jan. ³	532	387	201	186	145	132	13
Feb.	705	384	276	108	321	293	27
Mar.	642	523	287	235	120	90	30
Apr.	357	293	171	122	64	63	0
May	354	310	132	178	45	43	1
June	369	251	134	117	118	118	-
July	355	236	151	86	119	119	-
Aug.	396	310	142	168	86	82	5
Sept.	267	194	50	144	73	61	12
Oct.	225	162	38	124	63	49	14
Nov. ⁴	478	357	165	192	121	110	11
Dec. ⁴	595	427	241	186	168	153	15

Year & Month	Air Lifted ²				Not Air Lifted			Unit : t
	Total	Sub Total	Yellowfin Tuna	Bigeye Tuna	Sub Total	a	b	
1990 Total	10,341	3,897	2,509	1,388	6,444	4,518	1,926	
%	(100)	(37.7)			(62.3)			
		(100)	(64.4)	(35.6)	(100)	(70.1)	(29.9)	
Jan.	1,211 ⁵	462	263	199	749 ⁵	500	249	
Feb.	1,025 ⁵	350	177	173	675 ⁵	325	350	
Mar.	709 ⁵	183	95	88	526 ⁵	415	111	
Apr.	454	165	70	95	289	215	74	
May	468	130	66	64	338	260	78	
June	1,232 ⁵	252	166	86	980 ⁵	832	148	
July	841	415	302	113	426	219	207	
Aug.	750	419	304	115	331	180	151	
Sept.	879	380	263	117	499	350	149	
Oct.	1,283	368	245	123	915 ⁵	773	142	
Nov.	561	387	279	108	174	14	160	
Dec.	928	386	279	107	542	435	107	

Data Source : Jakarta Fishing Port Authority

According to the Jakarta Fishing Port Authority, categories (a) and (b) are defined as follows;

a Exported frozen fish, consisting of yellowfin tuna, bigeye tuna, albacore and southern bluefin tuna

b Domestic consumption, consisting of billfishes, sharks, seerfishes and some bottom fish.

It was felt, however, during the course of interview with officials in charge of JFP that a distinction between "a" and "b" was not well followed by fish dealers who reported their figures to the JFP authority.

- 1 Weight after gills and intestines were removed.
- 2 Depending on species, meat quality and size of fish, tunas are sorted into air-lifted and non air-lifted at processing rooms of the Jakarta Fishing Port. Air-lifted fish are mainly yellowfin and bigeye tuna for the overseas "Sashimi" market, mostly exported to Japan. Southern bluefin tuna and a few billfishes are air lifted.
- 3 The quantity air lifted and non-air lifted for January 1989 was recorded by total only. Therefore, catch by species was estimated.
- 4 The quantity not air lifted for November and December 1989 was recorded by total only. Therefore, quantities by categories, a and b, were estimated.
- 5 This figure is likely to have been overstated.

There is generally a reasonable level of correlation between the number of boat landings and the recorded catch. This is not the case for June 1990, however, when a large catch was recorded from a small number of landings. Table 9 (3) gives the weight of fresh tunas exported through Jakarta International Airport, compiled by the Customs. These figures do not correspond to the reported landings.

Of the three different sources, the number of tuna boat arrivals and quantity of fresh tuna airlifted through Jakarta airport seem to be correct. On the other hand, data on tuna landings reported to JFP Authority are likely to have been understated, as the tuna landing data are collected in relation to the imposition of a fishery tax.

Fresh tunas exported through Jakarta airport are considered to be those from JFP, amounting to 4,929 t in 1989 and 5,395 t in 1990. Japanese imports of fresh tunas from Indonesia in 1989 and 1990 were 7,511 t and 7,838 t respectively. It is, therefore, assumed that JFP contributes 65 % of the total fresh tunas exported from Indonesia.

The volume of tunas reported by the JFP Authority as "air-lifted" in 1989 was 3,834 t, whereas the corresponding volume of fresh tunas airlifted through Jakarta airport in the same year was 4,929 t. Assuming the same level of under-reporting for "non air-lifted" tunas, by dividing 5,276 t by 0.77, the actual total landings of all "tunas" landed at JFP in 1989 is estimated at 6,850 t.

The volume of tunas reported to JFP Authority as "air-lifted" in 1990 is also likely to have been understated. However, the volume of "tunas" reported as "non air-lifted" in the same year is unreasonably high. Therefore, no estimation was possible as for tuna landings in 1990.

There seems to be a tendency for an increase in the number of landings and total catch during a period corresponding to Japan's winter time, due probably to an increased demand of fresh tuna in Japan (Table 6 and 7).

Species composition of tuna landings at JFP

Two sources of data, indicate the species composition of tunas landed at JFP, the records of the JFP Authority and those of a tuna processing room at JFP, through which the weight record of individual tuna inspected was

secured. Both data sources give a higher proportion of bigeye than of yellowfin tuna landed. This information is quite important, as the price of bigeye tuna is generally much higher than that of yellowfin tuna on export markets. (Table 8 (1) and (2)).

Table 8 Species composition of tunas landed at JFP

(1) Based on the records of JFP Authority

<i>Unit : t</i>			
Year	Total	Yellowfin	Bigeye
1989	3,834 (100.0)	1,989 (51.9)	1,845 (48.1)
1990	3,987 (100.0)	2,505 (64.4)	1,308 (35.6)

(Note) Only fresh tuna airlifted.

(2) Based on the record of a tuna processing room

<i>Unit : No. of Fish</i>			
Year	Total	Yellowfin	Bigeye
1st Split Year (Aug.'88 to July'89)	38,501 (100.0)	22,762 (59.1)	15,739 (40.9)
2nd Split Year (Aug.'89 to July'90)	23,400 (100.0)	11,756 (50.2)	11,644 (49.8)

(Note) Tunas inspected at a processing room including those which were rejected

Based on Japanese statistics of imports from Indonesia

<i>Unit : t</i>					
Year	Total	Yellowfin	Bigeye	Bluefin	Albacore
1989	22,922 (100.0)	14,160 (61.8)	8,367 (36.5)	90 (0.4)	305 (1.3)
1990	23,356 (100.0)	16,152 (69.2)	6,987 (29.9)	55 (0.2)	162 (0.7)

(Note) Both fresh and frozen

Exports of tuna from Indonesia to Japan

Exports of frozen tuna from Indonesia to Japan began in 1973, when PT Perikani Samudra Besar, became operational at Benoa. However, exports of fresh tuna only began in 1985, most probably from Bali (Table 9 (1) and (3)). Exports of frozen tuna gradually increased from 11,200 t in 1987 to 15,500 t in 1990. For the same period, however, the import of fresh tuna from Indonesia increased sevenfold from 1,200 t to 7,800 t (Table 10 (1)).

Table 9 Indonesian Export of Fresh Tuna, 1985 to 1990

(1) By year and destination

Year	Quantity (t)				Value (1,000 US\$)			
	Total	Japan	U.S.A.	Others	Total	Japan	U.S.A.	Others
1985	...	...	...	...	...	...	...	...
1986	2,369	846	22	1,501	2,268	1,384	66	818
1987	2,311	1,736	139	436	5,138	4,380	432	326
1988	4,741	3,929	206	606	14,822	13,614	595	613
1989	8,630	7,171	384	1,075	26,668	23,081	1,609	1,978
1990	14,026	10,548	397	3,081	42,404	35,445	1,433	5,526

(2) Price/kg in US\$

Year	Japan	U.S.A.	Others
1986	1.64	3.00	0.54
1987	2.52	3.11	0.75
1988	3.47	2.89	1.01
1989	3.22	4.19	1.84
1990	3.36	3.61	1.79

Note : The price was derived by dividing total value of imported tuna by total quantity of the same, and hence it is a FOB price.

(3) By year and port of origin*(Unit : t)*

Year	Total	Jakarta	Bali	U.Pandang	Manado	Biak
1985	936	-	936	...	...	...
1986	2,369	-	2,369	...	...	...
1987	2,311	...	2,311	...	...	...
1988	4,735	1,875	2,860	...	...	...
1989	8,630	4,927	3,703	...	...	...
1990	14,018	5,395	8,623	...	...	...

Data Source : DGF

Table 10 Exports of tuna from Indonesia to Japan, 1987 to 1990

(1) Quantity*Unit : t*

Species	Status	1987	1988	1989	1990
Total	Fresh	1,163.0	2,888.0	7,511.0	7,838.0
	Frozen	11,252.0	11,776.0	15,411.0	15,518.0
	Total	12,415.0	14,664.0	22,922.0	23,356.0
Bluefin Tuna	Fresh	1.0	5.0	39.0	45.0
	Frozen	11.0	7.0	51.0	10.0
	Total	12.0	12.0	90.0	55.0
Albacore Tuna	Fresh	-	-	-	1.0
	Frozen	387.0	184.0	305.0	161.0
	Total	387.0	184.0	305.0	162.0
Yellowfin Tuna	Fresh	644.0	1,601.0	4,040.0	5,414.0
	Frozen	7,252.0	8,179.0	10,120.0	10,738.0
	Total	7,896.0	9,780.0	14,160.0	16,152.0
Bigeye Tuna	Fresh	518.0	1,282.0	3,432.0	2,378.0
	Frozen	3,602.0	3,406.0	4,935.0	4,609.0
	Total	4,120.0	4,688.0	8,367.0	6,987.0

(2) Price/kg in Yen

Species	Status	1987	1988	1989	1990
Yellowfin Tuna	Fresh	...	773	690	760
Tuna	Frozen	...	243	269	245
Bigeye Tuna	Fresh	...	795	740	761
Tuna	Frozen	...	499	591	489

Note : The price was derived by dividing total value of imported tuna by total quantity of the same, and hence it is a CIF price.

(3) Price /kg in US\$ rounded to two decimal points

Species	Status	1987	1988	1989	1990
Yellowfin	Fresh	4.40	6.10	5.10	5.44
Tuna	Frozen	1.44	1.89	1.99	1.70
Bigeye	Fresh	5.37	6.22	5.43	5.26
Tuna	Frozen	2.96	3.89	4.36	3.38

Note : The price was derived by dividing total value by total quantity of imported tuna and hence it is a CIF price.

Source : External Trade Statistics, 1987 - 1990, Japanese Ministry of Finance

Export processing of fresh tuna at Jakarta fishing port***Role of fish agents in the export of fresh tuna at JFP***

Japanese or Taiwanese agents handle the export of fresh tuna to Japan. The work includes processing and packing of the fresh tuna, air-lifting to its destination in Japan, sale through auction to fish wholesale companies and payment of the returns to the boat operators after deducting costs incurred from the gross sale value.

Processing and packing of fresh tunas at JFP

At JFP there are seven processing rooms for cleaning, inspection and packing of export quality fresh tuna for air-lifting. The fish agent will make an arrangement with one of the processing rooms for this work. All processing rooms are located along the fish landing piers.

All tunas unloaded from a tuna boat are brought into the processing room along a slide path. Then, gills and internal organs are removed and the fish is weighed. Yellowfin tuna of less than 25 kg and bigeye tuna of less than 30 kg are rejected for fresh export. An inspector sorts each tuna for air-lifting as fresh tuna, or for frozen tuna or domestic consumption. Tunas graded as fresh quality are cleaned and packed into a carton box with dry ice (Figs. 7 and 8). In recent years, however, crushed ice is being substituted for dry ice. Usually, a separate box is used for each tuna. With small fish, however, a carton box is used for two or three pieces.



Figure 7: Unloading tuna at Jakarta fishing port



Figure 8: Weighing (right) and packing (left) fish for export

Airlift of fresh tuna to Japan

Airlift of fresh tuna to Japan is arranged through Jakarta International Air Port (JKT), which is located within 20 minutes drive from JFP. Flying time to Tokyo Narita International Airport is around 6 to 7 hours by scheduled airlines or, occasionally chartered flights.

Export tariffs at JKT are based on the actual quantity of tuna in kg and the value assessed by a minimum guaranteed price. This is much cheaper than the prices realised at Japanese fish wholesale markets. Upon arrival at NRT, import tariffs are based on the actual quantity of tuna and the value as reported at JKT, plus the air freight charge.

Size composition of tuna by weight

Data used

With the co-operation of P. T. Coperasi Mina Utama which runs a processing room, tuna weight data were obtained for two years from August 1988 to July 1990. Weight records hereunder refer to gilled and gutted weight, covering both air lifted tunas and those which were not air lifted. No sex identification was made. For the convenience of data analysis, the period from August 1988 to July 1989 is called hereunder the first split year, and another period from August 1989 to July 1990 the second split year. Individual tuna weight data so obtained were grouped in four kg intervals to obtain the weight distribution. Based on these data, a weight-frequency distribution was drawn by month for yellowfin and bigeye separately (Fig. 9).

Fig. 9 also gives number of fishes (n), from which the weight frequency distribution was derived and monthly average weight of tuna per fish (\bar{x}). The latter may reveal seasonal changes in the average size of tuna. Annual average weight was also obtained for each split year to see any change in the size of tuna between two split years.

For the months of February and June 1990, the sample size for both tunas species was extremely small due to missing raw data at the processing room. The sample size in December 1988 and January 1989 for yellowfin however exceeded 3,000.

(2) Bigeye tuna, Aug. 1989 - July 1990

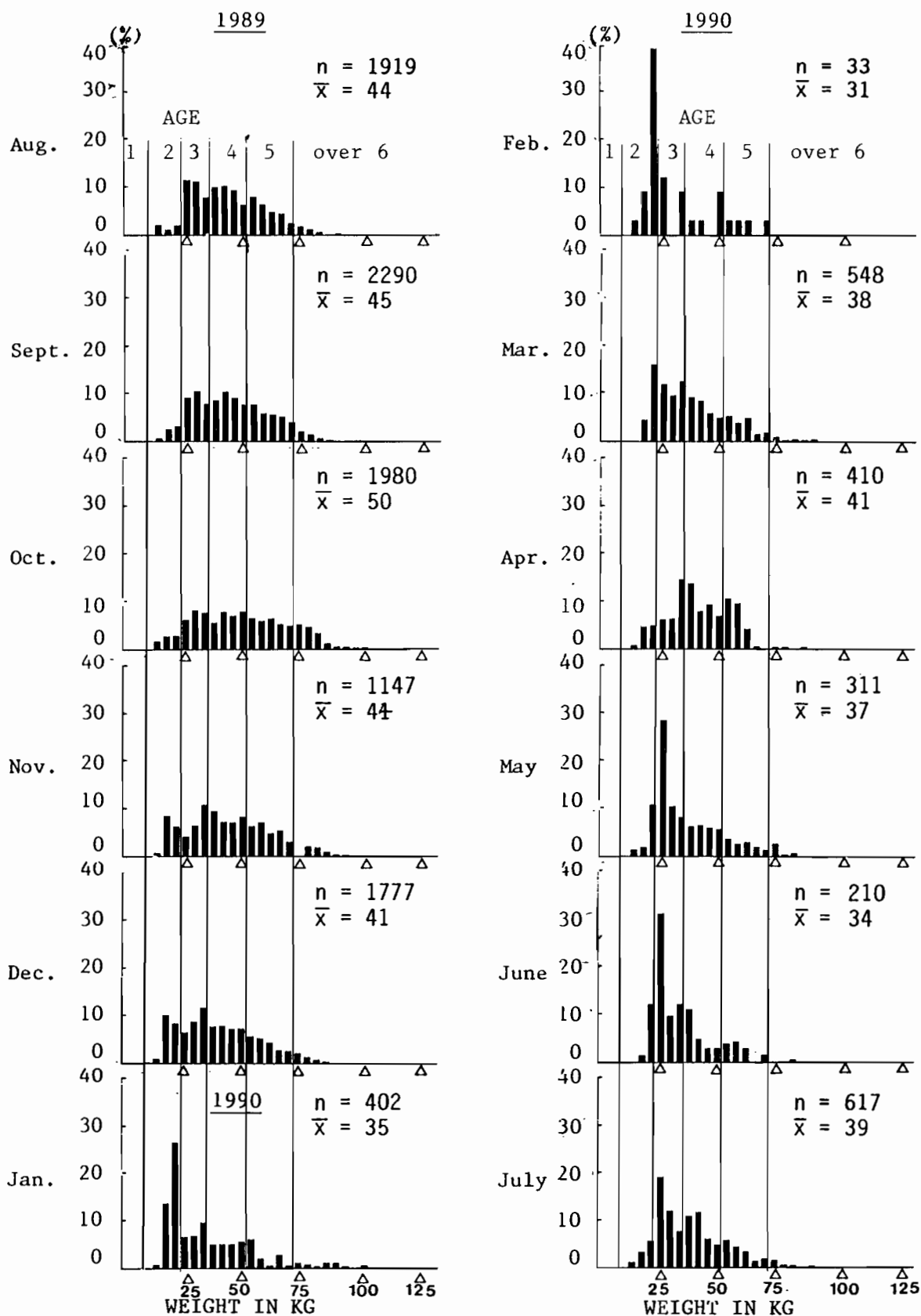


Figure 9: Weight-frequency distribution of tuna caught in the Indian Ocean by Jakarta-based longline boats from August 1988 to July 1990

(2) Bigeye tuna, Aug. 1988 - July 1989

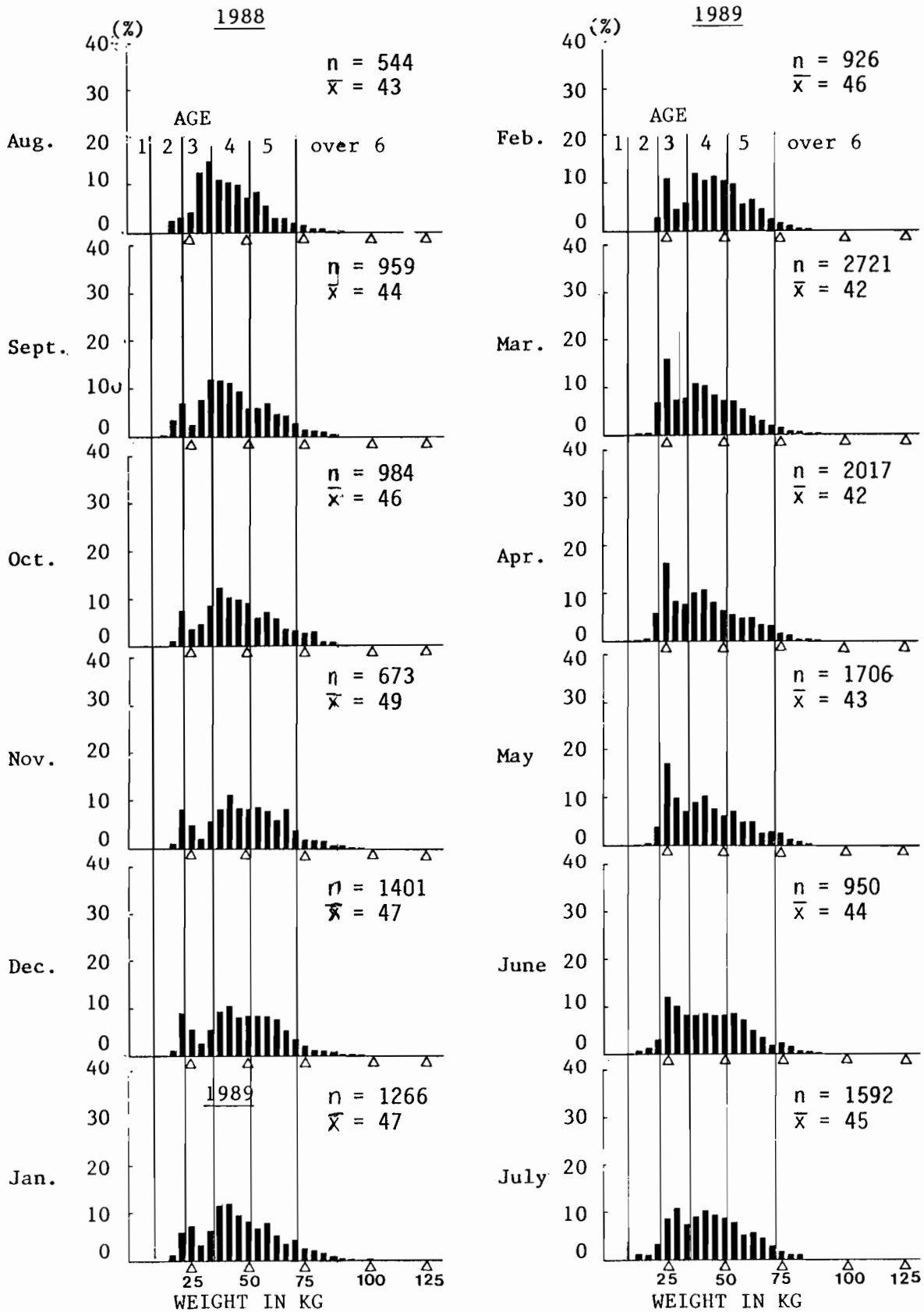


Figure 9: Weight-frequency distribution of tuna caught in the Indian Ocean by Jakarta-based longline boats from August 1988 to July 1990 (Continued)

(1) Yellowfin tuna, Aug. 1989 - July 1990

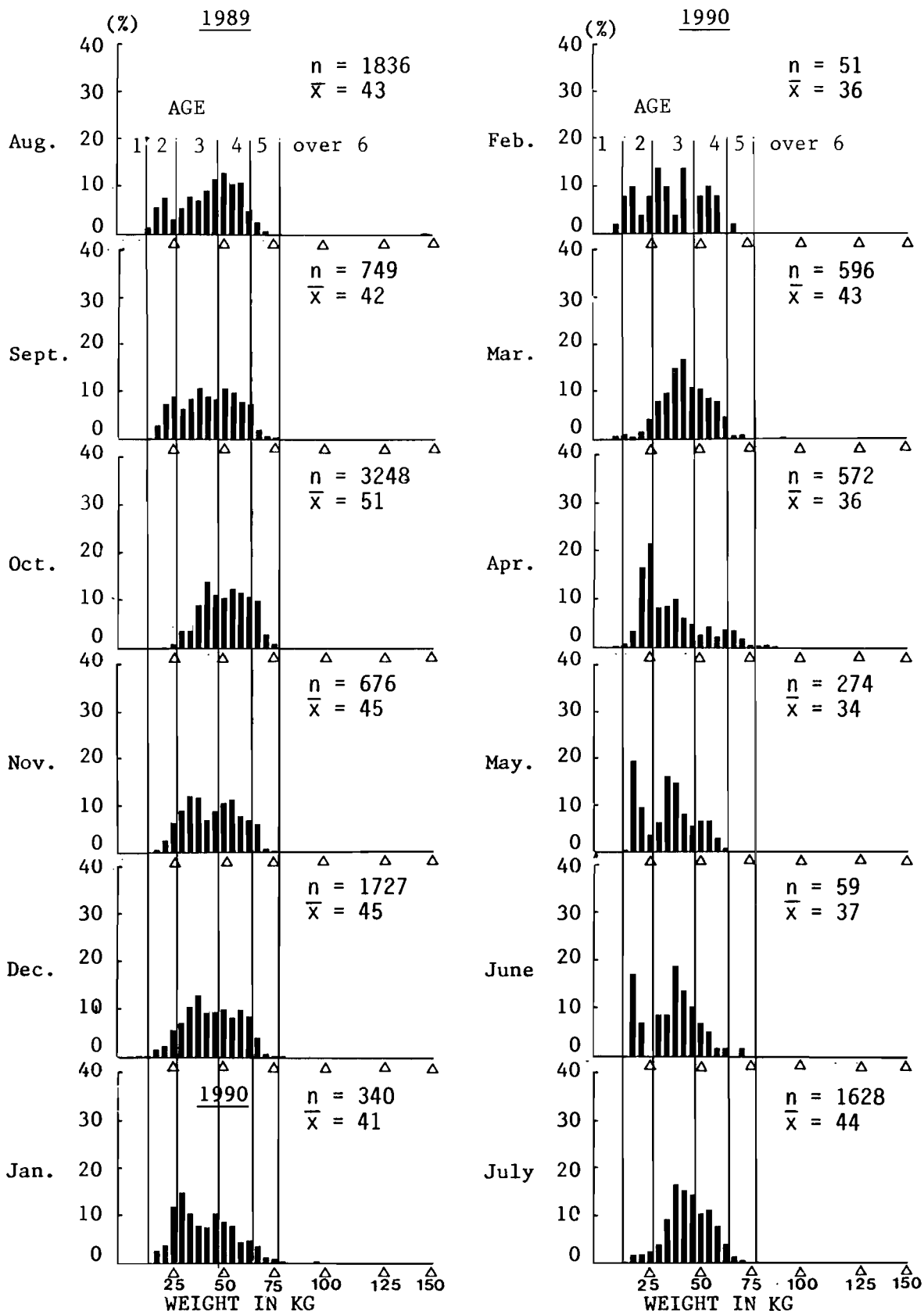


Figure 9: Weight-frequency distribution of tuna caught in the Indian Ocean by Jakarta-based longline boats from August 1988 to July 1990 (Continued)

(1) Yellowfin tuna, Aug. 1988 - July 1989

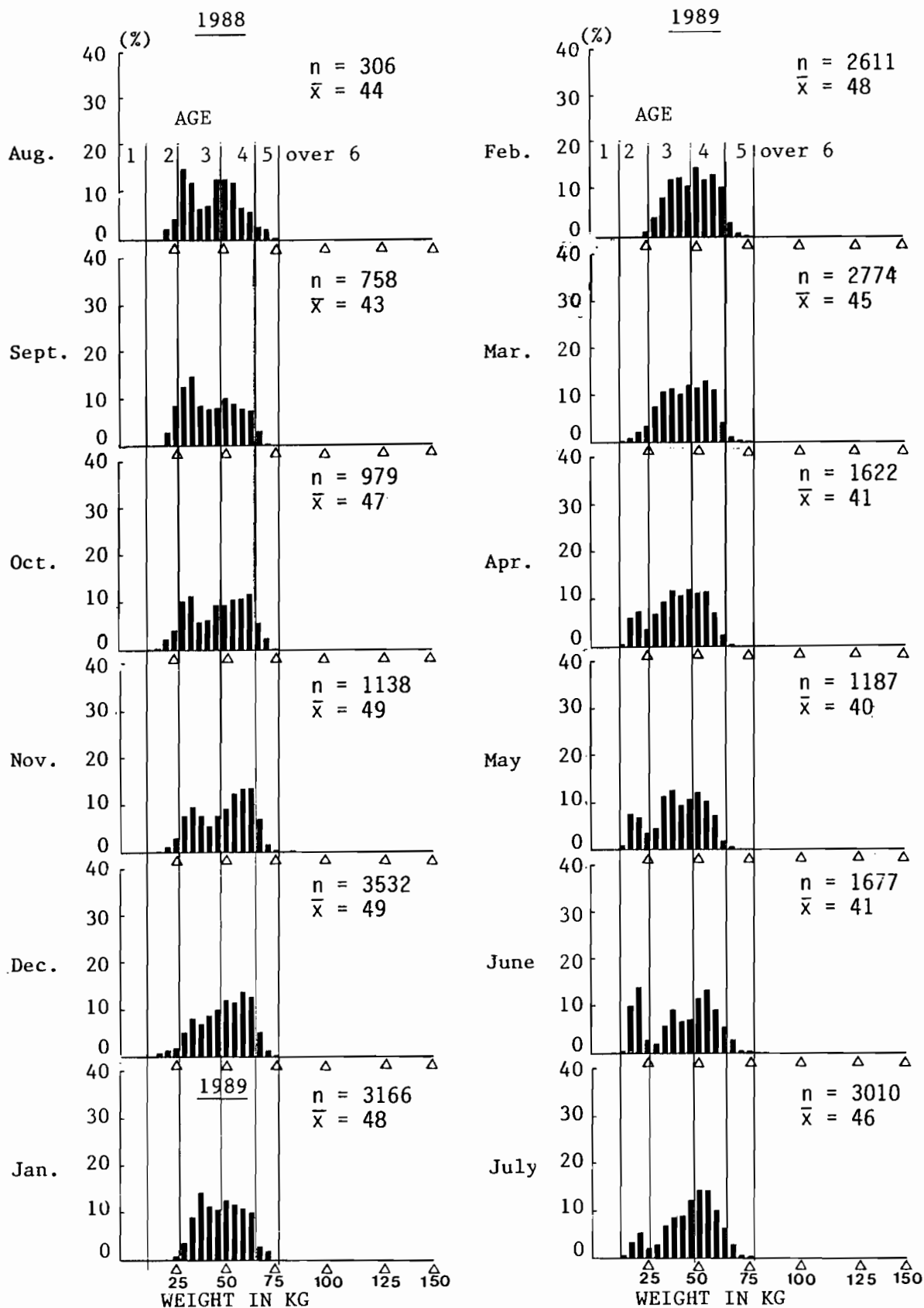


Figure 9: Weight-frequency distribution of tuna caught in the Indian Ocean by Jakarta-based longline boats from August 1988 to July 1990 (Continued)

Yellowfin tuna

Age composition

Based on the age determination study made by Yabuta *et al.* (1960) and correlations between length, gutted and gilled weight and age which were compiled by National Research Institute of Far Seas Fisheries (NRIFSF), Japan, the relationship between age classes and the gutted and gilled weight of yellowfin tuna were assumed as follows :

Less than 12 kg.	Age 1
12 kg to 28 kg	Age 2
28 kg to 48 kg	Age 3
48 kg to 64 kg	Age 4
More than 64 kg	Age 5

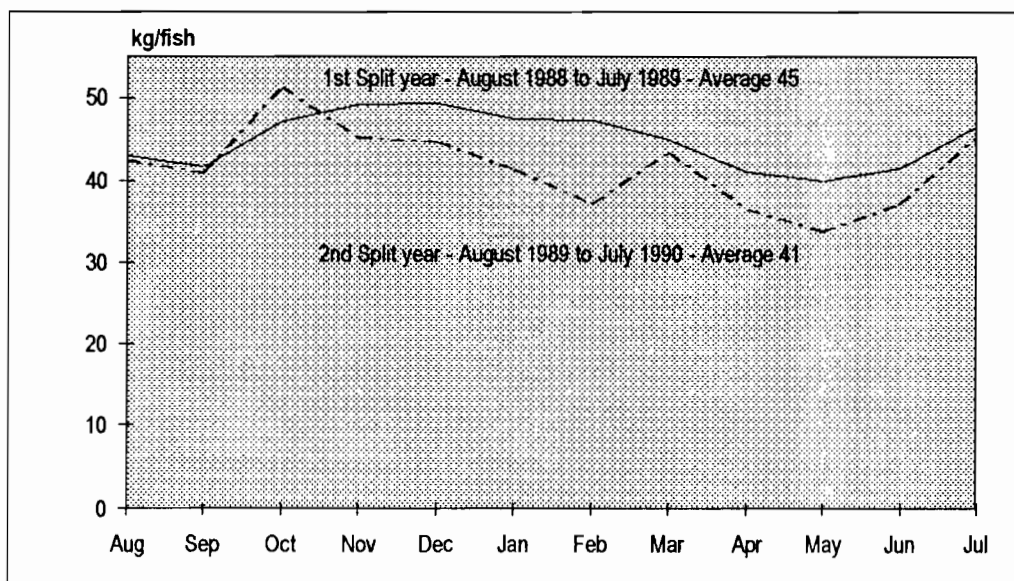
Based on the above relationship, yellowfin tuna caught in the Indian Ocean outside the Sunda Strait appear to be mainly from the 2 to 4 year classes.

Average weight

The average weight of yellowfin tuna for the first split year ranged from 40 to 48 kg with an annual average weight of 45 kg, whereas that for the second split year was from 34 to 52 kg with annual average weight of 41 kg (Fig. 10 (1)). In both split years, the monthly average weight per fish in the first half of the year, i.e., from July to December, was slightly higher than that of the second half of the year, i.e., from January to June (Fig. 10 (1)). The average weight of yellowfin tuna for JFP based tuna boats for two years from August 1988 to July 1990 was 43 kg. On the other hand, according to Naamin and Bahar (1991), annual average weights of yellowfin tuna for Benoa-based tuna boats for eleven years from 1980 to 1990 ranged from 30 to 36 kg, with an overall average of 32.6 kg. Those for 1989 and 1990 were 36 kg and 34 kg respectively (Table 11).

Figure 10 Monthly change in the average weight of tuna

(1) Yellowfin tuna



(2) Bigeye tuna

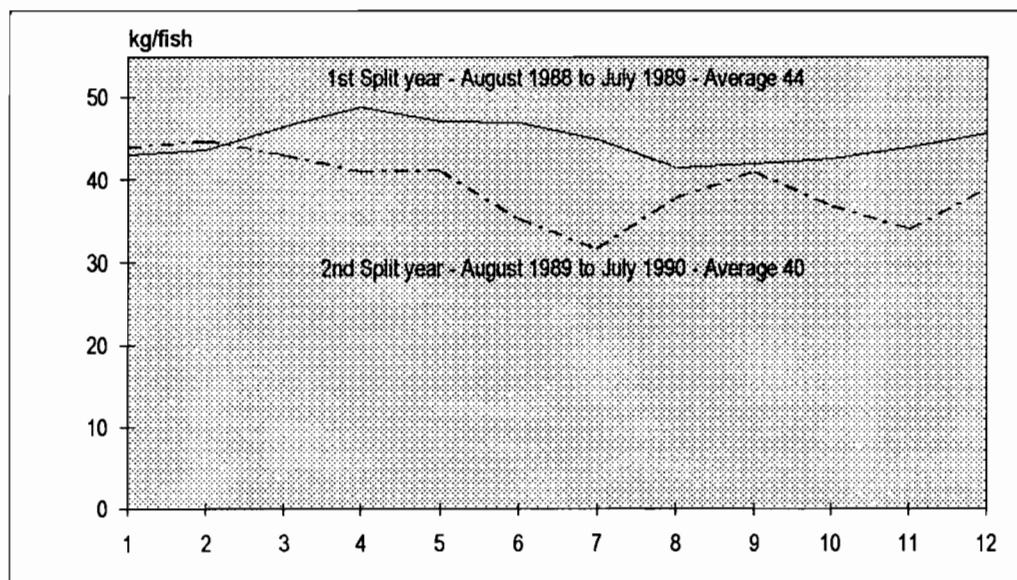


Table 11 Fishing effort, CPUE and average weight of yellowfin tuna caught by P.T. Perikani Samudra Besar

Year	Fishing Effort		Yellowfin tuna		Hook rate per 100 hooks (3)/(2)	Average weight per fish (kg) (4)/(3)
	No. of sets (1)	No. of hooks ('000) (2)	In number (3)	In t (4)		
1980	1,045	2,061	21,022	715	1.02	34
1981	1,334	2,121	22,483	764	1.06	34
1982	1,807	2,884	32,589	1,108	1.13	34
1983	691	1,132	11,658	350	1.03	30
1984	1,336	2,228	23,176	719	1.04	31
1985	1,429	2,366	27,687	831	1.17	30
1986 *1	38	62	648	21	1.04	32
1987 *2	503	785	6,513	235	0.83	36
1988 *2	460	705	5,148	160	0.73	31
1989 *2	239	360	2,412	87	0.67	36
1990 *2	350	532	6,171	210	1.16	34
Total	-	15,236	159,507	4,197	1.05	32.6

Data Source : Data are from the fishing operation record of P.T. Perikani Samudra Besar, State Tuna Fishing Company based at Benoa of Bali. Quoted from Naamin and Bahar (1991), "Interaction in the yellowfin tuna fisheries of the eastern part of Indonesian waters".

Notes *1 : Only 5 longliners operated for three months.

*2 : Low hook rate is due to the use of deep longlines.

Fishing Ground : Waters off the south coasts of Lesser Sunda Islands.

From the above data, it can be said that the yellowfin tuna caught in Indian Ocean right outside the Sunda Strait are about 8 kg bigger than those caught in the waters of Lesser Sunda Islands.

Bigeye tuna*Age composition*

Based on a study made by Kume (1979), the relationship between the weight and the age of bigeye tuna was assumed as follows :

1 kg to 8 kg	Age 1
8 kg to 24 kg	Age 2
24 kg to 36 kg	Age 3
36 kg to 52 kg	Age 4
52 kg to 72 kg	Age 5
72 kg to 88 kg	Age 6
More than 88 kg	Age 7

The weight distribution of bigeye tuna is much wider than that of yellowfin tuna, including bigger sized fish. As a result, the age composition stretches from 2 to 7 years old, with 3 to 5 year old fishes being the main component of the catch. Bigeye tuna caught in Indian Ocean outside the Sunda Strait are bigger and at least two years older than yellowfin tuna.

Average weight

The average weight of bigeye tuna for the first split year ranged from 42 to 48 kg with an average weight of 44 kg, whereas for the second split year they ranged from 32 to 45 kg and had an average weight of 40 kg. Unlike yellowfin tuna, there seems to be no clear change in monthly average weight. However, it is likely that the average weight of bigeye tuna from August to November is relatively higher than in the rest of year.

Concluding remarks

The licensing system.

During the course of our study, the number of tuna long line boats by size, by fishing areas, by nationality, etc. was sought by referring to the license records of tuna long line boats which are kept by DGF. It was noted that requirements for the submission of data were insufficient.

As tunas are migratory fishes, it would also be most desirable that the issue of tuna longline fishing license should be centralised at DGF, regardless of the size of the boat. The issue of licences to small boats by the Provincial Fisheries Service, limiting the fishing area to the waters off that province, may be effective for a short period, but movement of the tuna boats to other areas will cause difficulty for the collection of fishery statistics.

National fishery statistical system

The present study encountered many constraints in the use of fishery statistics currently available. It is suggested that the following steps be taken:

The DGF may instruct DPs to give a high priority to the production of reports on catch and effort by species and by type of fishing gear. This will greatly speed the release at least of the fisheries production statistics which are urgently needed by users.

The current national fishery statistical system, introduced in 1977, envisages a yearbook of fishery statistics compiled at the national level and the same compiled at the provincial level. Owing to the absence of a computer network system, the former is not fully implemented, missing some important tables such as those showing catch compiled by species as well as by type of gear. However, the latter is likely to have been fully implemented in many DPs, covering almost all statistical tables needed by users.

The DGF may request every DP to provide annually copies of the yearbooks of fishery statistics compiled at the provincial level, to the following national offices :

- Fisheries Statistics Subdivision of DGF
- Library of DGF
- Research Institute for Marine Fisheries, AARD
- Research Institute for Inland Fisheries, AARD
- Research Institute for Brackish Water Culture, AARD

This will greatly facilitate the use of fishery statistics which are not available in the yearbook of fishery statistics at the national level.

National classifications of species and fishing gear are also in need of revision so as to fit in the change in pattern of Indonesian fisheries.

Collection of tuna weight data

Processing rooms for the inspection of export quality tuna are available at Jakarta, Benoa and probably Biak in West Irian. It is suggested that collection of tuna weight data be made at those centres, as has been done at JFP in the current study.

Acknowledgement

The present paper was jointly prepared by Kenichi Ishida, Tadashi Yamamoto and Bachtiar Gafa. However, Ishida is now writing this acknowledgement on behalf of the remaining two authors, who honoured me to be a chief author for this paper.

In fact, this paper corresponds to my final report for my services at the Research Institute for Marine Fisheries (RIMF) in Jakarta for a period from September 1987 to December 1990. As Indonesia was completely new to me, during this period I was guided a lot by Dr. Nurzali Naamin, Director of RIMF and all staff of the Skipjack and Tuna Research Division.

It so happened that the timing of my assignment to RIMF coincided with the development of a new tuna long line fishery based at Jakarta fishing port (JFP), which aimed at exporting fresh tuna. For this reason, I used to go to JFP, where I was greatly obliged to Mr. Ichiro Shimoda of P.T. Minanusa Segara, and, with his introduction, Mr. Shu J. Jed, a Taiwanese tuna skipper, for the collection of many data especially with respect to the fishing operation of Jakarta based tuna long line fishing boats and tuna weight data measured at one of the tuna processing plants at JFP.

With the help of Messrs Sukirno and Sunyoto of Jakarta Fishing Port Authority, I was also able to gather various fisheries data kept by their office. Messrs S. Seregar and D. Suddikin of Directorate General of Fisheries also offered me much assistance for gathering data needed for this study. Professor Akira Nakai kindly allowed us to make use of cost and earning data of the tuna fishery he gathered, which made it possible to supplement data not obtainable in JFP.

Mr. Toshifumi Sakurai, who was actually my supervisor, assisted me with his many technical advice as well as funds needed for my services. He also gave me useful comments to improve this paper. Finally, I must mention that, while preparing this paper all the time Dr. Tadashi Yamamoto, one of the authors of this paper, rendered me his continuous technical guidance so as to make this paper substantial.

Upon the completion of this paper, I would like to express my sincere gratitude to all those who assisted me in the above ways.

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Appendix

Appendix 1

Catch of tuna and tuna like fishes out of total marine catch, 1977 - 1990

Unit : 1,000 t

Year	Catch (1,000 t)		Trend of Catch Using 1977 as the Base Year (%)			Catch of Tuna and Tuna Like Fishes out of Total Marine Catch (%)	
	Total Marine Catch	Tuna and Tuna Like Fishes	Total Catch	Marine	Tuna and Tuna Like Fishes	Tuna and Tuna Like Fishes	Marine Catch
1977	1,158	136	100		100		11.7
1978	1,227	133	106		98		10.8
1979	1,318	160	114		118		12.2
1980	1,395	189	120		139		13.6
1981	1,408	213	122		157		15.1
1982	1,491	245	129		180		16.4
1983	1,682	261	145		192		15.5
1984	1,713	263	148		193		15.4
1985	1,822	280	157		206		15.4
1986	1,923	292	166		215		15.2
1987	2,017	318	174		234		15.8
1988	2,170	350	187		257		16.1
1989	2,272	381	196		280		16.8
AGR (%)			4.9		8.2		

Data Source : Fisheries Statistics of Indonesia

AGR (%) = Annual growth rate for the period from 1977 to 1989

Appendix 2

Catch of Tuna and Tuna Like Fishes by Species, 1977 - 1989

Year	Catch by Species (1,000 t)						Species Composition (%)				
	Total	Tunas	Skipjack tuna	Eastern little tuna	Indo-Pacific king mackerel	Narrow barred king mackerel	Tunas	Skipjack tuna	Eastern little tuna	Indo-Pacific king mackerel	Narrow barred king mackerel
1977	136.0	13.2	30.4	62.4	3.6	26.4	9.7	22.4	45.9	2.6	19.4
	(100)	(100)	(100)	(100)	(100)	(100)					
1978	132.5	13.4	33.5	55.2	4.0	26.4	10.1	25.3	41.7	3.0	19.9
1979	160.2	17.9	42.8	66.6	5.2	27.7	11.2	26.7	41.6	3.2	17.3
1980	189.0	20.9	51.8	76.8	4.3	35.2	11.1	27.4	40.6	2.3	18.6
1981	212.9	25.2	57.4	87.7	5.2	37.4	11.8	27.0	41.2	2.4	17.6
1982	244.6	28.1	61.5	106.6	5.7	42.7	11.5	25.1	43.6	2.3	17.5
1983	261.2	26.1	76.8	103.9	7.1	47.3	10.0	29.4	39.8	2.7	18.1
1984	263.0	30.7	80.7	103.2	6.1	42.3	11.7	30.7	39.2	2.3	16.1
1985	280.2	33.7	87.4	111.6	6.8	40.7	12.0	31.2	39.8	2.4	14.5
1986	291.9	39.6	85.2	114.2	7.7	45.2	13.6	29.2	39.1	2.6	15.5
1987	318.1	40.5	102.6	122.7	7.5	44.8	12.7	32.3	38.6	2.4	14.1
1988	349.7	43.0	127.5	117.9	16.8	44.5	12.3	36.5	33.7	4.8	12.7
1989	381.2	66.3	113.8	135.3	22.4	43.4	17.4	29.9	35.5	5.9	11.4
	(280)	(502)	(374)	(217)	(622)	(164)					
AGR	8.2	13.2	10.6	6.1	15.0	3.9					

Data Source : Fisheries Statistics of Indonesia

Note: Figures in parentheses below 1989 figures indicate the growth rate in % against 1975 figure.

AGR : Annual Growth Rate in % for the period from 1977 to 1989

Appendix 3

Tuna catch by year and by coast, 1977 - 1990

(1) "Tunas"

Unit : 1,000 t

Year	West Indonesia								East Indonesia			
	Total	West coast of Sumatra	South coast of Java	Malacca Strait	East coast of Sumatra	North coast of Java	Southwest coast of Kalimantan	East coast of Kalimantan	Bali and Nusa Tenggara	South coast of Sulawesi	North coast of Sulawesi	Maluku and Irian Jaya
1977	13.2 (100.0)	2.2 (16.7)	0.2 (1.5)	0.5 (3.8)	0.4 (3.0)	0 (0.0)	-	0.2 (1.5)	2.4 (18.2)	1.8 (13.6)	3.5 (26.5)	2.0 (15.2)
	←----- (26.5) -----→								←----- (73.5) -----→			
1978	13.4	2.8	0	0.5	0.1	0	-	0	2.6	2.3	2.6	2.3
1979	17.9	3.2	0	0.5	0	0	-	0.1	2.3	6.2	2.9	2.7
1980	20.9	2.9	0.5	0.6	0	-	-	0.1	2.7	8.1	3.7	2.3
1981	25.2	2.5	0.9	0.7	0	-	-	0.1	4.0	5.6	8.7	2.8
1982	28.1	2.5	1.3	1.4	0.1	0.1	-	0.1	4.4	8.0	7.5	2.7
1983	26.1	1.9	1.9	0.3	0.1	0	-	0.1	2.2	7.8	7.3	4.6
1984	30.7	2.3	2.0	0.2	0	0	-	0.1	2.3	8.6	7.0	8.3
1985	33.7	2.3	0.3	1.5	0.2	0.3	-	0.1	3.6	9.9	6.4	9.1
1986	39.6	3.0	0.6	1.4	0.3	-	-	0.1	3.4	9.5	6.5	14.7
1987	40.5	4.9	0.3	2.3	0.3	-	-	0.1	6.0	11.4	6.9	8.5
1988	43.0	4.8	0.4	2.1	0.9	0	-	0.1	4.9	9.7	8.2	11.1
1989	66.3 (100.0)	7.3 (11.0)	0.7 (1.1)	3.3 (5.0)	1.2 (1.8)	1.7 (2.6)	-	0 (0.0)	9.9 (14.9)	12.0 (18.1)	8.7 (13.1)	21.3 (32.1)
	←----- (21.5) -----→								←----- (78.2) -----→			
Growth	5.0	3.3	3.5	6.6	4.0	...	...	-	4.1	6.7	2.5	10.7

Data Source : Fisheries Statistic of Indonesia

Note: Figures in parentheses below 1977 and 1989 figures indicate the catch proportion in % of the respective year. Growth is obtained by dividing catch of 1989 by that of 1977.

For those who wish to know the catch by province, please refer to Appendix 4.

(2) Skipjack tuna

Unit : 1,000 t

Year	West Indonesia								East Indonesia			
	Total	West coast of Sumatra	South coast of Java	Malacca Strait	East coast of Sumatra	North coast of Java	Southwest coast of Kalimantan	East coast of Kalimantan	Bali and Nusa Tenggara	South coast of Sulawesi	North coast of Sulawesi	Maluku and Irian Jaya
1977	30.4 (100.0)	2.2 (7.2)	1.8 (5.9)	0.9 (3.0)		0.1 (0.3)		0.1 (0.3)	1.9 (6.3)	6.9 (22.7)	5.5 (18.1)	10.9 (35.9)
	←----- (16.7) -----→								←----- (83.3) -----→			
1978	33.5	3.2	0.9	1.2		0.1		0	1.3	7.0	5.6	14.2
1979	42.8	5.3	1.2	2.1	-	0.5		0.2	1.3	9.7	8.5	14.0
1980	51.8	5.4	2.2	1.4	0	0.9		0.2	2.0	13.6	10.1	16.0
1981	57.4	5.0	1.5	1.5	-	0.3		-	3.1	18.0	9.0	19.0
1982	61.6	5.4	6.5	1.5	-	1.6		0.2	3.1	18.7	11.4	13.3
1983	76.8	5.9	6.5	1.0	0	2.1		-	5.8	19.1	11.4	25.0
1984	80.7	6.5	3.9	0.8	-	2.9		0	5.2	21.5	8.5	31.2
1985	87.4	6.9	1.9	2.6	1.2	3.1		0	7.1	23.4	8.7	32.6
1986	85.2	7.0	2.6	1.6	1.6	1.7	0	0	6.0	22.4	8.0	34.1
1987	102.6	7.1	2.9	2.0	2.0	1.7	0	0	9.3	27.0	9.3	41.1
1988	127.5	9.2	2.7	1.8	2.0	2.2	0.1	0	8.4	31.0	13.4	56.6
1989	113.8 (100.0)	13.6 (12.0)	3.4 (3.0)	2.1 (1.8)	0.9 (0.8)	2.1 (1.8)	0 (0.0)	0.1 (0.1)	6.9 (6.1)	30.2 (26.5)	10.2 (9.0)	44.3 (38.9)
	←----- (19.5) -----→								←----- (80.5) -----→			
Growth	3.7	6.2	1.9	2.3	...	21.0	...	1.0	3.6	4.4	1.9	4.1

Data Source : Fisheries Statistic of Indonesia

Note: Figures in parentheses below 1977 and 1989 figures indicate the catch proportion in % of the respective year. Growth is obtained by dividing catch of 1989 by that of 1977.

For those who wish to know the catch by province, please refer to Appendix 4.

(3) Eastern little tuna

Unit : 1,000 t

Year	West Indonesia								East Indonesia			
	Total	West coast of Sumatra	South coast of Java	Malacca Strait	East coast of Sumatra	North coast of Java	Southwest coast of Kalimantan	East coast of Kalimantan	Bali and Nusa Tenggara	South coast of Sulawesi	North coast of Sulawesi	Maluku and Irian Jaya
1977	62.4	8.2	7.0	8.6	2.3	10.5	3.2	1.4	6.1	6.8	3.7	4.6
	(100.0)	(13.1)	(11.2)	(13.8)	(3.7)	(16.8)	(5.1)	(2.2)	(9.8)	(10.9)	(5.9)	(7.4)
	←===== (65.9) =====→								←===== (34.1) =====→			
1978	55.2	5.2	3.9	6.9	2.2	13.5	2.6	2.6	4.5	6.4	4.8	2.7
1979	66.6	5.3	3.5	8.2	2.0	15.3	4.1	2.1	7.2	9.0	6.1	3.8
1980	76.8	6.2	9.0	7.5	2.4	20.8	2.4	3.4	6.1	8.3	7.1	3.7
1981	87.7	8.5	9.0	2.0	3.4	22.9	5.4	3.2	7.6	10.9	5.3	3.8
1982	106.0	6.4	16.4	8.6	7.7	27.8	4.6	3.5	7.9	10.7	7.1	5.3
1983	103.9	7.3	16.2	7.1	7.6	27.9	4.4	3.2	11.2	7.7	7.2	4.2
1984	103.2	9.2	15.0	9.4	3.7	23.9	2.9	3.1	15.0	8.5	6.8	5.6
1985	111.6	9.7	7.9	18.4	4.8	24.3	2.6	3.6	12.9	12.4	7.1	8.0
1986	114.2	9.1	3.9	19.9	4.4	28.9	4.8	2.1	14.5	13.0	6.9	6.7
1987	122.7	14.6	7.7	15.9	5.1	32.5	5.0	3.0	12.0	13.8	7.4	5.7
1988	117.9	15.7	10.5	16.1	5.0	21.6	5.0	2.4	13.4	14.7	7.8	5.7
1989	135.3	21.5	6.9	18.0	5.6	31.7	6.2	2.3	11.8	16.3	8.1	6.8
	(100.0)	(15.9)	(5.1)	(13.3)	(4.1)	(23.4)	(4.6)	(1.7)	(8.7)	(12.0)	(6.0)	(5.0)
	←===== (68.3) =====→								←===== (31.7) =====→			
Growth	2.2	2.6	1.0	2.1	2.4	3.0	1.9	1.6	1.9	2.4	2.2	1.5

Data Source : Fisheries Statistic of Indonesia

Note: Figures in parentheses below 1977 and 1989 figures indicate the catch proportion in % of the respective year. Growth is obtained by dividing catch of 1989 by that of 1977.

For those who wish to know the catch by province, please refer to Appendix 4.

(4) Indo-Pacific king mackerel

Unit : 1,000 t

Year	West Indonesia								East Indonesia			
	Total	West coast of Sumatra	South coast of Java	Malacca Strait	East coast of Sumatra	North coast of Java	Southwest coast of Kalimantan	East coast of Kalimantan	Bali and Nusa Tenggara	South coast of Sulawesi	North coast of Sulawesi	Maluku and Irian Jaya
1977	3.6	0.1	-	0.5	0.4	-	0.4	1.3	0.1	0.6	0	0.2
	(100.0)	(2.8)		(13.9)	(11.1)		(11.1)	(36.1)	(2.8)	(16.7)		(5.6)
	←===== (75.0) =====→								←===== (25.0) =====→			
1978	4.0	0.1	0	0.2	0.4	0.1	0.3	1.9	0	0.4	0	0.4
1979	5.2	0.2	0	0.6	0.3	0	0.8	1.8	0	0.7	0	0.5
1980	4.3	0.1	0	0.3	0.2	0.3	0.9	1.5	0	0.4	0	0.5
1981	5.2	0.2	0	0.3	0.3	0.5	1.2	1.5	0.1	0.7	0.1	0.5
1982	5.7	0.5	0	0.5	0.5	0.2	1.2	1.2	0.1	1.0	0	0.5
1983	7.1	0.3	0	0.5	0.3	0.5	2.3	1.2	0.2	1.0	0.1	0.6
1984	6.1	0.6	0	0.2	0.3	0.8	1.0	1.4	0.1	0.8	0.1	0.8
1985	6.8	0.4	-	0.9	0.4	0.9	0.8	1.4	0.1	0.8	0.1	0.9
1986	7.7	0.8	-	0.4	0.4	0.8	0.5	1.3	0.2	2.0	0.2	1.0
1987	7.5	0.6	0.2	0.4	0.4	0.8	1.0	1.9	0	0.9	0.2	0.8
1988	16.8	0.8	0	8.3	0.5	1.9	1.0	1.5	0.2	1.1	0.3	1.2
1989	22.4	1.1	0.3	12.0	1.8	1.7	1.1	1.7	0.2	1.1	0.2	1.3
	(100.0)	(4.9)	(1.3)	(53.6)	(8.0)	(7.6)	(4.9)	(7.6)	(0.9)	(4.9)	(0.9)	(5.8)
	←===== (87.9) =====→								←===== (12.5) =====→			
Growth	6.2	11.0	-	24.0	4.5	...	2.8	1.3	2.0	1.8	...	6.5

Data Source : Fisheries Statistic of Indonesia

Note: Figures in parentheses below 1977 and 1989 figures indicate the catch proportion in % of the respective year. Growth is obtained by dividing catch of 1989 by that of 1977.

For those who wish to know the catch by province, please refer to Appendix 4.

(5) Narrow-barred king mackerel

Unit : 1,000 t

Year	West Indonesia								East Indonesia			
	Total	West coast of Sumatra	South coast of Java	Malacca Strait	East coast of Sumatra	North coast of Java	Southwest coast of Kalimantan	East coast of Kalimantan	Bali and Nusa Tenggara	South coast of Sulawesi	North coast of Sulawesi	Maluku and Irian Jaya
1977	26.4 (100.0)	2.2 (8.3)	1.4 (5.3)	6.5 (24.6)	3.2 (12.1)	4.4 (16.7)	2.2 (8.3)	1.8 (6.8)	1.1 (4.2)	2.2 (8.3)	0.3 (1.1)	0.9 (3.4)
	←----- (93.0) -----→								←----- (17.0) -----→			
1978	26.4	2.5	1.2	4.6	2.8	4.1	3.4	2.9	0.6	2.7	0.3	1.2
1979	27.7	1.7	1.0	3.9	3.2	4.7	4.5	2.6	0.7	3.8	0.5	1.0
1980	35.2	1.8	2.8	6.2	3.3	7.3	4.9	2.5	1.0	3.4	0.8	1.1
1981	37.4	1.8	1.1	5.6	4.3	8.9	5.8	3.0	0.9	4.0	1.0	1.0
1982	42.7	2.4	1.5	5.5	7.0	10.2	5.1	3.6	0.9	4.4	1.1	1.2
1983	47.3	2.1	2.7	5.1	6.7	12.3	6.2	3.5	1.9	4.3	1.2	1.4
1984	42.3	2.5	1.5	4.1	6.4	10.4	5.9	3.8	1.8	3.3	1.4	1.4
1985	40.7	2.4	1.1	4.6	5.5	10.6	5.5	3.3	1.4	3.5	1.3	1.4
1986	45.2	3.3	1.5	5.3	5.9	13.7	4.3	3.0	1.6	3.8	1.4	1.4
1987	44.8	3.3	1.6	5.0	5.5	13.8	4.6	3.2	1.6	4.0	1.2	0.9
1988	44.5	4.0	2.5	4.2	6.5	9.8	4.6	2.9	1.9	4.7	1.2	2.2
1989	43.4 (100.0)	4.5 (10.4)	1.6 (3.7)	2.5 (5.8)	5.7 (13.1)	12.1 (27.9)	5.0 (11.5)	2.6 (6.0)	1.7 (3.9)	4.6 (10.6)	1.3 (3.0)	1.7 (3.9)
	←----- (78.6) -----→								←----- -----→			
Growth	1.6	2.0	1.1	0.4	1.8	2.8	2.3	1.4	1.5	2.1	4.3	1.9

Data Source : Fisheries Statistic of Indonesia

Note: Figures in parentheses below 1977 and 1989 figures indicate the catch proportion in % of the respective year. Growth is obtained by dividing catch of 1989 by that of 1977.

For those who wish to know the catch by province, please refer to Appendix 4.

Appendix 4

Tuna Catch by species and province arranged by coast, 1989

Coast	Province	Catch					
		Total	Tunas	Skipjack	Eastern little tuna	Indo-Pacific king mackerel	Narrow-barred king mackerel
Total		381.2	66.3	113.8	135.3	22.4	43.4
West Coast of Sumatra	Ache	19.5	1.5	4.9	11.4	0.2	1.5
	N. Sumatera	8.3	1.8	1.5	2.6	0.3	2.1
	W. Sumatera	19.3	3.7	7.1	7.4	0.4	0.7
	Bengkulu	1.1	0.4	0.1	0.2	0.2	0.2
	Lampung	0.2	0.1	-	0.1	-	-
South Coast of Java	W. Java	6.7	0.4	2.3	3.1	-	0.9
	C. Java	1.0	-	0.0	0.8	0.2	-
	Yogyakarta	0.0	0.0	-	0.0	-	0.0
	E. Java	5.3	0.3	1.1	3.1	0.1	0.7
Coast of Malacca Strait	Ache	21.1	3.3	2.1	4.8	9.8	1.1
	N. Sumatera	8.3	-	-	6.8	0.1	1.4
	Riau	8.6	-	-	6.5	2.1	-
East Coast of Sumatra	Jambi	1.2	-	-	-	1.2	-
	S. Sumatera	6.5	-	0.0	1.8	0.6	4.1
	Lampung	7.4	1.2	0.8	3.7	-	1.7
North Coast of Java	Jakarta	7.5	1.7	-	4.2	0.6	1.0
	W. Java	10.9	-	0.3	7.4	0.1	3.1
	C. Java	13.1	-	0.0	9.0	-	4.1
	E. Java	17.9	-	1.7	11.2	0.9	4.1

Coast	Province	Total	Tunas	Skipjack	Catch		
					Eastern little tuna	Indo-Pacific king mackerel	Narrow-barred king mackerel
Bali and Nusatenggara	Bali	12.9	6.8	1.5	4.5	-	0.1
	W. Nusa.	4.7	0.2	1.2	2.5	-	0.8
	E. Nusa.	13.0	2.9	4.3	4.8	0.2	0.8
	T. Timur	0.0	0.0	0.0	0.0	0.0	0.0
South/West Coast of Kalimantan	W. Kalimantan	7.1	0.0	0.0	4.7	-	2.7
	C. Kalimantan	4.9	-	-	1.5	1.1	2.3
East Coast of Kalimantan	S. Kalimantan	2.1	-	-	0.5	0.6	1.0
	E. Kalimantan	4.6	0.0	0.0	1.8	1.1	1.7
South Coast of Sulawesi	S. Sulawesi	48.5	8.6	21.6	13.5	0.9	3.9
	SE. Sulawesi	15.8	3.5	8.5	2.8	0.3	0.7
North Coast of Sulawesi	N. Sula	23.3	7.9	8.2	6.3	0.1	0.8
	C. Sulawesi	5.2	0.9	1.9	1.8	0.1	0.5
Maluku and Irian Jaya	Maluku	39.5	8.8	23.0	5.4	1.0	1.3
	Irian Jaya	36.1	12.5	21.4	1.5	0.3	0.4

Data Source : Fisheries Statistics of Indonesia

Appendix 5

Number of Fishing Units and Catch for Skipjack Pole and Line, 1977 - 1990

Coast	1977				1978				1979				1980			
	N1	N2	C1	C2	N1	N2	C1	C2	N1	N2	C1	C2	N1	N2	C1	C2
Total	513.0	513.0	15.4	15.4	1,166.0	660.0	23.8	18.8	575.0	575.0	21.7	21.7	673.0	673.0	25.6	25.6
West Coast of Sumatra	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
South Coast of Java	-	-	-	-	506.0	-	5.0	-	-	-	-	-	-	-	-	-
Coast of Malacca Strait	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
East Coast of Sumatra	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
North Coast of Java	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bali and Nusa Tenggara	-	-	-	-	-	-	-	-	1.0	1.0	0.0	0.0	1.0	1.0	0.0	0.0
South/West Coast of Kalimantan	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
East Coast of Kalimantan	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
South Coast of Sulawesi	7.0	7.0	0.1	0.1	26.0	26.0	1.0	1.0	24.0	24.0	1.7	1.7	57.0	57.0	2.7	2.7
North Coast of Sulawesi	68.0	68.0	3.6	3.6	129.0	129.0	3.3	3.3	69.0	69.0	5.5	5.5	123.0	123.0	7.4	7.4
Maluku and Irian Jaya	438.0	438.0	11.7	11.7	505.0	505.0	14.5	14.5	481.0	481.0	14.5	14.5	492.0	492.0	15.5	15.5
Province Maluku	408.0	408.0	9.8	9.8	476.0	476.0	9.3	9.3	453.0	453.0	10.4	10.4	462.0	462.0	11.9	11.9
I. Jaya	30.0	30.0	1.9	1.9	29.0	29.0	5.2	5.2	28.0	28.0	4.2	4.2	30.0	30.0	3.6	3.6

N1 : Number of fishing units based on Fisheries Statistics of Indonesia

N2 : Number of fishing units adjusted by authors

C1 : Catch based on Fishery Statistics of Indonesia (in 1,000 t)

C2 : Catch adjusted by authors (in 1,000 t)

Coast	1981				1982				1983				1984			
	N1	N2	C1	C2	N1	N2	C1	C2	N1	N2	C1	C2	N1	N2	C1	C2
Total	1,257	646	29	28.9	541	541	27.1	30.6	1,932	595	32.9	32.9	683	683	45.6	45.6
West Coast of Sumatra	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
South Coast of Java	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Coast of Malacca Strait	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-
East Coast of Sumatra	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-
North Coast of Java	-	-	0.1	-	-	-	0.4	-	-	-	0.0	-	-	-	-	-
Bali and Nusa Tenggara	1.0	1.0	-	-	1.0	1.0	0.5	0.5	17.0	17.0	2.7	2.7	21.0	21.0	1.5	1.5
South/West Coast of Kalimantan	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
East Coast Kalimantan	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
South Coast of Sulawesi	65.0	65.0	6.0	6.0	67.0	67.0	6.1	6.1	69.0	69.0	6.3	6.3	75.0	75.0	5.8	5.8
North Coast of Sulawesi	80.0	80.0	6.0	6.0	174.0	174.0	7.7	7.7	159.0	159.0	7.1	7.1	148.0	148.0	4.7	4.7
Maluku and Irian Jaya	1,111.0	500	17.1	17.1	299	299	12.3	16.3	1,687	350	16.8	16.8	439	439	33.6	33.6
Province Maluku I. Jaya	1,031	470	13.1	13.1	269	269	12.3	12.3	427	310	13.6	13.6	392	392	18.9	18.9
	30	30	4	4	30	30	-	4	1,260	40.0	3.2	3.2	47	47	14.7	14.7
Coast	1985				1986				1987				1988			
	N1	N2	C1	C2	N1	N2	C1	C2	N1	N2	C1	C2	N1	N2	C1	C2
Total	1,159	1,159	52.6	52.6	1,307	1,307	49.8	49.8	7,414	1,267	56.5	56.4	1,720	1,720	73.2	73.2
West Coast of Sumatra	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
South Coast of Java	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Coast of Malacca Strait	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
East Coast of Sumatra	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-
North Coast of Java	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bali and Nusa Tenggara	29	29	3	2.8	...	...	...	...	36	36	1.3	1.3	86	86	3.9	3.9
South/West Coast of Kalimantan	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
East Coast Kalimantan	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
South Coast of Sulawesi	74	74	8.7	8.7	84	84	7	7	110	110	10.7	10.7	119	119	14.9	14.9
North Coast of Sulawesi	128	128	4.9	4.9	137	137	5.1	5.1	6,287	140	6.3	6.3	141	141	7.8	7.8
Maluku and Irian Jaya	928	928	36.2	36.2	1,086	1,086	37.7	37.7	981	981	38.2	38.2	1,374	1,374	46.5	46.5
Province Maluku I. Jaya	567	567	21.3	21.3	489	489	23.2	23.2	484	484	22.4	22.4	465	465	25.2	25.2
	361	361	15	15	597	597	14.5	14.5	497	497	15.7	15.7	909	909	21.3	21.3

Coast	1989				1990			
	N1	N2	C1	C2	N1	N2	C1	C2
Total	1,204	1,009	71.4	71.3	-	-	-	-
West Coast of Sumatra	-	-	-	-	-	-	-	-
South Coast of Java	-	-	-	-	-	-	-	-
Coast of Malacca Strait	-	-	-	-	-	-	-	-
East Coast of Sumatra	-	-	-	-	-	-	-	-
North Coast of Java	-	-	-	-	-	-	-	-
Bali and Nusa Tenggara	87	87	3.4	3.4	-	-	-	-
South/West Coast of Kalimantan	-	-	-	-	-	-	-	-
East Coast Kalimantan	195	.*	0.1	.*	-	-	-	-
South Coast of Sulawesi	160	160	18.5	18.5	-	-	-	-
North Coast of Sulawesi	151	151	6.2	6.2	-	-	-	-
Maluku and Irian Jaya	611	611	43.2	43.2	-	-	-	-
Province Maluku	572	572	26.5	26.5	-	-	-	-
I. Jaya	39	39	16.7	16.7	-	-	-	-

Appendix 6

Number of fishing units and tuna longline catch, 1977 - 1990

Coast	1977				1978				1979				1980			
	N1	N2	C1	C2	N1	N2	C1	C2	N1	N2	C1	C2	N1	N2	C1	C2
Total	18	18	1.9	1.9	18	18	2.3	2.3	19	18	2.1	2.1	372	17	3.0	2.5
West Coast of Sumatra	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-
South Coast of Java	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Coast of Malacca Strait	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
East Coast of Sumatra	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
North Coast of Java	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-
Bali and Nusa Tenggara	18	18	1.9	1.9	18	18	2.3	2.3	18	18	2.1	2.1	17	17	2.5	2.5
South/West Coast of Kalimantan	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
East Coast Kalimantan	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
South Coast of Sulawesi	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
North Coast of Sulawesi	-	-	-	-	-	-	-	-	-	-	-	-	355	-	0.4	-
Maluku and Irian Jaya	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-

N1 : Number of fishing units based on Fisheries Statistics of Indonesia

N2 : Number of fishing units adjusted by authors

C1 : Catch based on Fishery Statistics of Indonesia (in 1,000 t)

C2 : Catch adjusted by authors (in 1,000 t)

Coast	1981				1982				1983				1984			
	N1	N2	C1	C2	N1	N2	C1	C2	N1	N2	C1	C2	N1	N2	C1	C2
Total	20	20	4.8	3.6	73	20	5	3.6	170	23	4.3	3.7	277	20	2.3	1.7
West Coast of Sumatra	-	-	-	-	-	-	-	-	-	-	0.4	-	-	-	-	-
South Coast of Java	-	-	-	-	-	-	-	-	15	-	-	-	-	-	-	-
Coast of Malacca Strait	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-
East Coast of Sumatra	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-
North Coast of Java	-	-	-	-	1.0	-	0	-	-	-	-	-	-	-	-	-
Bali and Nusa Tenggara	20	20	3.6	3.6	20	20	3.6	3.6	21	21	1.8	1.8	20	20	1.7	1.7
South/West Coast of Kalimantan	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
East Coast Kalimantan	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
South Coast of Sulawesi	-	-	-	-	-	-	0	-	84	2	1.9	1.9	-	-	-	-
North Coast of Sulawesi	-	-	1.1	-	-	-	1.1	-	-	-	-	-	203	-	0.5	-
Maluku and Irian Jaya	-	-	0.1	-	52	-	0.1	-	50	-	0.1	-	54	-	0.1	-

Coast	1985				1986				1987				1988			
	N1	N2	C1	C2	N1	N2	C1	C2	N1	N2	C1	C2	N1	N2	C1	C2
Total	395	21	2.9	2.4	74	12	0.5	0.4	835	36	3.7	2.5	197	103	4.3	2.5
West Coast of Sumatra	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-
South Coast of Java	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-
Coast of Malacca Strait	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-
East Coast of Sumatra	89	-	0.1	-	-	-	-	-	-	-	0.4	-	-	-	-	-
North Coast of Java	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bali and Nusa Tenggara	21	21	2.4	2.4	9	9	0.3	0.3	32	32	1.6	1.6	98	98	2.2	2.2
South/West Coast of Kalimantan	-	-	-	-	-	-	-	-	-	-	-	-	13	-	0.3	-
East Coast Kalimantan	-	-	-	-	-	-	-	-	-	-	-	-	81	-	-	-
South Coast of Sulawesi	-	-	-	-	3	3	0.1	0.1	40	4	0.9	0.9	5	5	0.3	0.3
North Coast of Sulawesi	227	-	0.5	-	-	-	-	-	689	-	0.7	-	-	-	1.5	-
Maluku and Irian Jaya	58	-	0	-	62	-	0.1	-	74	-	0.1	-	-	-	-	-

Coast	1989				1990			
	N1	N2	C1	C2	N1	N2	C1	C2
Total	874.0	139.0	14.8	10.0	-	-	-	-
West Coast of Sumatra	-	-	-	-	-	-	-	-
South Coast of Java	-	-	-	-	-	-	-	-
Coast of Malacca Strait	-	0.0	-	-	-	-	-	-
East Coast of Sumatra	339.0	-	1.2	-	-	-	-	-
North Coast of Java	31.0	31.0	0.1	0.1	-	-	-	-
Bali and Nusa Tenggara	88.0	88.0	6.7	6.7	-	-	-	-
South/West Coast of Kalimantan	-	-	0.0	-	-	-	-	-
East Coast of Kalimantan	258.0	-	2.4	-	-	-	-	-
South Coast of Sulawesi	20.0	20.0	0.3	0.3	-	-	-	-
North Coast of Sulawesi	43.0	-	1.2	-	-	-	-	-
Maluku and Irian Jaya	95.0	-	2.9	2.9	-	-	-	-