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**COUNTRY STATUS REPORT
MALAYSIA**

(1) SABAH

STATUS REPORT: SABAH, MALAYSIA

By:

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ABSTRACT

This status report is based on the Malaysian fish landing statistics for the 1991-1995 period. The status of the pelagic fishery in Sabah are given in this report. An attempt is also made to assess the mackerel, round scad and tuna fisheries using the Beverton and Holt Yield per Recruit Model. From available statistics, it seems that the annual landings for tunas and mackerels are on a declining trend, and on the contrary for round scads and mixed pelagic group. These trends maybe attributed to the saturation of fishing effort, where the fishery is concentrated mainly in inshore waters. However, limited sampling coverage can also be a major contributing factor.

1. INTRODUCTION

Fisheries play an important role in the economic development of the country. Besides providing cheap protein (national per caput: 37kg/year or 60-70% of animal protein consumed), it also provides various social economic opportunities (including employment for full-time 82,200 fishermen). In 1995, the total fisheries production (including ornamental fish production) amounted to 1,245,117 metric tons valued at RM3.15 billion constituting about 1.47% of the national GDP or about 19.19% of the agricultural sector. Compared to 1994, there was an increase of 5.36% in terms of quantity of the total production and 5.35% in terms of value of the total production. Table 1 shows the annual fisheries statistics (capture fisheries and aquaculture only) for the 1990-1995 period which are self explanatory.

During the 1991-1995 period, the annual pelagic landings fluctuated between 305,904 - 412,273 metric tons. The main components are mackerels (63,582 - 127,461 metric tons), round scads (44,645 - 64,722 metric tons) and tunas (25,444 - 35,980 metric tons) which contributed about 48.3 - 50.6% of the pelagic landings or about 15.3-18.8% of the marine landings. During the same period, Sabah contributed 18.6-22.0% of the annual pelagic landings in the country, i.e. contributing 38.6-47.6% of tuna, 7.7-18.6% of mackerel, 12.6-26.6% of round scad and 18.0-24.0% of other pelagic species landed. This report covers the sectoral performance of the pelagic fisheries sector in Sabah, with emphasis on mackerels, tunas and round scads.

2. OVERVIEW OF THE FISHERIES INDUSTRY IN SABAH

2.1. The Marine Capture Fisheries Sector

2.1.1. *Physical Environment*

The fishing grounds in Sabah can be divided into three main zones: west coast (South China Sea), Kudat (South China Sea and Sulu Sea) and east coast (Sulu Sea and Sulawesi Sea). Its 1600 km coastline fringed with vast areas of coral reefs, sea grasses, mangroves, estuaries, and its diverse aquatic ecosystems have one of the richest diversity of marine life in the Indo Pacific region. Fishing grounds within the continental shelf are estimated about 30,000 nm² (102,000 km²), i.e. 9,000 square nautical miles on the east coast and 21,000 nautical miles on the west coast (Figure 1).

In general most of the fishing activities are concentrated in the coastal waters within the 30 nautical mile zone which sustains both traditional and commercial fisheries. On the other hand, the offshore waters (beyond the 30 nautical mile zone) are at present still under-exploited. For purse seiners, the main fishing grounds are mainly of Semporna, Lahad Datu and along the west coast, where the target species are coastal tunas and small pelagics (*mackerels, round scads, scads*).

The physical and oceanographic features of the Palawan Trench located off the west coast makes it a potential fishing ground for oceanic tunas. Data from past fishing operations indicated that both bigeye (*Thunnus obesus*) and yellowfin (*Thunnus albacares*) tunas are abundant and widely distributed in the area.

2.1.2. Potential Yield

There is limited information on the potential yield of marine fishery resources in Sabah. Preliminary estimate indicated the potential yield to be around 350,000 metric tons, consisting of 174,000 metric tons of pelagic fish and 176,000 metric tons of assorted demersal species (including crustaceans (busing, 1995a). This is a rather conservative estimate, where the potential yield of pelagic resources (e.g. tuna and small pelagics) in the EEZ and fishes in coral reefs and shoal areas are unknown and might be underestimated.

2.1.3. Fishing Boats

The commercial fisheries comprised of large-scale fishing operations using various types of modern gears (e.g. trawlnets, purse seiners, gillnets), which is better organized, more capital intensive and accounts for greater income as opposed to traditional fisheries involving various traditional gears (misc. traps, hook & lines, liftnets) which is much smaller, dispersed and often fragmented in organization, high labour intensive and low in capital investment. The operators involved are artisanal fishermen who operated non-motorised or small boats. Coastal fisheries are defined as to all fishing activities confined within 30 nautical miles of the coast, where fishing vessels that operate within this zone are not greater than 70 GRT in size. While deepsea fisheries are defined as fishing operations carried out by large vessels (beyond 70 GRT in size) beyond the 30 nautical mile zone. Deep sea fishing are mainly carried out by purse seiners, trawlers and longliners.

Sabah has the largest traditional fishing fleet, i.e. 86% for non-powered boats and 41% for outboard engine boats. The main gears are liftnets (*selambau*), hook and lines and other static gears (e.g. traps). However, for inboard engine boats, the percentage is rather low (14% of the national commercial fishing fleet size). The fishing fleet breakdown are given in Tables 2-3.

2.1.4. Fishermen Population

It is estimated that there are about 19,819 people involved in fulltime fishing in Sabah with the breakdown by gear group is given in Figure 2. The number of fishermen without licensed gears are not taken into account.

2.1.5. Marine Fish Landings

The estimation of fish landings is carried out in major landing sites in each of the 15 major fishing districts in Sabah (Figure 1). Catch statistics for each fish group are estimated by gear and GRT under the national SMPP (or *Fisheries Management Information System*) program. An overview of the capture fishery in Sabah is given in previous papers (Biusing, 1994a, 1994b, 1995a, 1995b, 1997).

In general, about 200-300 species of marine fishes (including trash fish) are landed in the major local fish markets, with an average of 50-100 species displayed for sale daily in the market stalls. Additional species may appear from time to time depending on the time of the year. Some species are found to predominate the market landings during the monsoons, while others which permanently inhabits estuaries, bays or coral reefs are usually landed throughout the year. The magnitude of fish landings are closely linked to the monsoons. Generally, during the northeast monsoon between the months of January - March, the supply is low due to rough sea conditions which lead to minimum fishing activities carried out. In some areas, fish landings might increase during this time of the year, where pelagic fishes migrate to inshore waters to avoid the strong winds and currents prevailing in the open seas.

The annual marine landings in Malaysia during the 1991-95 period are given in Figure 3. In 1995, about 1,108,436 metric tons was landed, with an increase of 4.02% over the previous year. During the 5 year period, the average marine landing is about 1,031,364 metric tons, with 44.8% landed on the west coast of Peninsular Malaysia, followed by the east coast (30.3%), Sabah (14.3%), Sarawak (8.8%) and FT Labuan (1.8%).

The breakdown of the pelagic landings during the 1991-95 period are given in Table 4 and Figure 4. In 1995, pelagic landings accounted about 412,273 metric tons or about 37% of the total marine landings, with an increase of 8.9% over 1994. During the 1991-95 period, pelagic landings fluctuated around 305,904 to 412,273 metric tons (mean 363,921 metric tons) or about 34-37% (mean 35%) of the total annual marine landings. The west coast of Peninsular Malaysia contributed the highest pelagic landings (31-45%, mean 38% or 137,494 metric tons), followed by the east coast (26-40%, mean 34% or 122,854 metric tons), Sabah (19-22%, mean 21% or 75,068 metric tons), Sarawak (5-6%, mean 6% or 20,084) metric tons) and FT Labuan (1-3%, mean 2% or 8,421 metric tons). In Sabah annual pelagic landings fluctuated between 56,877-84,136 metric tons (mean 75,068 metric tons), which represented about 48-53% (mean 51%) of the annual marine landings in the state.

Table 4 and Figures 5-6 shows the species breakdown by fishing region of pelagic landings in the country. Mackerels formed the most important pelagic group (5-year mean 85,983 metric tons), which represented about 23.6% of the pelagic landings or 8.3% of the marine landings (Figure 7). Round scads formed the second largest group (mean 55,966 metric tons), contributing respectively about 15.4% and 5.4% of the pelagic and marine landing (Figure 8). Tunas formed the third largest group (mean 30,161 metric tons), contributing respectively about 8.3% and 2.9% of the pelagic and marine landings (Figure 9). Other species (mainly selar scads, hardtail scads, anchovies, spanish mackerels, sardines) contributed the bulk of the pelagic landings (mean 191,911 metric tons), i.e. 52.7% and 18.6% of the pelagic and marine landings in the country (Figure 10).

The estimated marine landing breakdown by gear type and resource group in Sabah (incl. FT Labuan) during the 1991-1995 period are given respectively in Figures 11-12 and Table 5. Trawl nets contributed the bulk of the landings (29.1%), followed by drift nets (21.4%), purse seiners (19.0%), hook and line (12.6%), lift nets (12.3%) and misc. traditional gears (5.6%). About 34.1% of the pelagic landings are contributed by purse seiners, followed by gillnets (23.3%), lift nets (22.1%), hook and line (11.1%), trawl nets (8.5%) and less than 1% by misc. traditional gears. Purse seines and lift nets are the principal pelagic gears, with > 90% of the catch consisting of pelagic species. About 55.4% of the gillnet landings consisted of pelagic species. While pelagic species represented about 44.9% of the hook and line landings. Only 14.8% of the trawl landings consisted of pelagic species, where the target species are shrimps.

From the 1991-1995 annual statistics, pelagic fishes contributed between 48-52% (mean 50.9% or 75,068 metric tons) of the marine landings in Sabah. Demersal fishes contributed between 19-22% (mean 20.6% or 30,363 metric tons), followed by crustaceans between 10-14% (mean 11.4% or 16,807 metric tons). While the mixed portion (various species including invertebrates) contributed between 13-22% (mean 17.2% or 25,347 metric tons).

During the 1991-1995 period, tunas, mackerels (*Rastrelliger*) and round scads (*Decapterus*) contributed about 46.7% of the pelagic landings in Sabah (excluding FT Labuan). This group of fishes contributed respectively about 42-51% of the total pelagic landings or 21-26% of the total marine landings in Sabah each year. The annual gear landing breakdown of mackerels, round scads, tunas and mixed pelagic species for the 1991-1995 period are given in Figures 13-16. The Yield per Recruit (Y/R) isopleth for mackerels (*Rastrelliger*), round scads (*Decapterus*) and kawakawa (*Euthynnus affinis*) are given respectively in Figures 17-19. The analysis are based on biological data reported for these species (Busing, 1991, 1994a, 1994b, 1995a).

Tunas (mainly neretic species) contributed the highest pelagic landings (17% pelagic landings). The landing in 1995 was about 10,704 metric tons (decreased by 7.4% from 1994). The principle gears are purse seiners (61.3% of tuna landings) and gillnets (28.5%). Hook and line gears only contributed about 6.9% of the landings (except in 1993, where it contributed about 12.8%). It was noted that lift nets contributed 9.0% and 4.8% of the landings in 1993 and 1994, and in other years (1991-92 and 1995) less than 0.02% (2-3 metric tons). It is believed that these landings consisted of juveniles caught in near inshore waters. During the 5-year period, the mean landing is about 13,045 metric tons. There is a declining trend in the landings, which reached its peak in 1993 (17,136 metric tons) and then decreased gradually to only 10,704 metric tons in 1995.

Mackerels formed the second largest group (14.8% pelagic landings). The landing in 1995 was about 9,830 metric tons (increased by 5.7% from 1994). Purse seine is the principle gear used in the fishery. During the 1991-95 period, purse seines contributed between 51-55% (mean 52.4%) of the mackerel landings. Other important gears in the fishery are lift nets (14.4% landings), trawl nets (14.1%) and gillnets (11.3%). During the 5-year period, the mean landing is about 11,089 metric tons. Like tunas, there is also a declining trend in the landings, reaching its peak in 1992 (13,337 metric tons) and then decreased to only between 9,300-9,830 metric tons in 1994-95.

Round scads formed the third largest group (14.6% pelagic landings). The landing in 1995 was about 14,784 metric tons (increased by 12.4% from 1994). The principle gears used in the fishery are liftnets, purse seiners and trawlnets. Lift nets contributed about 33-58% (mean 46.2%) of the annual round scad landings. While purse seiners contributed about 32-49% (mean 40.8%) of the landings. Trawlnets as part of the by-catch contributed about 5-17% (mean 11.6%) each year. During the 5-year period, the mean landing is about 10,935 metric tons. Unlike tunas and mackerels, it seems that round scads landings are on an increasing trend, from only 6,701 metric tons in 1991 to its peak in 1995 (14,784 metric tons).

The mixed pelagic catch represented by various species (sardines, hardtail scads, king mackerels, selar scads, anchovies, etc.) represented about 49-58% of the annual pelagic landings. In 1995 the total landings was about 48,818 metric tons (increased by 14.6% from 1994). The main gears used to land these species in order of importance are gill nets (22.1-36.4% annual landings, mean 31.0%), liftnets (22.8-24.5%, mean 23.8%), purse seines (12.2-26.7%, mean 18.3%), hook and line (11.5-18.8%, mean 16.5%) and trawlnet (8.4-9.4%, mean 8.8%). During the 5-year period, the mean landing is about 39,998 metric tons. Likewise for round scads, this group of fish is only on an increasing trend, from only 29,006 metric tons in 1991 increased to its peak in 1995 (48,818 metric tons).

3. CONCLUSION AND RECOMMENDATIONS

3.1. Conclusion

There is an indication that the tuna and mackerel fisheries in Sabah are declining. However, more studies are needed to confirm this finding. Sampling error in the collection of landing data might have been a possible contributing factor. As such, there is an urgent need to carry out more rigorous assessment on the pelagic fishery sector, including catch and effort monitoring and biological studies. At present, the paucity of required information on the status of pelagic fisheries resources in the state make it very difficult for DOF managers to implement rational management measures to manage the fishery within sustainable levels.

3.2. Recommendation

A comprehensive study on the pelagic fisheries resources in Sabah is urgently needed. This study should cover extensive acoustic surveys both on a temporal basis (between monsoons) in both inshore and offshore waters, catch and effort monitoring and related biological studies.

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Table 1: Fish production statistics, Malaysia (1990-95) (metric tons)

		1991	1992	1993	1994	1995
Marine Landings	Sabah	108,464	136,300	155,115	160,328	166,462
	Sarawak	86,610	88,240	81,920	95,624	99,255
	FT Labuan	7,275	19,743	19,141	24,554	23,255
	Semenanjung	709,590	767,530	791,620	785,079	819,464
Total		911,939	1,011,813	1,047,796	1,065,585	1,108,436
Marine Aquaculture	Sabah*	900	900	2,143	2,869	3,226
	Sarawak	49	144	50	82	104
	FT Labuan	0	0	0	0	0
	Semenanjung	48,290	62,662	86,054	92,564	110,618
Total		49,239	63,706	88,247	95,515	113,949
Freshwater Aquaculture	Sabah	6,223	7,086	5,800	6,015	6,123
	Sarawak	165	1,634	811	1,342	1,210
	FT Labuan	0	0	0	0	0
	Semenanjung	4,701	7,271	8,857	11,238	11,160
Total		11,089	15,991	15,467	18,598	18,493
Grand Total		972,267	1,091,510	1,151,510	1,179,698	1,240,878

Note: 1991-92 statistics only for shrimp, 1993-1995 including shrimp, mollusc and fish.

Source: Annual Fisheries Statistics of Malaysia (1991-1995)

Table 2: Licensed fishing fleet by GRT (gross tonnage), Sabah 1995

	Inboard engine boats GRT category									
	Grand Total	Non Powered	Outboard Engined	Inboard Engined	<10	10-20	20-25	25-40	40-70	>70
Sabah	9,144	2,597	3,939	2,608	1,498	635	163	250	53	9
FT Labuan	89	3	75	11	0	0	0	0	5	6
Sub Total	9,233	2,600	4,014	2,619	1,498	635	163	250	58	15
Malaysia	34,906	3,097	13,829	17,980	9,798	4,262	790	1,394	1,164	572
% Malaysia	26.45	83.95	29.03	14.57	15.29	14.90	20.63	17.93	4.98	2.62

Source: Annual Fisheries Statistics of Malaysia (1991-1995)

Table 3: Licensed fishing fleet by gear type, Sabah 1995

gear group	Sabah	FT Labuan	Sub Total	Malaysia Total	% Malaysia
Gillnet	915	31	946	16,551	5.72
Trawl-net	1,058	5	1,063	5,632	18.87
Hook & line	424	27	451	2,470	18.26
Seine net	158	8	166	1,838	9.03
Liftnet	146	8	154	265	58.11
Others	367	10	377	2,396	15.73
Total	3,068	89	3,157	29,152	10.83

Source: Annual Fisheries Statistics of Malaysia (1995)

REFERENCES

- Abdul Hamid Yasin. 1987. *Tuna fisheries in Sarawak and Sabah, Malaysia*. Proceedings of the 2nd meeting of tuna research groups in the Southeast Asian Region. Manila, Philippines 25-28 August 1987. Indo-Pacific Tuna Development and Management Programme. IPTP/87/GEN/12.
- Abdul Hamid Yasin; P.E., Chee. 1987. *Status Report from Malaysia*. Proceedings of the 2nd meeting of tuna research groups in the Southeast Asian Region. Manila, Philippines. 25-28 August 1987. Indo-Pacific Tuna Development and Management Program. IPTP/87/GEN/12.
- Anonymous. 1989a. *Deepsea fisheries resources within the Malaysian Exclusive Economic Zone*. Seminar sumber perikanan laut dalam di zon ekonomi eksklusif (ZEE) Malaysia. 20 Mei 1989. Kuala Lumpur.
- Anonymous. 1989b. *Tuna fisheries resource and development*. Seminar sumber perikanan laut dalam di zon ekonomi eksklusif (ZEE) Malaysia. 20 Mei 1989. Kuala Lumpur.
- Biusing, E.R. 1989. *Status report of the tuna fisheries in Sabah, Malaysia*. Proceedings of the 3rd meeting of tuna research groups in the Southeast Asian Region. Kuala Terengganu, Malaysia. October 1989. Indo-Pacific Tuna Development and Management Program. IPTP/88/GEN/12.
- Biusing, E.R. 1991. Population dynamics and biological reproduction aspects of the ikan rumahan stock, *Rastrelliger kanagurta* (Cuvier, 1817), off the west coast of Sabah. *vide* Ho, Y.W.; M.K. Vidyadaran; Norhani Abdullah; M.R. Jainudeen; A.R. Rahman (editors). 1992. Proceedings of the National IRPA (*Intensification of Research in Priority Areas*) Seminar (*agricultural sector*). February 1991, Kuala Lumpur. Volume II.
- Biusing, E.R. 1994a. *Status report on the pelagic fisheries sector in Sabah, Malaysia*. Paper presented during the 1st Workshop on data collection and management related to shared stocks in the Southeast Asian Region. Kuala Terengganu, 28-30 March 1994. SEAFDEC (*Southeast Asian Fisheries Development Center*).
- Biusing, E.R. 1994b. Population dynamics and biological reproduction aspects of the ikan rumahan stock (*Rastrelliger* spp.: Scombridae) along the west coast of Sabah. Proceedings of the Seminar on

Marine Fisheries Resources. Kota Kinabalu, 8-9 June 1994.

Biusing, E.R. 1995a. *Status report on the pelagic fisheries sector in Sabah, Malaysia*. Paper presented during the 2nd Workshop on data collection and management related to shared stocks in the Southeast Asian Region. Kuala Terengganu, July 1995. SEAFDEC (*Southeast Asian Fisheries Development Center*).

Biusing, E.R. 1995b. *Status of the coastal fisheries resources of Sabah*. Paper presented at the Seminar on Sustainable Development of Fishery Resources in Malaysia. Kota Kinabalu, 12-13 September 1995.

Biusing, E.R. 1997. *Investment opportunities in the marine fisheries sector*. Paper presented at the BIMP-EAGA Seminar on investment opportunities in Sabah, Malaysia. Kota Kinabalu, 26 June 1997.

Department of Fisheries Malaysia. Annual fisheries statistics of Malaysia. Reports for 1991, 1992, 1993, 1994 and 1995.

Makajil, A.F. 1995. *Development issues and challenges facing the fisheries industry in Sabah*. Paper presented at the Seminar on Sustainable Development of Fishery Resources in Malaysia. Kota Kinabalu, 12-13 September 1995.

Makino, Y. 1983. *The fishing gears and methods survey in west coast of Sabah*. JOCV Report. Department of Fisheries, Kota Kinabalu, Sabah.

Table 4: Marine fish landings (metric tons) in Malaysia (1991-95)

Region	species	1991	1992	1993	1994	1995	mean
Sabah AREA I	Tunas	10,821	15,000	17,136	11,564	10,704	13,045
	<i>Rastrelliger</i>	10,349	13,337	12,631	9,300	9,830	11,089
	<i>Decapterus</i>	6,701	9,143	11,094	12,954	14,784	10,935
	Other pelagics	29,006	40,177	39,403	42,587	48,818	39,998
	PELAGIC	56,877	77,657	80,264	76,405	84,136	75,068
	DEMERSAL	23,040	30,788	29,153	32,341	36,492	30,363
	CRUSTACEAN	14,834	19,983	16,817	16,306	16,093	16,807
	OTHERS	13,713	19,572	28,433	35,276	29,741	25,347
	SUB TOTAL	108,464	148,000	154,667	160,328	166,462	147,584
FT Labuan AREA II	Tunas	302	1,698	1,381	1,465	2,281	1,425
	<i>Rastrelliger</i>	452	1,736	2,528	2,536	1,907	1,832
	<i>Decapterus</i>	116	204	321	711	688	408
	Other pelagics	1,776	5,329	4,492	6,429	5,755	4,756
	PELAGIC	2,646	8,967	8,722	11,141	10,631	8,421
	DEMERSAL	3,224	6,191	5,708	6,008	5,902	5,407
	CRUSTACEAN	975	2,634	1,672	1,638	939	1,572
	OTHERS	430	1,951	3,039	5,767	5,783	3,394
	SUB TOTAL	7,275	19,743	19,141	24,554	23,255	18,794
Sarawak AREA III	Tunas	1,992	2,109	1,511	1,519	1,835	1,793
	<i>Rastrelliger</i>	3,003	3,610	3,090	3,270	2,646	3,124
	<i>Decapterus</i>	119	118	190	114	361	180
	Other pelagics	14,058	13,703	16,367	13,308	17,496	14,986
	PELAGIC	19,172	19,540	21,158	18,211	22,338	20,084
	DEMERSAL	13,943	14,594	13,486	13,911	19,089	15,005
	CRUSTACEAN	15,152	14,724	10,918	16,724	10,755	13,655
	OTHERS	38,340	39,383	36,362	46,778	47,073	41,587
	SUB TOTAL	86,607	88,241	81,924	95,624	99,255	90,330
Peninsular East Coast AREA IV	Tunas	9,890	8,002	10,492	8,334	6,897	8,723
	<i>Rastrelliger</i>	14,398	12,501	13,622	14,769	12,075	13,473
	<i>Decapterus</i>	39,622	28,211	42,610	37,883	29,398	35,545
	Other pelagics	57,322	64,863	75,748	67,820	59,813	65,113
	PELAGIC	121,232	113,577	142,472	128,806	108,183	122,854
	DEMERSAL	37,537	43,542	45,430	39,869	38,058	40,887
	CRUSTACEAN	8,007	8,805	9,968	8,898	9,449	9,025
	OTHERS	140,911	127,613	147,233	147,204	134,956	139,583
	SUB TOTAL	307,687	293,537	345,103	324,777	290,646	312,350
Peninsular West Coast AREA V	Tunas	5,051	8,194	5,460	2,939	3,727	5,074
	<i>Rastrelliger</i>	35,380	46,066	36,104	63,771	101,003	56,465
	<i>Decapterus</i>	6,641	6,969	10,507	9,979	10,392	8,898
	Other pelagics	58,905	77,486	59,639	67,393	71,863	67,057
	PELAGIC	105,977	138,715	111,710	144,082	186,985	137,494
	DEMERSAL	44,230	46,611	51,374	50,498	53,515	49,246
	CRUSTACEAN	69,856	89,558	76,631	67,764	66,449	74,052
	OTHERS	181,837	199,111	206,800	197,958	221,869	201,515
	SUB TOTAL	401,900	473,995	446,515	460,302	528,818	462,306
Grand Total	Tunas	28,056	35,003	35,980	25,821	25,444	30,061
	<i>Rastrelliger</i>	63,582	77,250	67,975	93,646	127,461	85,983
	<i>Decapterus</i>	53,199	44,645	64,722	61,641	55,623	55,966
	Other pelagics	161,067	201,558	195,649	197,537	203,745	191,911
	PELAGIC	305,904	358,456	364,326	378,645	412,273	363,921
	DEMERSAL	121,974	141,726	145,151	142,627	153,056	140,907
	CRUSTACEAN	108,824	135,704	116,006	111,330	103,685	115,110
	OTHERS'	375,231	387,630	421,867	432,983	439,422	411,427
GRAND TOTAL	911,933	1,023,516	1,047,350	1,065,585	1,108,436	1,031,364	

Source: Annual Fisheries Statistics of Malaysia (1991-1995)

Table 5: Pelagic fish landings (metric tons) by gear type, Sabah (1991-95)

	Year	LANDING BY GEAR TYPE (in metric ton)						GRAND	%
		TN	PS	GN	LN	HL	OT	TOTAL	Pelagic
<i>Rastrelliger</i>									
	1991	1,120	5,334	1,791	1,411	584	109	10,349	18.2
	1992	1,343	6,838	2,437	1,792	797	130	13,337	17.2
	1993	1,609	6,892	1,240	2,312	542	36	12,631	15.7
	1994	2,500	4,782	288	1,244	419	67	9,300	12.2
	1995	1,244	5,215	522	1,224	1,555	70	9,830	11.7
	Mean	1,563	5,812	1,256	1,597	779	82	11,089	14.8
<i>Decapterus</i>									
	1991	365	2,293	113	3,862	68	0	6,701	11.8
	1992	500	3,128	153	5,269	93	0	9,143	11.8
	1993	817	3,505	321	6,451	0	0	11,094	13.8
	1994	2,223	6,411	0	4,320	0	0	12,954	17.0
	1995	2,443	6,990	0	5,338	13	0	14,784	17.6
	Mean	1,270	4,465	117	5,048	35	0	10,935	14.6
Tunas									
	1991	22	7,479	2,719	2	599	0	10,821	19.0
	1992	28	10,210	3,928	3	831	0	15,000	19.3
	1993	5	7,683	5,724	1,538	2,186	0	17,136	21.3
	1994	1	6,808	3,362	557	836	0	11,564	15.1
	1995	0	7,784	2,874	3	40	3	10,704	12.7
	Mean	11	7,993	3,721	421	898	1	13,045	17.4
Other pelagics									
	1991	2,568	3,525	9,918	7,115	5,457	423	29,006	51.0
	1992	3,781	5,269	13,187	9,838	7,501	601	40,177	51.7
	1993	3,346	5,302	14,359	8,969	6,849	578	39,403	49.1
	1994	3,831	9,533	13,717	9,921	4,882	703	42,587	55.7
	1995	4,088	13,022	10,769	11,796	8,360	783	48,818	58.0
	Mean	3,523	7,330	12,390	9,528	6,610	618	39,998	53.3
Combined Pelagic Landings									
	1991	4,075	18,631	14,541	12,390	6,708	532	56,877	
	1992	5,652	25,445	19,705	16,902	9,222	731	77,657	
	1993	5,777	23,382	21,644	19,270	9,577	614	80,264	
	1994	8,555	27,534	17,367	16,042	6,137	770	76,405	
	1995	7,775	33,011	14,165	18,361	9,968	856	84,136	
	Mean	6,367	25,601	17,484	16,593	8,322	701	75,068	

TN = trawl net PS = purse seine GN = gillnet LN = lift net HL = hand line OT = others
 Source: Annual Fisheries Statistics of Malaysia (1991-1995)

Figure 1: Fishing grounds of Sabah, Malaysia.

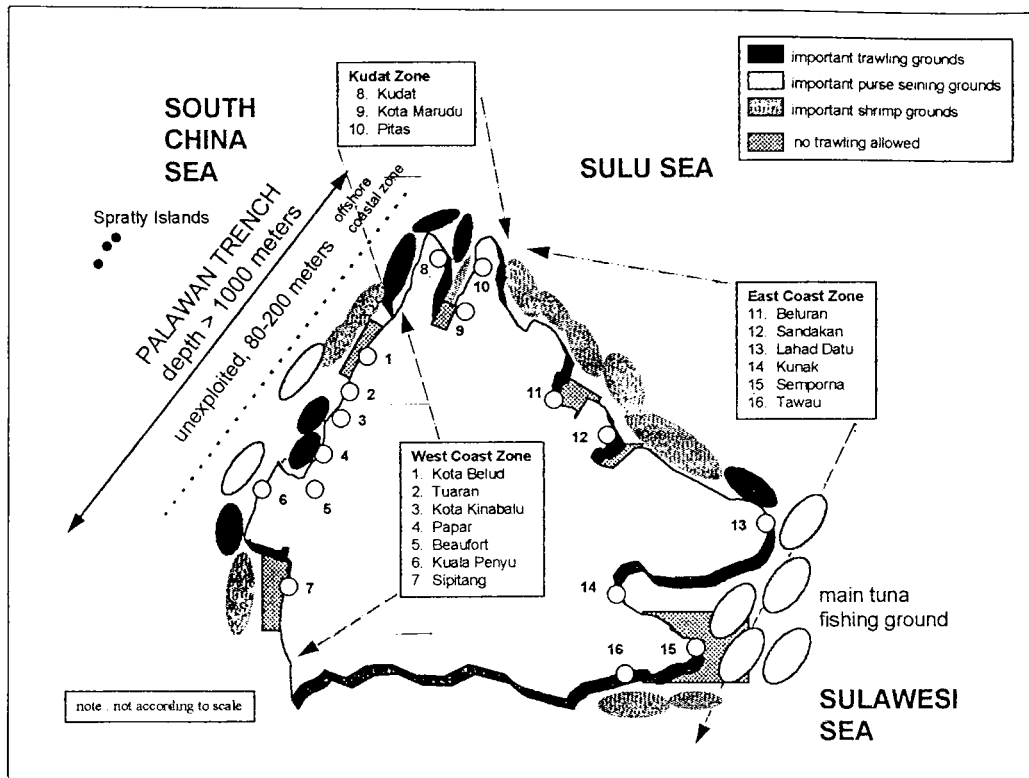


Figure 2: Breakdown of fishermen population by gear group, Sabah 1995.

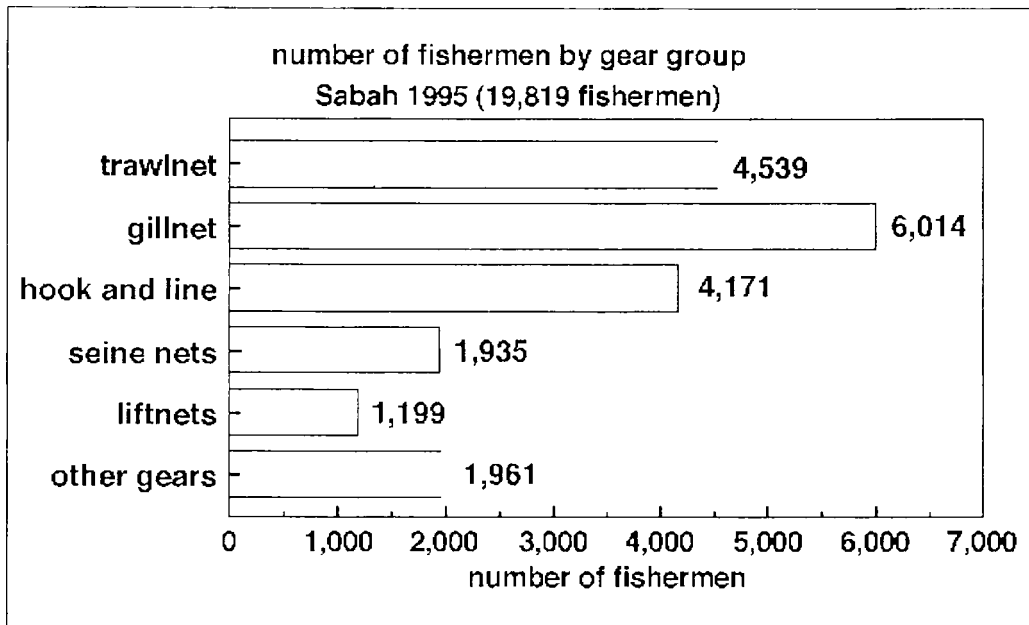


Figure 3: Landing breakdown of marine landings, Malaysia (1991-95).

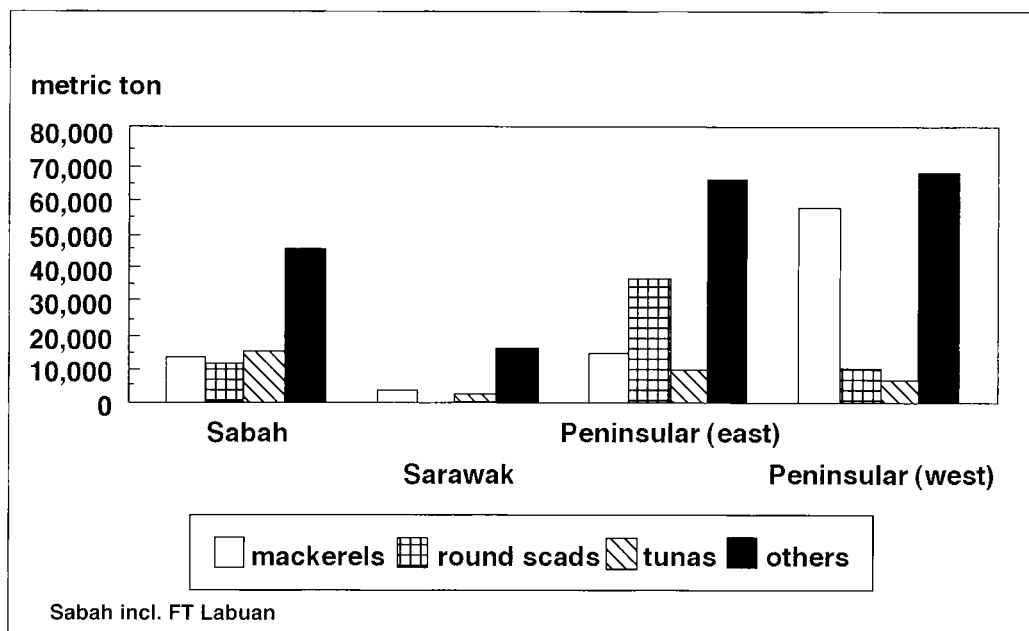


Figure 4: Landing breakdown of pelagic landings, Malaysia (1991-95).

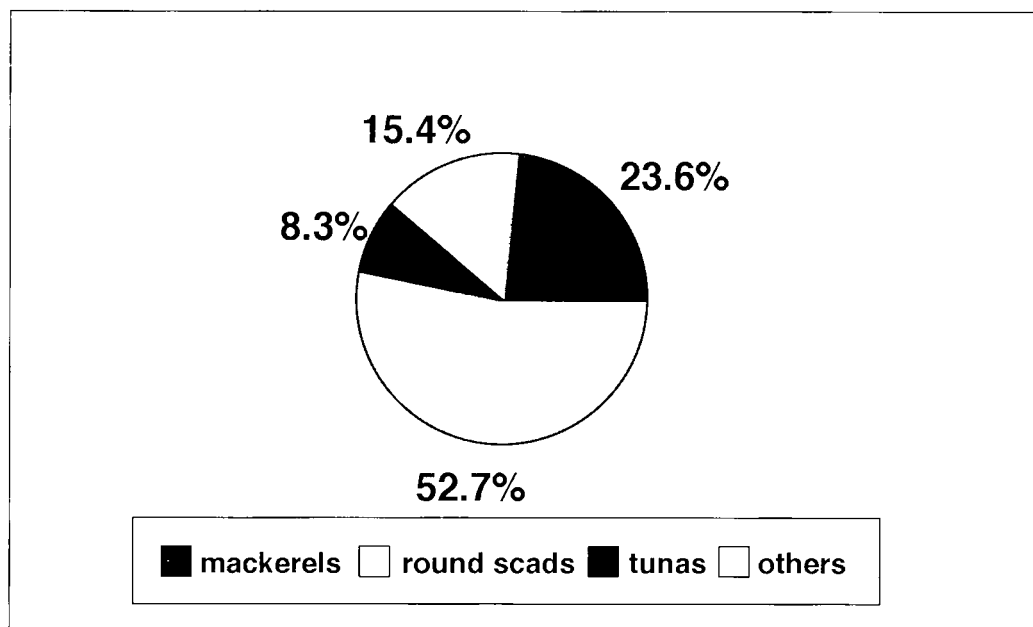


Figure 5: Species breakdown of pelagic landings, Malaysia (1991-95).

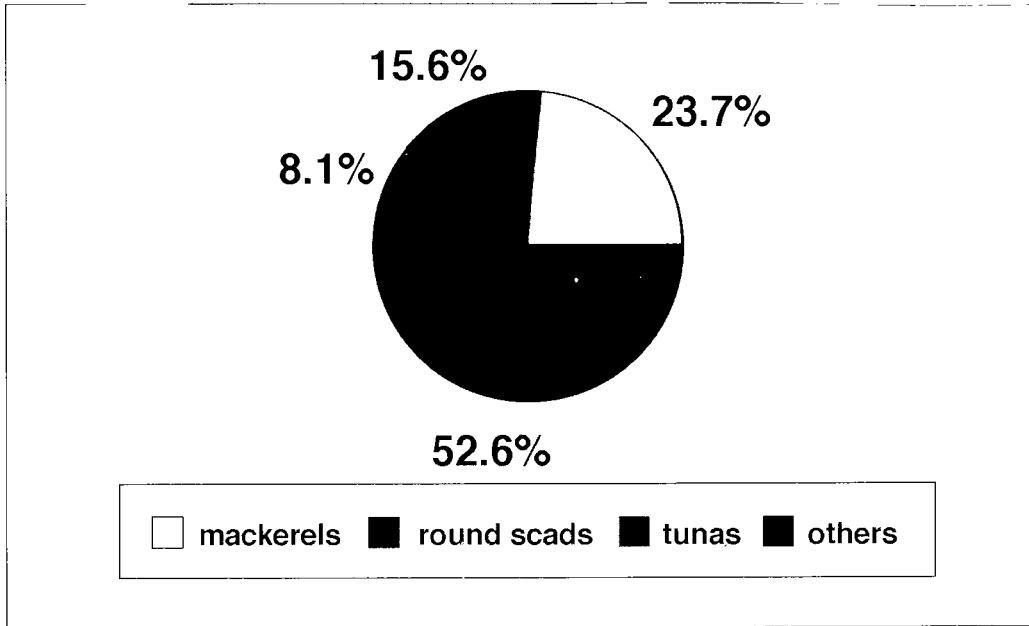


Figure 6: Species breakdown of pelagic landings, Malaysia (1991-95).

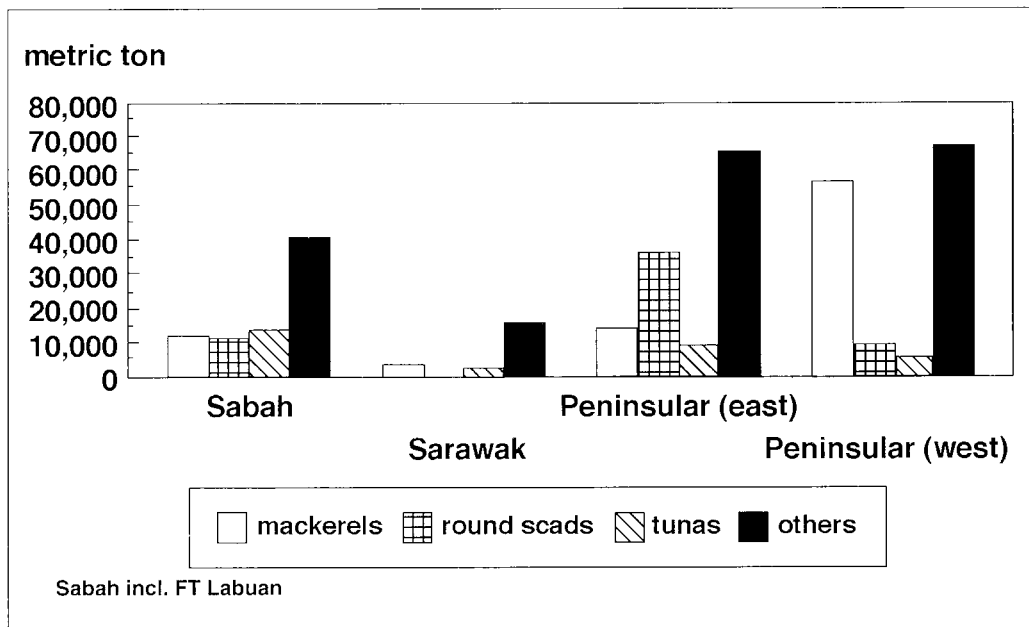


Figure 7: Landing breakdown of mackerel, Malaysia (1991-95)

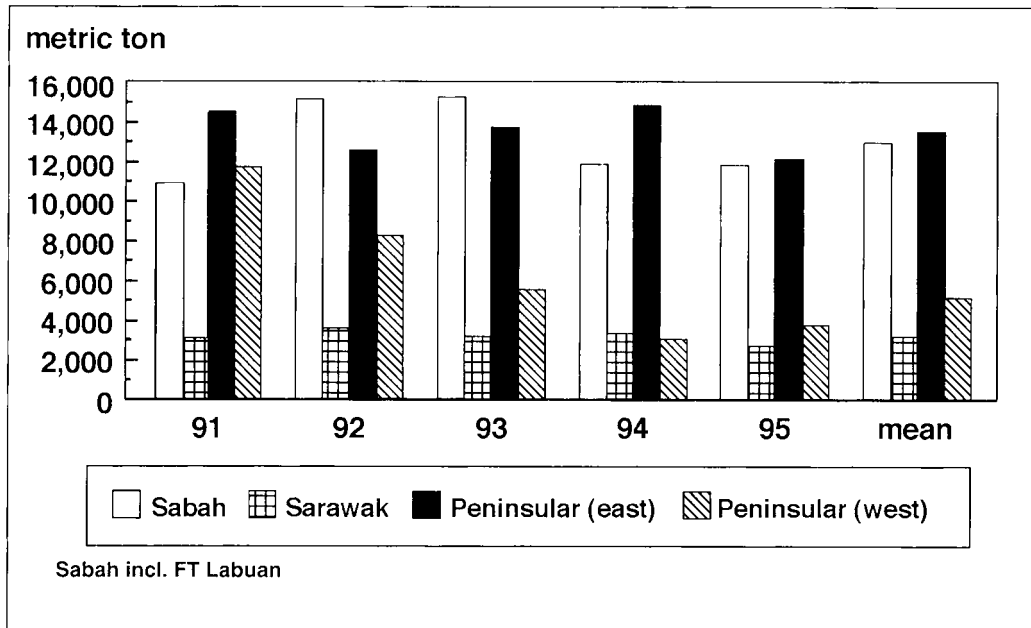


Figure 8: Landing breakdown of round scad, Malaysia (1991-95)

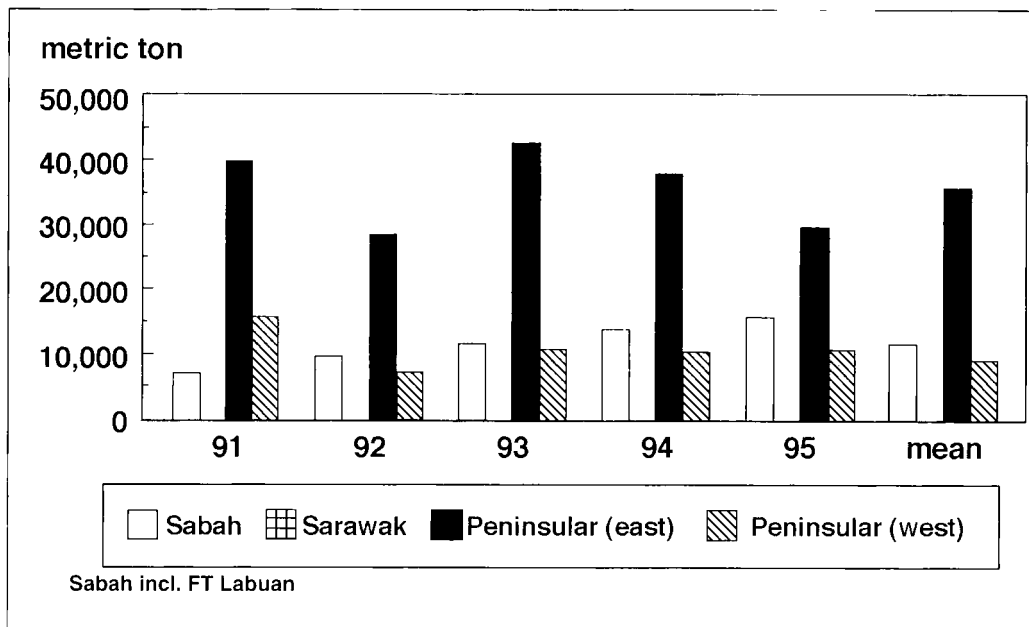


Figure 9: Fish landing breakdown of tuna, Malaysia (1991-95).

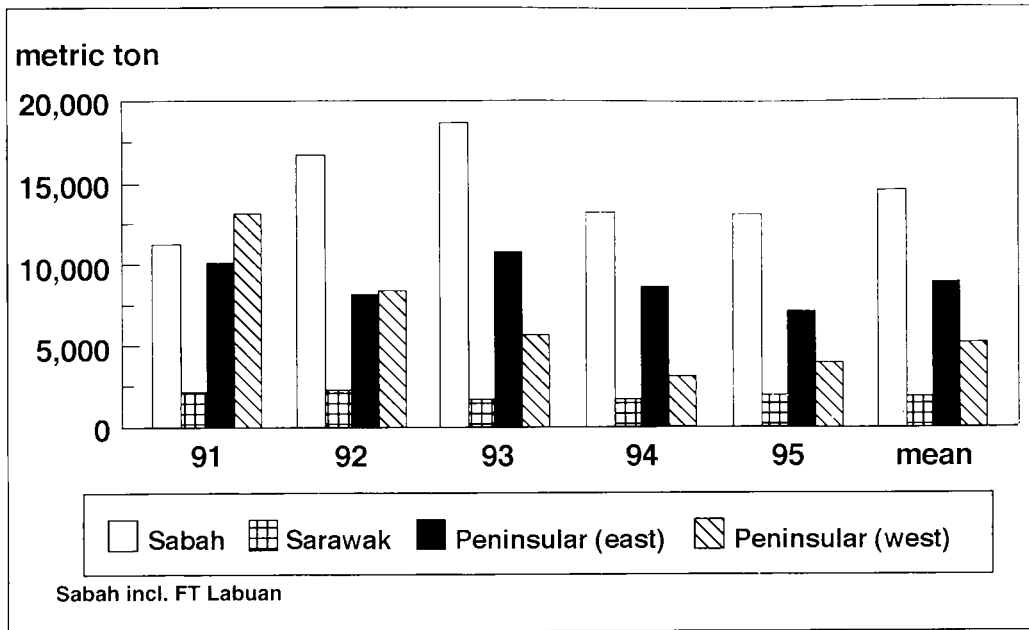


Figure 10: Fish landing breakdown of misc. pelagics, Malaysia (1991-95).

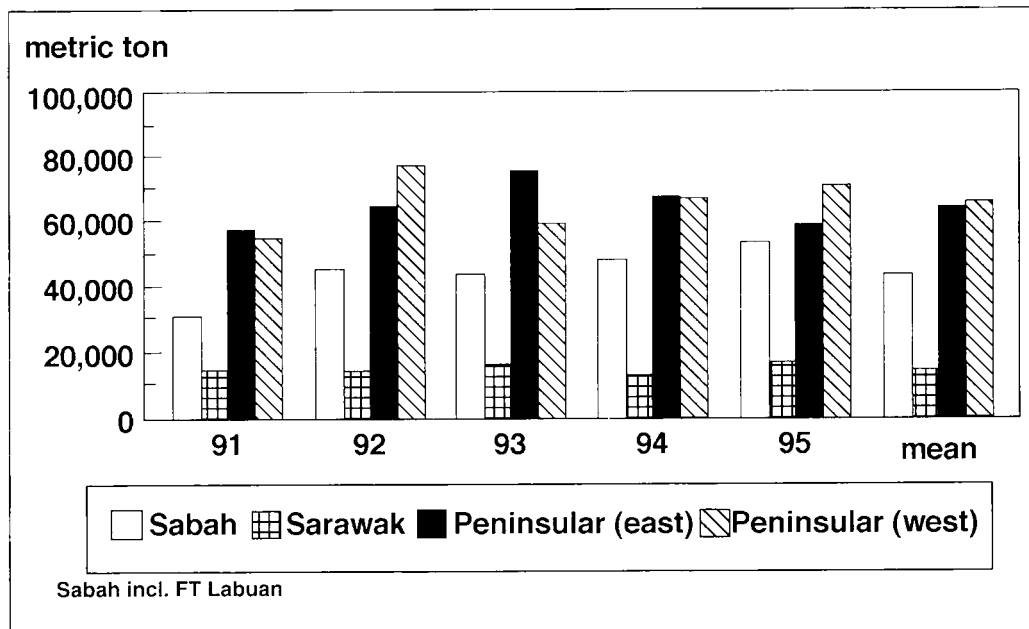


Figure 11: Marine Fish landing breakdown by gear group, Sabah (1991-95).

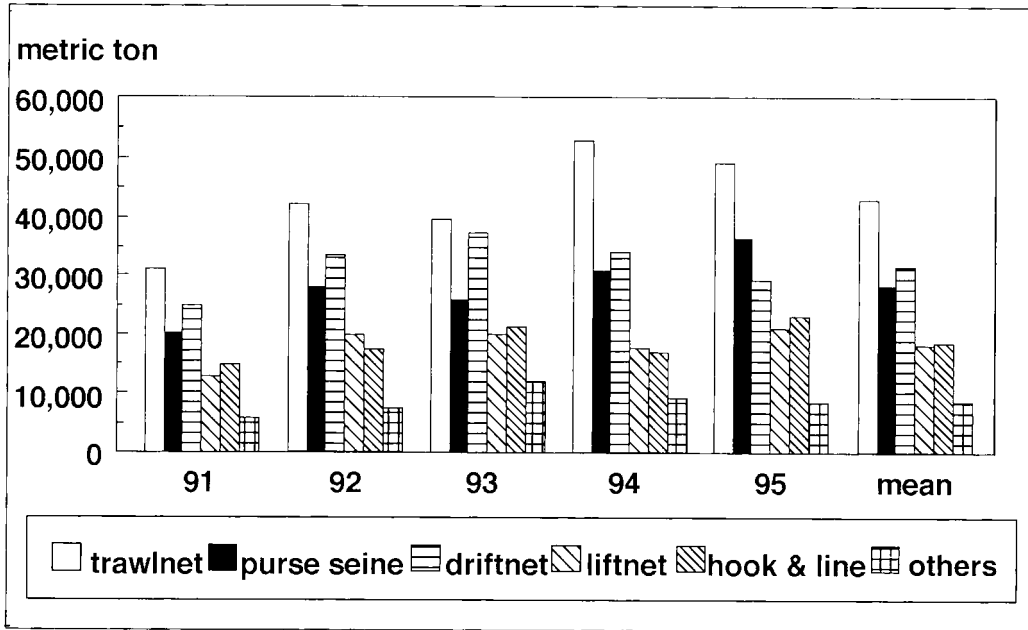


Figure 12: Fish landing breakdown by resource group, Sabah (1991-95).

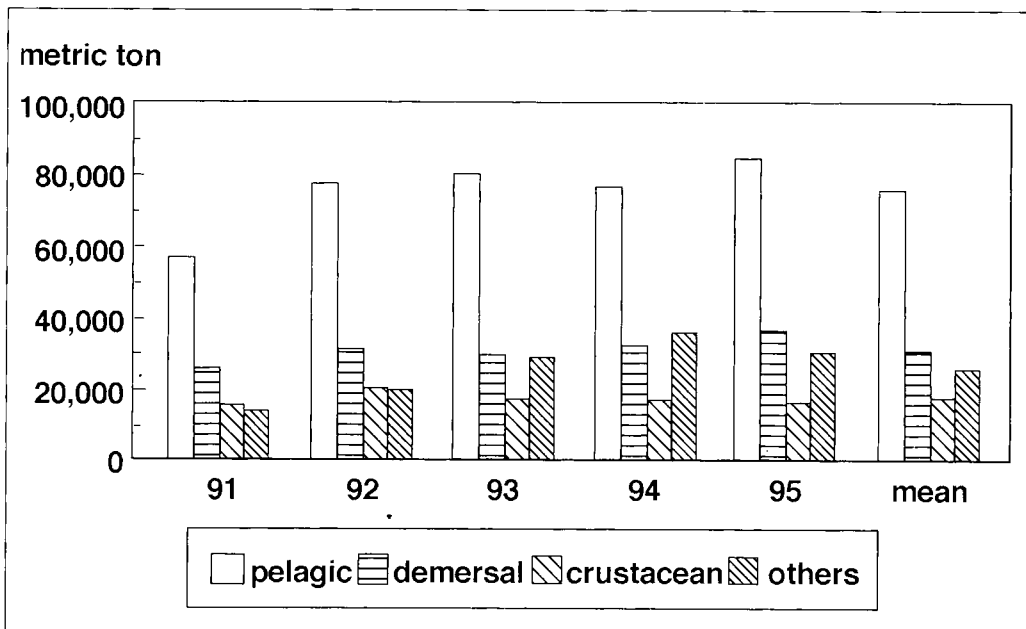


Figure 13: Gear landing breakdown of mackerel (*Rastrelliger*), Sabah (1991-95).

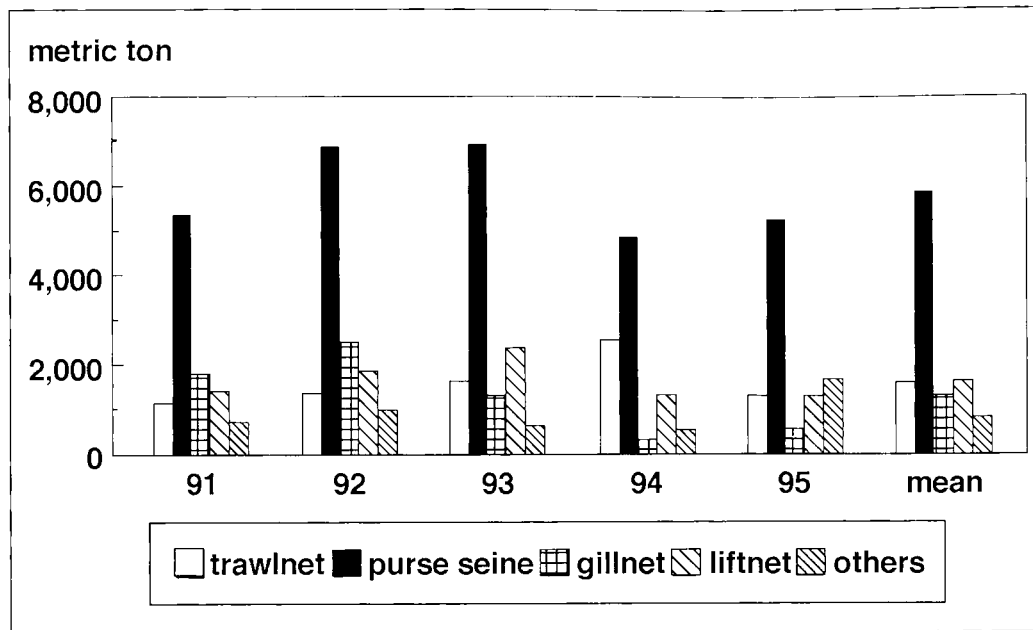


Figure 14: Gear landing breakdown of round scad (*Decapterus*), Sabah (1991-95).

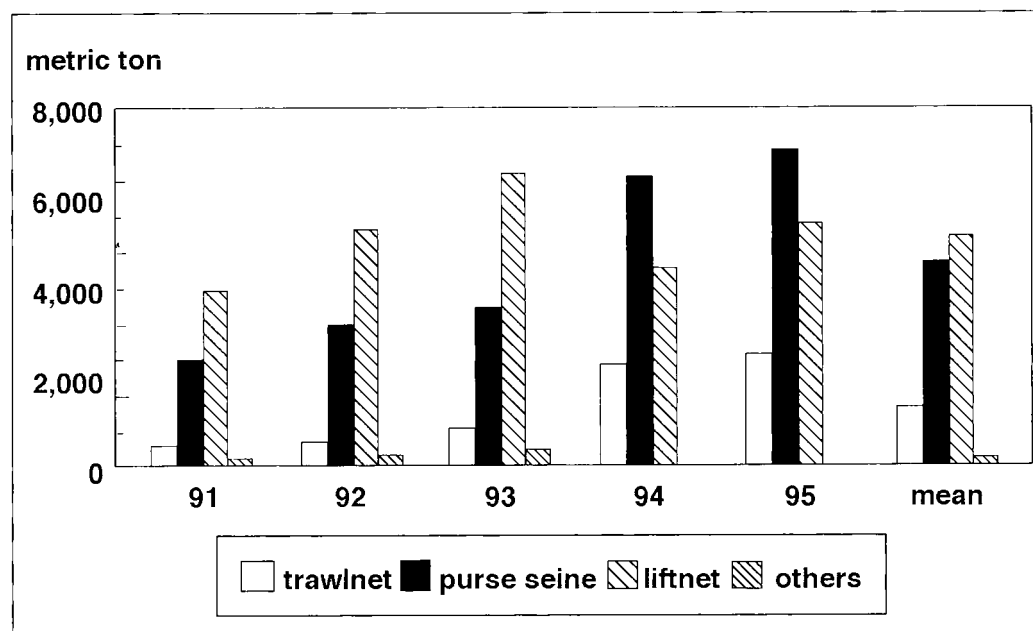


Figure 15: Gear landing breakdown of tuna (mixed species), Sabah (1991-95).

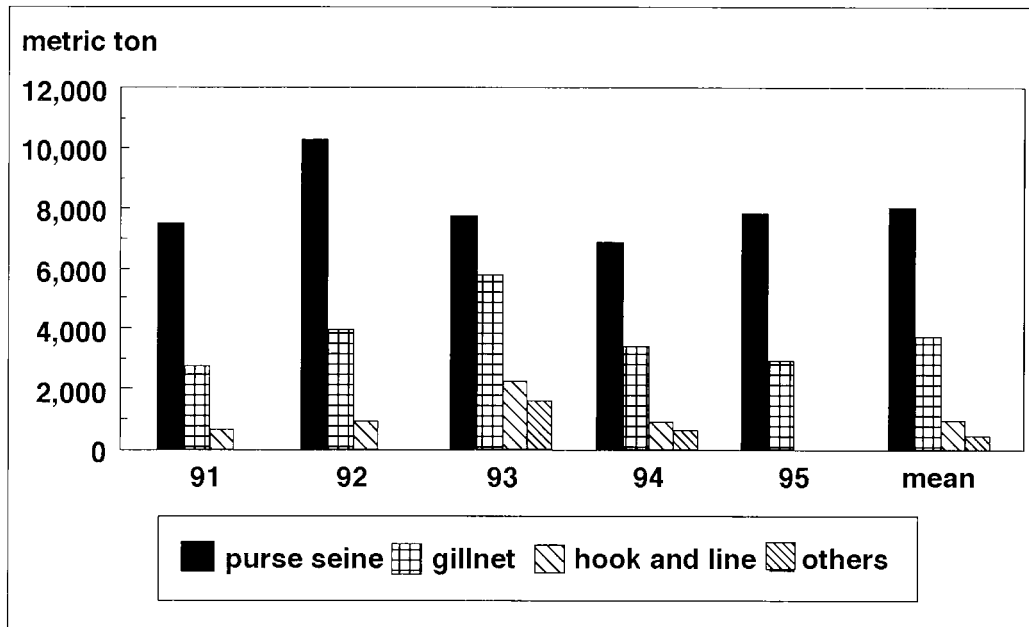


Figure 16: Gear landing breakdown of other pelagic species, Sabah (1991-95).

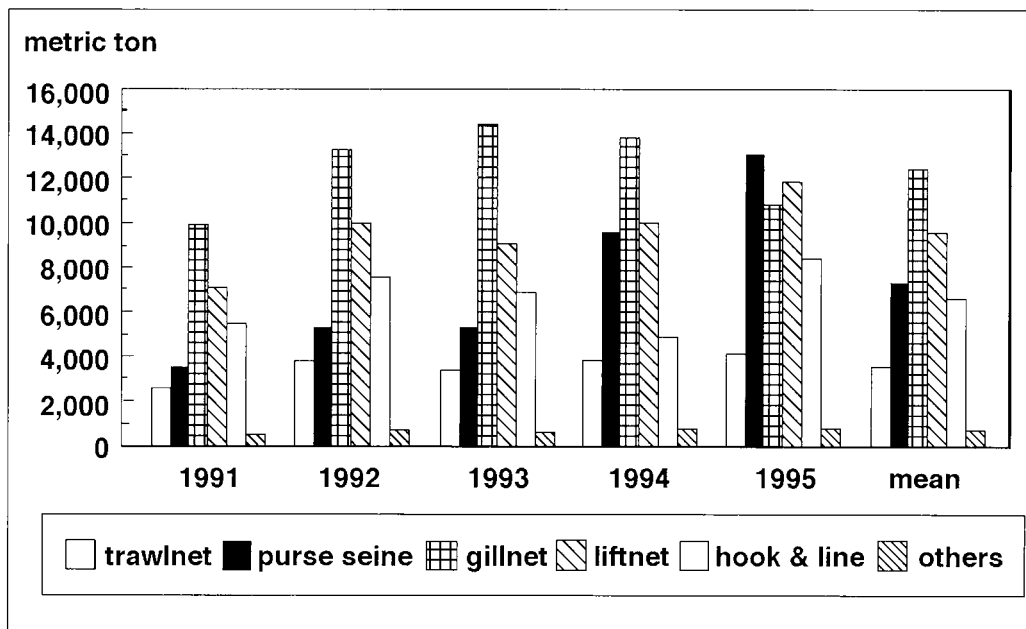


Figure 17: Yield per Recruit (Y/R) isopleth model of *Rastrelliger kanagurta* stock (South China Sea) (Loo = 35.7cm TL, K = 0.73/yr, Woo = 613 gram, M = 1.41/yr, Tr = 0.45 yr = 10cm TL)

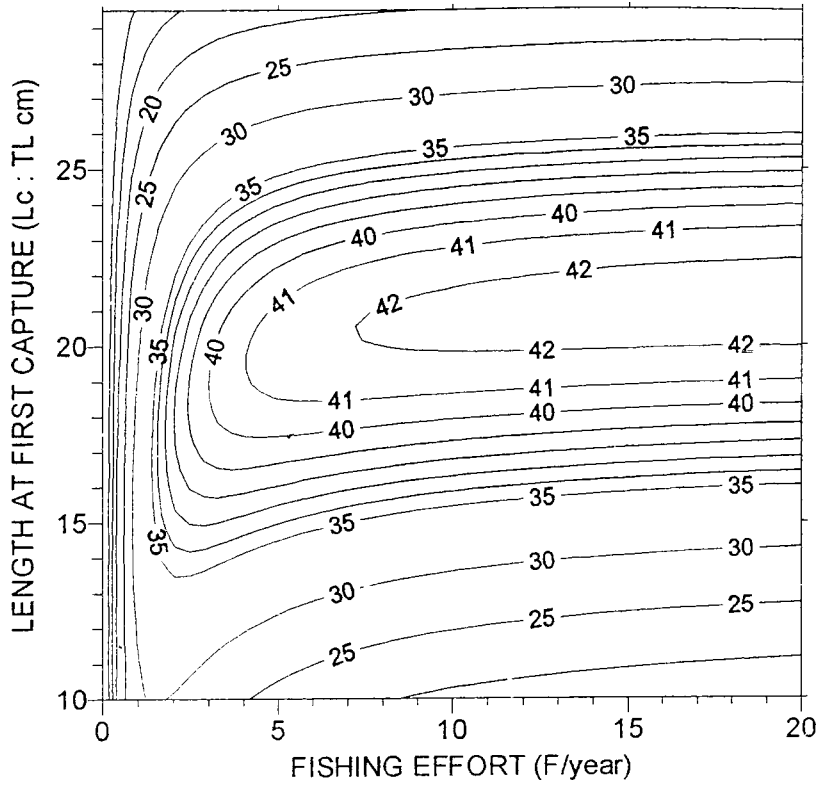


Figure 18: Yield per Recruit (Y/R) isopleth model of *Rastrelliger kanagurta* stock (South China Sea) (Loo = 33.8cm TL, K = 0.54/yr, Woo = 500 gram, M = 1.31/yr, Tr = 0.55 yr = 10cm TL)

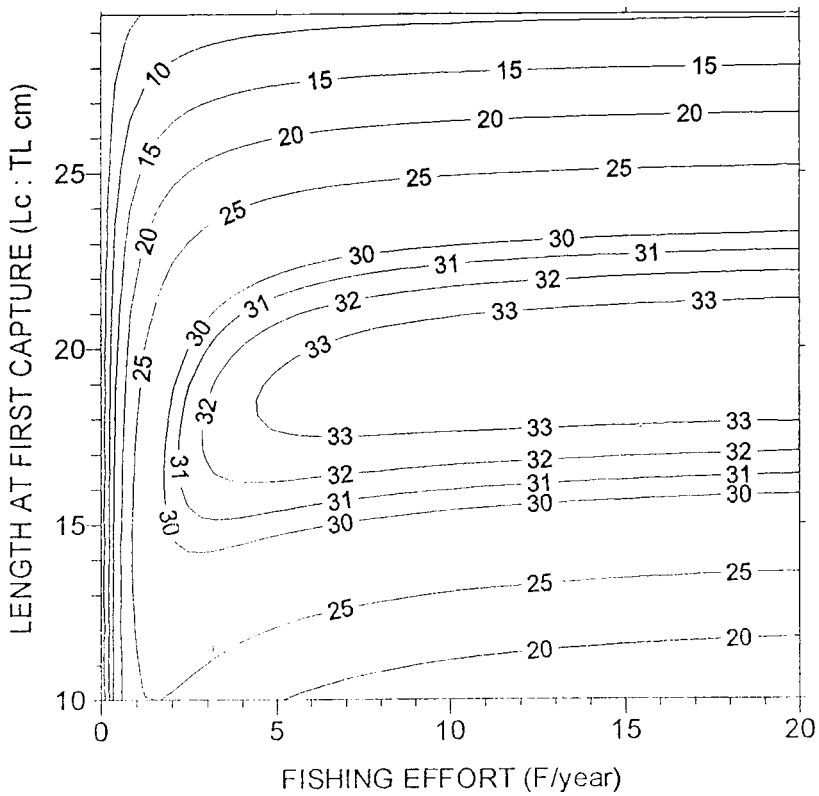


Figure 19: Yield per Recruit (Y/R) isopleth model of *Decapterus russelli* stock (South China Sea) (Loo = 27.3cm TL, K = 0.56/yr, Woo = 155 gram, M = 1.28/yr, Tr = 0.36 yr = 5cm TL)

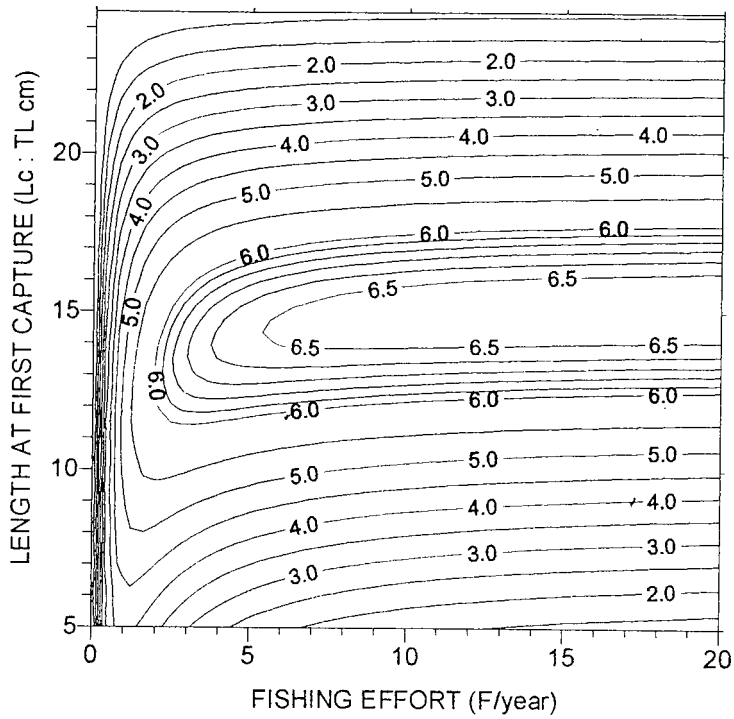


Figure 20: Yield per Recruit (Y/R) isopleth model of *Decapterus macrosoma* stock (South China Sea) (Loo = 30.0cm TL, K = 0.56/yr, Woo = 281 gram, M = 1.24/yr, Tr = 0.33 yr = 5cm TL)

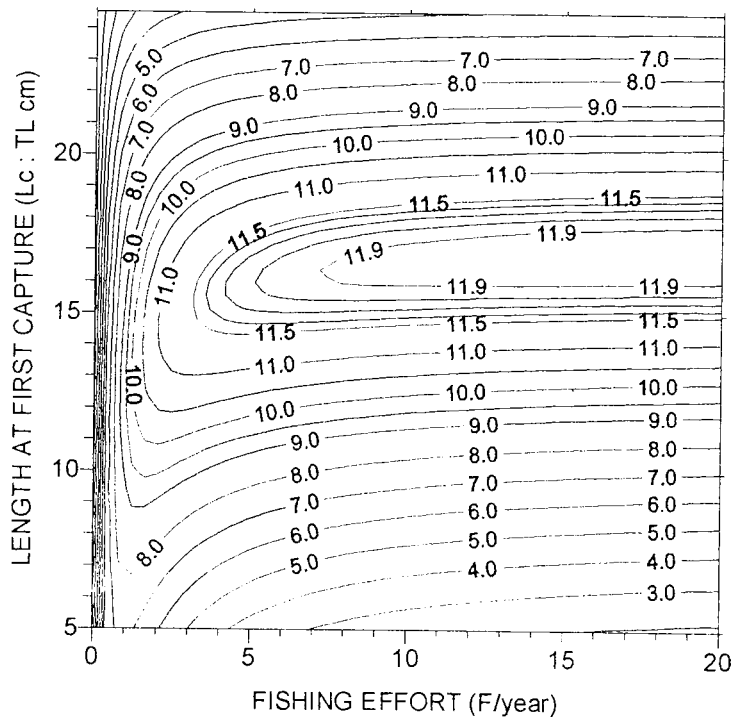


Figure 21: Yield per Recruit (Y/R) isopleth model of *Euthynnus affinis* stock (South China Sea) ($L_{\infty} = 66.8\text{cm TL}$, $K = 0.52/\text{yr}$, $W_{\infty} = 4087\text{ gram}$, $M = 0.95/\text{yr}$, $T_r = 0.50\text{ yr} = 15\text{cm TL}$)

