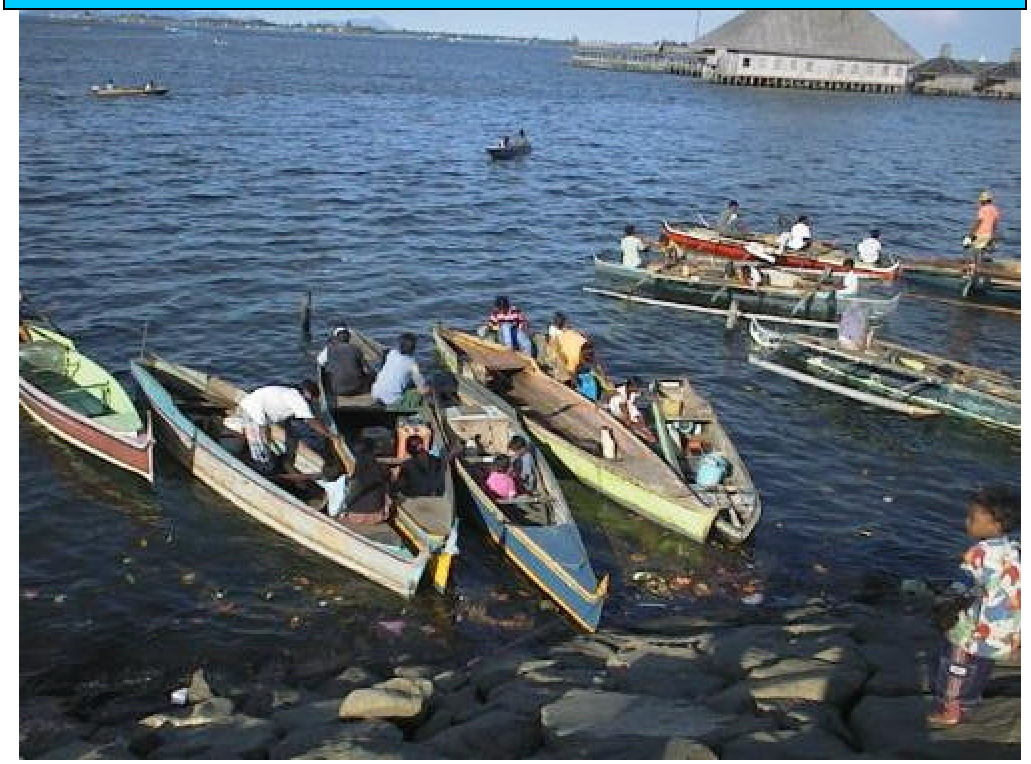
ASSESSMENT OF COASTAL FISHERIES IN THE MALAYSIAN – SABAH PORTION OF THE SULU SULAWESI MARINE ECOREGION (SSME)



Small-scale fishing boats in Semporna

Report Submitted to WWF Malaysia

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TABLE OF CONTENTS

LIST OF CONTENTS page

EXECUTIVE SUMMARY

Fisheries play a very important role in terms of providing food security, employment, trade and economies development of countries in the SSME (Sulu Sulawesi Marine Ecoregion). It is also a major contributor to the world supply of fish and home to 67% of the Southeast Asian population that is rapidly increasing. In general, the combined fish production of the Philiipines, Indonesia and Malaysia account for more than 50% of the total production in Southeast Asia. In 1996, the total fish production of Southeast Asia was about 14 million metric tons, with 75% from marine fisheries, aquaculture (17%) and inland fisheries (8%). In 1993, the combined fish landings of Indonesia, Thailand, Philippines, Malaysia, and Vietnam account for 94% of the fish production in Southeast Asia or 97% of the total fish production in FAO Fishing Area 71. It was reported that Southeast Asian countries exported over USD$ 5 billion per annum from marine fisheries alone.

In Malaysia, fisheries play an important role in the economic development including employment opportunities, its support towards economic growth, foreign exchange through fish exports, and most important is its role in the provision of food security for its increasing human population of 23.3 million. With the 200-nm ZEE declaration in 1984, its fishing grounds had increased by 3.5-fold from 47,000 nm^2 to 162,000 nm^2.

The fisheries industry in Malaysia can be divided into three sectors: marine fisheries, aquaculture, and public water bodies. At present, production from public water bodies has insignificant role in the fisheries industry, with more than 99% of the annual fish production contributed by marine fisheries and aquaculture. For management purposes, the marine fisheries sector in Malaysia is categorized into two (2) sub sectors: inshore and offshore (also called deep-sea) fisheries.

Fisheries management and conservation in Malaysia is governed by the Malaysian Fisheries Act 1985 (revised 1993), which has provisions for the conservation, management and development of fisheries. It is a federal law for the conservation, management and development of maritime and estuarine fishing and fisheries in Malaysian waters. Under this act, provisions pertaining to fishing effort regulation include limited entry through licensing, minimum mesh sizes, minimum harvesting of cockles, prohibition of destructive fishing gears and fishing zones defined by vessel size, engine power and method of fishing. The Act also contains provisions for the establishment of marine parks and reserves aimed at the conservation and rehabilitation of fish stocks and the environment.

In 1998, the total fish production amounted to 1,353,197 metric tons valued at RM4.53 billion, up 5.6% by volume and 4.1% by value over the previous year. Its contribution to the agriculture and national GDP both increased to 13.2% and 1.6% respectively from 12.6% and 1.6% in 1997. Marine fisheries contributed 1,215,060 metric tons valued at RM3.81 billion (89.8% by volume) to the total production. While the aquaculture sector contributed 133,647 metric tons valued at RM654 million or 9.9% by volume of the total fish production. Public w ater bodies contributed only 4,344 metric tons (0.3% of total fish production). The freshwater ornamental fish sector produced 325 million tails of fish valued at RM70.4 million that represents 1.68% of the total fish production value.

During the 1993-1998 period, Peninsular Malaysia – West Coast contributed about 44.9% of the annual fish landings, followed by Peninsular Malaysia – East Coast (28.6%), Sabah (15.3%), Sarawak (9.0%) and FT Labuan (2.2%). In terms on state contribution to the total fish landing in 1998, Sabah ranked second (16.2%) after Perak (17.6%). Combined with 50% of the fish landings in FT Labuan, makes Sabah on par with Perak as the top marine fish contributor in the country.

In general, trawling is the most dominant gear used, contributing more than 50% of the total landings. This is evident also from the high percentage of demersal finfish and shrimp in the annual marine fish landings that are mostly caught by this gear. Pelagic fishes make up more than 30% of the total marine fish landings, which make up the bulk of the purse seine net, gill net and lift net landings. During the 1993-1998 period, both commercial and traditional gears contributed 85% and 15% respectively to the total annual fish landings.

Demersal finfish make up 46% of the annual landings, followed by pelagic fish (36%), shrimp (8%), mollusks including cephalopods (7%) and other miscellaneous invertebrates (3%). Overall, demersal resources (including shrimp and mollusks) make up about 62% of the total fish landings in 1996-1998. In 1998, Sabah contributed 14% and 21% to the total demersal and pelagic landings respectively – with overall contribution of 16% of the total fish landings in the country. In Peninsular Malaysia and Sarawak, demersal fishes dominated the total landings. However, in FT Labuan and Sabah, pelagic fishes are dominant in the annual landings.

In 1998, commercial gears make up 1,065,260 metric tons or 87.7% of the total marine fish landings. In terms of commercial gear landings – trawlers contributed 63.9%, fish purse seine (20.5%), gill net (12.2%), anchovy purse seine (1.8%) and other seine net (1.5%). While traditional gears make up 12.3% (149,946 metric tons) of the total marine fish landings. In terms of landings – hook & line contributed 42.0%, followed by lift net (14.8%), Bag net (14.1%), push scoop net (10.2%), traps (9.8%), shellfish collector (3.6%), barrier net (1.3%) and other miscellaneous gears (4.1%). Sabah is the highest contributor of traditional gear landings (33.1%) in the country, followed by Terengganu (19.3%), Selangor (14.8%), Sarawak (11.6%), Perak (5.8%), Kelantan (5.7%) and other states contributing less than 5%.

The inshore fishery sub sector comprised of fishing vessels of below 70 GRT operating various types of gears in both inshore and coastal waters. In 1998, about 1,079,953 metric tons of fish was landed, with an increase of 19.76% from 901,802 metric tons in 1993. Overall, inshore fisheries contributed 89% of the total marine landings. However, no significant increase in fish landings is expected from this fishery, where annual landings seems to have stagnate around the 1.1 million metric ton level, where except for Sabah and Sarawak, where there is still some room for development especially for pelagic exploitation in the South China Sea and Sulawesi Sea (around the Sipadan – Ligitan Islands). In 1998, West Coast of Peninsular Malaysia contributed about 508,464 metric tons, followed by East Coast of Peninsular Malaysia (294,362 metric tons), Sabah (190,992 metric tons), Sarawak (81,874 metric ton) and FT Labuan (4,271 metric tons) to the total inshore fish landings. Inshore fisheries contributed RM3.45 billion in 1998 or 90.4% of the total wholesale value marine fish landings. Overall, the inshore fisheries had increased by value to 63.5% in 1998 from RM2.11 billion in 1993.

The deep-sea fishery sub sector includes fishing vessels of more than 70 GRT which uses various types of gears including trawl net, purse seines, long lines, drift gill nets and operate a distance beyond 30 nm from the coast. In 1998, deep-sea fisheries landed 135,253 metric tons or 11% of the total landings, showing a decline of 7.07% compared to 1993 (145,549 metric tons). The decrease in fish landings was due to the declining number of fishing vessels in operation as well as other unknown internal and external factors. Trawlers contributed the bulk (63.5% or 85,831 metric tons) of the deep-sea fish landings, followed by fish purse seines (36.2% or 48,996 metric tons) and long lines (0.3% or 426 metric tons). About 37.4% of the trawl landings come from the east coast of Peninsular Malaysia, followed by west coast of Peninsular Malaysia (34.8%), Sarawak (23.8%) and FT Labuan (3.9%) with no landings recorded in Sabah. For fish purse seine landings, east coast of Peninsular Malaysia contributed almost 50%, followed by the west coast of Peninsular Malaysia (26.2%), FT Labuan (12.6%), Sabah (10.3%) and Sarawak (1.4%). Long line landings make up only 0.31% of the total landings, with fishing operations confined to the waters off East Malaysia – Sarawak (46.7%), Sabah (46.0%) and FT Labuan (7.3%). In 1998, the east coast of Peninsular Malaysia contributed 56,399 metric tons, followed by west coast of Peninsular Malaysia (42,718 metric tons), Sarawak (21,399 metric tons), FT Labuan (9,562 metric tons) and Sabah (5,235 metric tons) to the total deep-sea fish landings. Deep-sea fisheries contributed RM0.37 billion in 1998 or 9.6% of the total value of marine fish landings. Deep-sea fisheries had increased by value to 37.1% from RM0.27 billion in 1993.

The aquaculture sector in Malaysia is in its developing phase. In terms of operation scale, small fish farms tend to be more dominant with only a small number are considered to be commercially oriented in practice. There are several fish culture systems that have already been successfully operated and/or being developed in Malaysia. These systems include: mollusks culture (cockle, mussel culture, oyster), freshwater fish culture (earthen ponds, ex-mining pools, cage, concrete ponds and pens), brackish earthen pond culture (finfish and shrimp), marine finfish cage culture; and marine seaweed culture (in Sabah).

Aquaculture contributed 9.3% by volume and 12.2% by value to the annual fish production during the 1993-1998 period. In 1998, aquaculture production (excluding freshwater ornamental fish) increased by 27% to 133,648 metric tons from 105,237 metric tons in 1993. In terms of production value, it increased by 124% from only RM292 million in 1993 to RM654 million in 1998. In freshwater aquaculture, the common cultured species are: tilapia (*Oreochromis* spp.), catfish species (*Clarias* spp. and *Pangasius* spp.), giant freshwater prawn (*Macrobranchium rosenbergi*), Javanese carp, bighead carp, grass carp, common carp, freshwater eels, various local cyprinids, snakehead and marble goby. In marine and bracksihwater aquaculture, the popular culture species are cockle (*Anadara granosa*), mussel (*Perna viridis*), oyster (*Crassostrea* spp.), shrimp (*Penaeus monodon, P. mergueinsis*), seabass (*Lates calcarifer*), groupers (*Epinephelus* spp.), mangrove snappers (*Lutjanus* spp.), seaweed (*Eucheuma cottonii*), mangrove crabs and various species of high value reef fishes (mainly in Sabah).

In 1998, aquaculture production amounted to 135,433 metric tons with a farm gate value of RM658 million including 1,785 metric tons of seaweed worth RM3.6 million from Sabah. Mollusk culture contributed 61.2% to the total production volume, followed by freshwater earthen pond culture (19.5%), brackish water pond culture (8.6%), marine fish cage culture (4.4%), ex-mining pool culture (2.7%), freshwater fish cage culture (1.5%), seaweed culture (1.3%), freshwater cement tank culture (0.6%) and freshwater fish pen culture (0.2%). Brackish water pond culture contributed 46.9% to the total production value, followed by freshwater earthen pond culture (25.4%), marine fish cage culture (12.7%), mollusk culture (10.2%), ex-mining pool culture (1.9%), freshwater fish cage culture (1.7%), seaweed culture (0.5%), freshwater cement tank culture (0.5%) and freshwater fish pen culture (0.2%). Excluding mollusks and seaweed, marine fish including crustaceans contribute 35% by volume and 67% by value to the total aquaculture production in 1998. Economic analysis of the total aquaculture production by culture system in 1998 clearly shown that Sabah plays an important and critical role in the development of the aquaculture sector in the country.

There are a total of 3,412 establishments involved in food processing in Malaysia, of which 96% are categorized as small and medium-scale industries (SMI). The fish processing industry in Malaysia is dominated by the small and medium-scale operators. Most of the processing establishments are small and mainly located along the coastal zone, close to fish landing points except for bigger establishments that process canned, frozen, *surimi* and *surimi*-based products. Traditional fish products processed in Malaysia can be broadly categorized into fish snacks, salted and dried, *surimi* and *surimi*-based, fermented and miscellaneous products. Most are operated at both small scale or cottage level using traditional methods and the market is limited in most cases for local consumption. These industries produce products such as dried salted fish, fish crackers, shrimp paste, fermented anchovies, fish satay, fish ball and fish cake. R&D efforts in Malaysia are now focused on upgrading production efficiency and development of new products.

The total export volume of fishery commodities in 1998 amounted to 144,540 metric tons of fish (RM1.23 billion), with an increase of 34% by volume and 31% by value compared to 1997. Crustaceans and mollusks – in fresh, chilled, frozen, salted and dried forms, make up 54% by value (33% by volume) of the total exports in 1998. Imports of fishery commodities in 1998 amounted to 249,860 metric tons (RM0.91 billion), with a decrease of 16% by volume and 7% by value compared to 1997 – showing a deficit trade balance volume of 105,320 metric tons and surplus trade balance value of RM324 million. Fish – in fresh, chilled and frozen, make up 60% by value (75% by volume) of the total imports in 1998.

The average value of exported fisheries products had increased by 142.9% from RM3.51/kg in 1994 to RM8.53/kg in 1998. Correspondingly, the value of imported fisheries products also increased at a much lower 24.1% from RM2.93/kg in 1994 to RM3.64/kg in 1998. During that period, Malaysia's annual fisheries imports and exports averaged 276,798 metric tons (RM882 million) and 176,332 metric tons (RM951 million) respectively.

Malaysia's main export partners are Thailand, Japan and Singapore. In 1994, 76% of Malaysia's total fish exports were to these countries: Thailand (32%), Japan (22%) and Singapore (22%). However, in recent years (from 1995 onwards), Malaysia had found new niche markets in Europe, USA and other parts of Asia. This also corresponded with decreasing exports to Thailand, Japan and Singapore during that particular period. Exports to Japan had decreased by 67% from 55,320 metric tons in 1994 to 18,310 metric tons in 1998. While fish exports to Singapore had decreased by 62% from 54,110 metric tons in 1994 to 20,390 metric tons in 1998. Fish exports to Thailand decreased by 66% from 77,530 metric tons in 1994 to 26,540 metric tons in 1998. Overall, fisheries exports to Japan, Singapore and Thailand represented only 45% of

Malaysia's total export volume in 1998. Malaysia's traditional import partners are Thailand and Indonesia. In 1998, about 77.5% by volume (56.0% by value) of Malaysia's total fish imports were from Thailand (147,352 metric tons, RM271.14 million) and Indonesia (46,172 metric tons, RM237.31 million). Other countries that contribute to Malaysia's fisheries imports are India, Taiwan, New Zealand, United Kingdom, Myanmar and Chile.

Fish imports from Indonesia in 1998 amounted 46,172 metric tons, up by 30% compared to 35,557 metric tons in 1994. This translated into 12.9% and 18.5% of the total imports in 1994 and 1998 respectively. Fish exports to Indonesia are less than 2,000 metric tons annually and comprised mainly of canned products and other fish products that had been imported from other countries including Thailand – with substantial increase noted in 1998-1999 due to fish meal imports from Sabah. Existing official records indicated negligible trade volume with the Philippines and it is mainly due to most of the fish trade transacted between Sabah and the Southern Philippines not being documented. Imports from the Philippines consisted of dried fish products. While exports to the Philippines consisted of canned fish and other dried products including dried anchovies from Sabah.

The inshore fishery sub sector in Malaysia is already heavily exploited with compelling evidence showing that present exploitation is already beyond the upper limit of sustainable production in many areas especially in Peninsular Malaysia. In the deep-sea sub sector, some areas in the Peninsular Malaysia had probably reached the lower limit of sustainable exploitation where future development will be focused on deep-sea areas off the states of Sarawak and Sabah, which are relatively underexploited. Based on the present scenario, further development of the fisheries industry is geared towards the sustainable utilization of deepsea fisheries and and enhancing aquaculture production while sustaining inshore fisheries at its present exploitation level. The future development of these two sectors had been given special attention and focus under the third National Agriculture Policy (1999-2010). A significant portion of the potential areas for future development lies in Sabah – Malaysian portion of the SSME area.

In 2000, the population of Malaysia is around 23-odd million, with 11% residing is in the state of Sabah. The population of Sabah including the transient population is around 2.45 million, of which 75% of them live and work in the coastal zone. The total land area that falls within the Malaysian SSME portion in Sabah represents 65% of the state area or 15% of the country total. About 52% of the state population live and work in the Malaysian SSME, which represents 5% of the country population total.

The state of Sabah located on the northern part of Borneo Island (4^{o}10' - 7^{o}40'N and 115^{o}10' - 119^{o}20'E), is bordered by Brunei on the southwest and Indonesia on the south. With a total land area of 74,236 km^2 – with 60% covered with forests, Sabah has the second largest area (after Sarawak) among the 13 states in Malaysia. Considering all coasts with direct marine exposure (lagoons, mainland and islands), the total length of Sabah coastline becomes around 4,315 km including islands and lagoons, making it being the longest coastline in Malaysia. Sabah borders the South China Sea on its west coast, the Sulu Sea on the northeast and the Sulawesi Sea on its southeast coast. The state territorial waters extend to 12 nautical miles. Malaysia maintains an Economic Exclusive Zone (EEZ) of 200 nautical miles or until the 200-meter isobath whichever is the furthest distance. The territorial waters of Sabah cover around 51,360 km^2 or about 32% of the Malaysian EEZ (170,773 km^2).

The agriculture sector, including forestry, livestock and fishing, contributed the largest portion to the state GDP, making up 41% of the state GDP of RM9.1 billion in 1999. Fisheries alone make up 7% of the agriculture GDP or 2% of the state's annual GDP. In terms of employment, the agriculture sector has the largest work force with 32% of the state's total in 1999.

The development setting in Sabah encompasses both national and state policies. In the national context, the development of Sabah is closely tied to the objectives of the 8th Malaysian Plan (2001-2005), the National Development Policy during the period of the 3rd Outline Perspective Plan OPP3 (2001-2010), Vision 2020 and the 3rd National Agriculture Policy (1999-2010). In the state context, the agriculture development in Sabah (including fisheries) is closely tied with the Outline Perspective Plan Sabah (OPPS: 1995-2010) and the second State Agriculture Policy (1999-2010).

There are 18 administrative districts in the coastal zone – including two municipalities and the City of Kota Kinabalu. Ten coastal districts make up the Malaysian portion of the SSME area, comprising of three sub zones: SSME-1 (Kudat, Kota Marudu, Pitas) in the north; SSME-2 (Sandakan, Kinabatangan, Beluran) in the northeast; and SSME-3 (Tawau, Semporna, Lahad Datu, Kunak) inn the southeast.

The Malaysian SSME area covers an area of 48,393 km^2 or 65% of the state land area, which comprised of 3% (1,485 km^2) on islands, 50% (24,359 km^2) on the coastal mainland and 47% (22,549 km^2) in the non-coastal area. The coastal zone of the SSME making up 89% of the state total (29,074 km^2), covers an area of 25,844 km^2 or 53% of the SSME total land area, with 94% of it on the mainland and 6% on islands. The coastal waters in the SSME area cover an area of 28,966 km^2 or 53% of the state total (51,360 km^2). The SSME area has a total coastline of 3,557 km or 82% of the state total coastline (4,316 km), with 27% (947 km) distributed along the mainland proper – 74% state total (1,285 km), 26% (925 km) along lagoons – 78% state total (1,185 km) and 47% (1,685 km) around the islands – 91% state total (1,846 km). The characteristics and fisheries profile of the coastal districts that fall within the SSME area are described in this report.

The major part of the fishing grounds in Sabah lies in the South China Sea that extends to the limit of the continental shelf off the west coast. The continental shelf is about 100 km in width and extends up to the 200-metres depth contour. The fishing grounds on the east coast are limited in area and in close proximity with the international boundaries between Malaysia – Philippines for SSME-1 and SSME-2 and between Malaysia – Indonesia for SSME-3. SSME-1 is bounded by the South China Sea on the western part and Sulu Sea in the north. Fishing grounds of SSME-2 and SSME-3 are respectively in the Sulu Sea and Sulawesi Sea. In general, most of the fishing activities in Sabah are concentrated in coastal waters within the 30 nautical mile zone sustaining both traditional and commercial fisheries sectors. On the other hand, the offshore fishing waters beyond 30 nautical miles (west coast) are still not yet fully exploited fully by the local fishing fleet. On the east coast, fishing is also contrainted by security problems. Most of the inshore coastal zone is trawlable, with substrates ranging from soft corals, mixture of mud-sand to muddy bottoms. Untrawlable areas including mainly in reef areas off Semporna, some parts on the west coast and northern Kudat are important fishing grounds for both commercial and traditional fishing vessels.

There are five main shrimp fishing grounds in Sabah; Brunei Bay; between Tuaran and Kota Belud; Marudu Bay in Kudat - SSME-1; Labuk Bay in Sandakan - SSME-2; Cowie Bay in Tawau – SSME-3 and Darvel Bay in Lahad Datu – SSME-3. These areas are located within the inshore waters and the 50-m depth tends to define the outer limit of commercially viable shrimp trawling operations. On the east coast, the major trawling areas are in Tawau, Darvel Bay, and between Tambisan Island and northern Sandakan (Marchesa Bay and Labuk Bay). Fishing grounds on the east coast are limited in area due to close proximity with international waters. On the west coast, the trawlable grounds are more extensive, stretching from the Brunei Bay in the south up to the southwestern portion of Kudat Peninsular. Mangroves are highly productive ecosystems and are reported to be critical to the life cycles of most marine life including shrimps. High shrimp catch rates were often observed in most areas adjacent to extensive mangrove swamps and river estuaries (e.g. Labuk Bay, Brunei Bay, Marudu Bay, Cowie Bay). There is a total of 316,000-odd hectares of mangrove swamps in Sabah, out of which a large portion is protected as mangrove forest reserves. The coral reefs in Sabah are in various stages of degradation due to land-based pollution, sedimentation and destructive fishing practices (blast and cyanide fishing).

There is a paucity of information and enormous knowledge gaps pertaining to the distribution, biology and stock assessment of fisheries resources in Sabah. Previous preliminary studies had been concentrated in the non-SSME area, with very limited work done in the SSME area. At present, the potential yield of marine fisheries resources in Sabah is still unknown. Analysis of historical landing data and results obtained from past resource surveys gave a preliminary MSY estimate around 350,000 metric tons. However, this estimate should be taken with great caution until more rigorous resource assessment are carried out.

At present, fishing activities in the state are mainly concentrated within the 30 nautical mile limit and thus Sabah's fisheries may be termed as predominantly coastal. Some of the resources have have already shown signs of overfishing, particularly for shrimps resources. Fishing grounds that still have some room for further development include the Sipadan-Ligitan waters off Semporna, Malaysian EEZ waters along the Palawan Trench, and the outer portion (>100 meter depth) of the continental shelf along the west coast.

Among high-value resources found along the outer west coast of Sabah include various species of invertebrates, coastal tunas and small pelagics. Past resource surveys and fishing operations shown that there are abundant small pelagics and oceanic tunas in these offshore waters. However, the economic viability of exploiting these fishing grounds is still unknown because of insufficient catch and effort data to carry out a thorough evaluation of available fisheries resources.

The marine fishes assemblage in Sabah is typical of tropical demersal (including reef fishes) and pelagic communities in the Indo Pacific region. There are about 400 pelagic species representing 170 genera and 100 families in Sabah waters. On the other hand, the pelagic fish assemblage comprised of about 100 species distributed among 50 genera and 20 families.

In general, about 200-300 species of marine fishes are landed in the major landing sites, with an average of 50-100 species being displayed for sale daily in the fish markets. Additional seasonal species may appear from time to time depending on the time of the year. Some species were found to predominate market landings during the monsoons, while other permanent residents of estuaries, bays and reef areas are usually landed throughout the year. The temporal and spatial distribution of fish landings are closely linked with the monsoons. In general, fish supply is relatively lower during the northeast monsoon (*musim tengkujuh*) months of January to March. In some areas, fish landings might increase during the *tengkujuh* period where pelagic fishes migrate to inshore waters to avoid the strong winds and currents prevailing in the open seas.

In general, fishing operations in Sabah can be broadly categorized into two groups: commercial and traditional sectors. The commercial fishery sector involved fishing using various types of commercial gears operated by motorized vessels in both coastal and offshore waters. On the other hand, the traditional fishery sector involved fishing using various types of traditional gears operated by non-motorized and motorized boats in both inshore and coastal waters. The former is better organized, more capital intensive and accounts for greater income as opposed to latter, which is much smaller, dispersed and often fragmented in organization, high labor intensive and low in capital investment. The fishing gears used in the fisheries industry in Sabah are decribed in detail in this report.

There are 590-odd fishing villages scattered along the coast of Sabah, with 389 fishing villages (66% state total) in the SSME area. 360 villages or 67% of the SSME total are confined in four districts: Beluran, Semporna, Kudat and Lahad Datu. In the non-SSME area, there are 201 fishing villages (34% state total), with 147 or 73% non-SSME total confined in four districts: Beaufort, Papar, Kota Kinabalu and Kuala Penyu. The fishing villages in Sabah has an average of 39 fishermen per village, with high densities noted for Sandakan (133), Kota Belud (86), Tawau (57), Kota Kinabalu (49), Pitas (46) and Kudat (45).

There are 20,976 fishing gears operating in the SSME area in 1999 (69% state total), which is 2.2-fold of the fishing effort in the non-SSME area. Traditional gears represents 77% of the SSME total fishing effort, with traditional miscellaneous gears making up 68%, followed by hook & lines (28%) and lift net (4%). Commercial gears represents 23% of the SSME total fishing effort, comprising of gill nets (72% total), (25%) and seine nets (3%). Overall, 53% of the SSME total fishing effort comprised of miscellaneous traditional gears, followed by hook & lines (22%), gill nets (16%), trawl nets (6%), lift nets (3%) and seine nets (1%). Excluding other miscellaneous traditional gears, hook & lines make up 46% of the total fishing effort, followed by gill nets (34%), trawl nets (12%), lift nets (6%) and seine nets (2%).

There are 9,384 fishing gears operating in the non-SSME area in 1999 (31% state total), which is about 50% of the SSME total fishing effort. Traditional gears represents 72% of the non-SSME total, with miscellaneous gears making up 72%, followed by hook & lines (26%) and lift net (2%). Commercial gears represents 23% of the non-SSME total fishing effort, where gill nets make up 87% of the total, followed by trawler nets (9%) and seine nets (4%). Overall, 52% of the non-SSME total fishing effort comprised of other miscellaneous traditional gears, followed by hook & lines (19%), gill nets (24%), trawl nets (3%), lift nets (1%) and seine nets (1%). Excluding miscellaneous traditional gears, gill nets make up 50% of the non-SSME total fishing effort, followed by hook & lines (40%), trawl nets (6%), lift nets (2%) and seine nets (2%).

In 1999, there are 10,456 fishing vessels in Sabah, comprising of 2,524 non-motorized boats (24% total), 4,653 outboard engine boats (45%), and 3,279 inboard engine boats (31%). Compared to 1991, there was an increase of 75% for non-motorized boats, 56% for outboard engine boats and 54% for inboard engine boats. Overall, the fishing fleet in 1999 had increased by 59% over the 1991 period (6,562 units).

There are 20,845 full-time fishermen in Sabah, which represents 26% of the total fishermen population in the country (81,547). There are 15,120 fishermen in the SSME area (73% state total), which represent 19% respectively of the country total. About 9,833 fishermen or 65% of the SSME total are based in the Sulu Sea and 5,287 (35%) in the Sulawesi Sea. In the non-SSME area, there are 5,725 fishermen, which represents respectively 28% and 19% of the state and country total number of fishermen. Fishing in the non-SSME area is strictly confined to the South China Sea.

Out of the 20,845 fishermen in Sabah, 29.4% are involved in gill netting, followed by trawling (24.6%), hook & line fishing (23.1%), seine netting (7.2%), lift netting (6.7%) and 9.1% in other miscellaneous traditional gears. In the SSME area, about 75% of the fishermen are involved in trawling (27.5%), gill netting (27.0%) and hook & line fishing (22.7%), followed by seine netting (7.5%), lift netting (6.4%) and other miscellaneous traditional gears (8.9%). On the other hand, more than 60% of the fishermen in the non-SSME area are involved in gill netting (35.7%) and hook & line fishing (23.9%), followed by trawling (16.9%), lift netting (7.5%), seine netting (6.4%) and 9.5% involvement in other miscellaneous traditional gears.

The ethnic composition of fishing communities is strongly influenced by human settlements along the coastline. In the SSME area, transient fishermen comprising of illegal immigrants from the Philippines and Indonesia make up a large portion of the fishing community. In 2000, transient fishermen makes up at least 28% or (5,767) of the total fishermen population. Local fishermen make up 72% of the state fishermen population, comprising of 98% (14,835) of *bumiputeras* from various dominant ethnic groups of coastal communities and 2% Chinese (243). Chinese fishermen, with most of them recruited from Peninsular Malaysia are employed either as skippers or master fishermen onboard large commercial fishing vessels owned by big fishing companies, with 81% of them involved in trawling (143) and purse seining (53%). *Bumiputera* fishermen are either self-employed operating their own traditional fishing vessels or employed as crewmembers onboard commercial fishing vessels. About 78.5% (6,051) of them are in traditional fishing and 21.5% as crewmembers of trawlers (2,348) and purse seiners (656). Most of the transient fishermen are involved in commercial fishing, with 65% of them employed as crewmembers, master fishermen or skippers of smaller commercial fishing vessels – trawlers (2,632), purse seiners (788) and gill netters (335) and about 35% in traditional fishing – hook & line fishing (1,168), *bagang* fishing (476) and other miscellaneous fishing gears (368).

Transient fishermen respectively make up 25% and 29% of the state total fishermen involved in traditional and commercial fishing in Sabah. It is estimated that 4,561 or 79% of total transient fishermen population are based in the SSME – making up 30% of the total fishermen population in the SSME area.

In SSME-1, the local fishermen comprised mainly of *Suluk*, *Ubian* and *Orang Sungai* ethnic groups. The transient fishermen population in SSME-1 is mainly based in Kudat – employed either as crewmembers of the commercial fishing fleet based in Kudat Town or engaged in traditional fishing in the Banggi Group of Islands. On the other hand, fishermen in SSME-2 and SSME-3 comprised of locals (*Orang Sungai, Suluk, Bugis* and *Bajau*) and transient population from the Philippines (*Bajau Laut* or *Suluk* – mainly in Semporna, Kunak, Lahad Datu and Sandakan) and Indonesia (mainly *Bugis* – mainly in Tawau). In the non-SSME area, most of the fishermen in Kota Belud comprised predominantly *Iranun*, *Bajau* and *Ubian* ethnic groups– and further south dominated by *Bajaus* in Kota Kinabalu and Tuaran and *Brunei Malays* in the disricts of Papar, Beaufort, Kuala Penyu and Sipitang. There are at least 1,200-odd transient fishermen based in the non-SSME area, with most of them employed onboard trawlers (mainly Indonesian *Bugis*) and purse seiners (mainly Filipinos) based in Kota Kinabalu and surrounding areas.

There are 8,091 fishermen involved in the operation of traditional gears in Sabah and defined in this report as traditional fishermen, which make up 39% of the total fishermen population in the state. About 71% of them are engaged in hook & line fishing (59%) and *bagang* fishing (a total of 17% involved in lift netting). About 68% of the traditional fishermen are in six districts: with 52% in the SSME area - Kudat (1,531), Tawau (913), Sandakan (903) and Semporna (826), and 16% in the non-SSME area - Kota Belud (771) and Kota Kinabalu (551). In the SSME area, there are 5,747 traditional fishermen or 71% of the total traditional fishermen population in the state. Traditional fishermen make up 38% of the total fishermen population in the SSME area, where 60% of them are involved in hook & line fishing (83% in SSME-1, 49% in SSME-2 and 49% in SSME-3). In the non-SSME area, there are 2,344 traditional fishermen, which make up 41% of its total fishermen population – where 58% are involved in hook & line fishing.

There are 12,754 fishermen involved in the operation of commercial gears in Sabah and defined here as commercial fishermen (61% total fishermen population). About 48% are involved in gill netting, followed by trawling (40%) and seine netting (12%). About 76% of the commercial fishermen are concentrated in 6 districts: 61% in the SSME area – Sandakan (3,084), Kudat (1,384), Beluran (1,241), Tawau (1,123) and Semporna (955), and 15% in the non-SSME area – Kota Kinabalu (1,168) and Kuala Penyu (681). In the SSME area, there are 9,373 commercial fishermen or 73.5% of the total number of commercial fishermen in the state. Commercial fishermen make up 62% of the total fishermen population in the SSME area – with 44% of them involved in trawling. In the non-SSME area, commercial fishermen make up 59% of the total fishermen population, with 60% of them involved in gill netting.

In 1999, total marine fish landings amounted to 207,211 metric tons, showing an increase of 91% over the 1991 period (108,437 metric tons). The non-SSME and SSME areas respectively contributed 25-44% (33%) and 56-75% (67%) to the annual marine fish landings during the 1991-1999-year. The non-SSME contribution to the total fish landings had declined by 24%, from 44% in 1991 to 33% in 1999. On the other hand, the SSME contribution to the total fish landings had increased by 19%, from 56% in 1991 to 67% in 1999.

In summary, the SSME area contributed 65% to the total fish landings, with SSME-3 making up 50% of the SSME share of the total fish landings, followed by SSME-1 (26%) and SSME-2 (24%). During the 9-year period, the SSME contribution had increased by 19%, from 56% in 1991 to 67% in 1999 (peaking at 75% in 1996), where SSME-1 and SSME-3 share of the annual landings had respectively increased by 56% and 61%. SSME-1 share had increased from 11% in 1991 to 17% in 1999 (peaking at 21% in 1993 – due to jellyfish landings). While SSME-3 share had increased from 21% in 1991 to 34% in 1999 (peaking at 41% in 1996 – due to seine net landing). On the other hand, SSME-2 share had decreased by 34%, from 24% in 1991 to 16% in 1999. The non-SSME contribution to the annual landings had decreased by 24%, from 44% in 1991 to 33% in 1999 (minimum of 25% in 1996). Overall, the non-SSME area had contributed less than 35% to the annual fish landings in Sabah.

During the 1991-1999 period, trawl net contributed 33% to the annual fish landings, followed by seine net (20%), gill net (18%), hook & line (13%), lift net (10%) and miscellaneous traditional gears (6%). Overall, commercial gears contributed 61% to the annual fish landings in Sabah.

Trawl net is the principal landing gear in the SSME-1 area. During the 1991-1999 period, trawl net contributed 63% to the SSME-1 annual fish landings, followed by gill net (16%), hook & line (7%), miscellaneous traditional gears (7%), seine net (5%) and lift net (1%). Overall, commercial gears contributed 84% to the SSME-1 annual landings during the 1991-1999 period. In 1999, trawl net contributed 66% to the annual fish landings, followed by hook & line (18%), seine (9%), gill net (6%), lift net (1%) and miscellaneous traditional gears (1%). Overall, commercial gears contributed 81% to the SSME-1 total fish landings in 1999.

Gill net is the principal landing gear in the SSME-2 area. During the 1991-1999 period, gill net contributed 40% to the SSME-2 annual fish landings, followed by trawl net (25%), miscellaneous traditional gears (13%), hook & line (12%) and seine net (9%). Overall, commercial gears contributed 75% to the SSME-2 annual fish landings during the 1991-1999 period. In 1999, gill net contributed 34% to the annual fish landings, followed by trawl net (32%), hook & line (16%), miscellaneous traditional gears (12%) and seine net (6%). Overall, commercial gears contributed 72% to the SSME-2 total fish landings in 1999.

Seine net is the principal landing gear in the SSME-3 area. During the 1991-1999 period, seine net contributed 43% to the SSME-3 annual fish landings, followed by lift net (22%), hook & line (16%), trawl net (12%), gill net (5%) and miscellaneous traditional gears (2%). Overall, commercial gears contributed 60% to the SSME-3 annual fish landings during the 1991-1999 period. In 1999, seine net contributed 43% to the total fish landings, followed by hook & line (18%), trawl net (17%), lift net (11%), gill net (6%) and miscellaneous traditional gears (3%). Overall, commercial gears contributed 67% to the SSME-3 total fish landings in 1999.

Trawl net is the principal landing gear in the non-SSME area. During the 1991-1999 period, trawl net contributed 45% to the non-SSME annual fish landings, followed by gill net (15%), seine net (13%), hook & line (13%), lift net (10%) and miscellaneous traditional gears (4%). Overall, commercial gears contributed 73% to the non-SSME annual fish landings during the 1991-1999 period. In 1999, trawl net contributed 66% to the annual fish landings, followed by seine net (13%), gill net (7%), hook & line (6%), miscellaneous traditional gears (5%) and lift net (3%). Overall, commercial gears contributed 86% to the non-SSME total fish landings in 1999.

Pelagic landings in 1999 amounted to 96,410 metric tons or 47% of the total fish landings. Round scad make up 16.1% of the pelagic landings, followed by sardine (14.9%), tuna (11.8%), Indian mackerel (9.0%), horse mackerel (5.8%), Japanese mackerel (5.7%), Spanish mackerel (5.5%), barracuda (5.2%), selar scad (3.2%), anchovy (2.8%), slender shad (2.7%), queen fish (2.4%), threadfin (2.4%), hardtail scad (2.1%), mullet (1.9%), ribbon fish (1.9%), and other miscellananeous pelagic species (8.5%).

Demersal landings in 1999 amounted to 110,801 metric tons or 53% of the total fish landings: comprising of finfish (75%), invertebrates (15%) and shrimps (10%). Demersal finfish landings comprised of commercial species (62%), sharks & rays (7%) and trash fish (31%). Threadfin bream make up 16.2% of the commercial fish landings, followed by snappers (15.8%), grouper (12.6%), catfish (9.3%), lizard fish (6.9%), jew fish (6.1%), humphead wrasse (3.3%), flat fish (3.3%), conger eel (2.6%), slipmouths (2.6%), barramundi (2.2%) and various species of bottom & reef resident fishes (19.3%). Invertebrate landings comprised of cephalopods (55.4%), mangrove crabs (17.4%), pelagic crabs (17.1%), shellfish (6.4%), lobsters (2.6%), sea cucumbers (1.1%) and other crustaceans & invertebrates (0.1%). Shrimp landings comprised of banana shrimp (43.3%), followed by sand shrimp (14.6%), yellow shrimp (11.3%), *Acetes* shrimp (9.5%), pink shrimp (6.2%), sharp rostrum shrimp (5.9%), rainbow shrimp (4.3%), tiger shrimp (3.4%) and various other penaeid species (1.5%).

The demersal landings seems to have stagnated around the 80,000 metric ton level and might have already reached the lower limits of sustainable production since 1994-1996. The substantial increase in demersal landings for the 1997-1999 period are considered here as "*pseudo landings*", where a large portion of it comprised of trash fish from trawler landings. During the 1997-1999 period, trawl net contributed 59% to the annual demersal landings. Kudat, Kota Kinabalu and Sandakan contributed most of these trawl-based demersal landings, where a substantial portion of the landings comprised of trash fish. In recent years, a large portion of the annual demersal landings comprised of trash fish from trawl net by-catches that had been previously discarded at sea because of marketing constraints.

In recent years, a large portion of the trawler by-catch and other trash fish had been brought back to shore in increasing quantities to meet the demand from fish meal processing plants based in Kudat, Kota Kinabalu, Kuala Penyu, Sandakan, Tawau and Kunak. Trawl net landings had also increased in Tawau during the 1996-1999 period, where a substantial portion of the landings is used as raw materials for local fish meal plants or as supplies to commercial shrimp farms in the area. Tawau has the largest shrimp farm (924 ha) in the state, where trash fish is also being used as feed supplements in addition to formulated feed. During the 10-year period, it is estimated around 24-62% (mean 42%) of the annual landings in Sabah had been used as raw materials for fish meal production. A large portion of these raw materials was sourced from the SSME area. In general, raw materials for fish meal production comprised mainly of low value demersal fishes sourced from trawl net landings except for SSME-3, where pelagic fishes are also being used. In SSME-3, there are two fish processing plants in Kunak which operated their own purse seiners for raw materials. The high value fishes are exported in frozen forms to Peninsular Malaysia and other countries in the region including Hong Kong, China, Korea and Taiwan. Low value fishes including pelagic species (mainly sardine and round scad) and other utilized fish are used by these processing plants into fish meal products. Most of the fish meal was exported to Singapore and domestic markets in Peninsular Malaysia and Sarawak, and in recent years had found other new markets in the region including Indonesia. During the last 10 years, fish meal make up 22.6-43.7% (mean 31.5%) of the annual fisheries export volume. However, fish meal only make up 2.4-11.0% (mean 6.7%) of the annual fisheries export value.

Shrimp landings fluctuated around 8,128-12,495 metric tons (mean 10,978 metric tons) during the 1991-1999 period. Shrimp landings had decreased by 11.5%, from 12,495 metric tons in 1991 to 11,058 metric tons in 1999. The fluctuation in the annual shrimp landings had to a certain extent indicate a gradual decline, where landings had declined to a low 8,128 metric tons in 1998 before increasing to its present levels in 1999. Landings during the last few years had been influenced by SSME-3 contribution, which contributed around 31-36% to the annual landings. SSME-3 contribution had increased by 71.5%, from 20.0% in 1996 to 34.4% during the 1997-1999 period. Shrimp landings in SSME-3 had increased by 35.4%, from 2,452 metric tons in 1996 to 2,958-3,607 metric tons (mean 3,322 metric tons) in 1997-1999. The principal gears of the shrimp fishery are trawl net, gill net and miscellaneous gears. Trawl net contributed 69% to the annual shrimp landings during the 1997-1999 period, followed by gill net (21%) and miscellaneous gears (8%). Other gears only contributed around 1% each to the annual shrimp landings. The reasons for the decline in shrimp landings in Sabah during the last few years might have been due to overfishing, decline in non-trawler fishing effort of the shrimp fishery and increasing contribution from demersal finfish landings in the annual trawl net landings. The shrimp share had decreased by 32.8%, from 14.2% share in 1996 to only 9.5% share during the 1997-1999 period.

Pelagic landings had increased by 71.7% during the 9-year period, from 56,137 metric tons in 1991 to 96,410 metric tons in 1999. Pelagic fishes make up around 46-53% (mean 49.2%) of the annual landings. During the 1991-1999 period, the pelagic portion had declined by 10.1% from 51.8% in 1991 down to 46.5% in 1999.

Fishing gears with dominant pelagic fishes in the annual pelagic landings are seine net, lift net and gill net. Seine net is the principal pelagic gear, which contributed 40.9% to the annual pelagic landings during the 1997-1999 period. Besides seine net, other important contributing gears are trawl net (19.8% annual contribution), gill net (13.5%), *selambau* and *bagang* lift nets (13.4%), hook & line (10.8%) and miscellaneous gears (1.6%). Overall, commercial gears contributed 74.2% to the annual pelagic landings during the 1997-1999 period, with seine net contributing 55.1% to the commercial gear share of the annual pelagic landings, followed by trawl net (26.7%) and gill net (18.2%). Lift net is the principal traditional pelagic gear in Sabah. During the 1997-1999 period, lift net contributed 52.0% to the traditional gear share of the annual pelagic landings, followed by hook & line (41.7%) and miscellaneous gears (6.3%). During the 1991-1999 period, *selambau* and *bagang* contributed respectively 17-61% (mean: 34.1%) and 39-83% (mean: 65.9%) to the annual lift net landings. The non SSME-based *selambau* share of the annual lift net landings had declined by 63.9% during the 9-year period, from 61% in 1991 to only 22% in 1999. On the other hand, the SSME-based *bagang* share of the annual lift net landings had increased by 100.1%, from 39% in 1991 to 78% in 1999.

The present development of the marine aquaculture sector in Sabah is still in its initial phase. In terms of operation scale, most small-scale farms predominate, with most operations carried out on a subsistence level supplementing incomes of coastal communities. Only a few farms of medium scale operations are commercially oriented in practice, among them, shrimp farming and holding cage culture. Marine aquaculture mainly deals, in order of importance, in the culture of tiger shrimp (*Penaeus monodon*) in brackish water ponds, cage culture targeted for the LRFT in Hong Kong, fish culture in brackish water ponds, seaweed (*Eucheuma cottonii*) culture, oyster culture (*Crassostrea* spp.) and green mussel (*Perna viridis*) culture. Besides the above, other marine aquaculture practices include the fattening of mangrove crabs in brackish water ponds, sea cucumber grow-out (mainly sand fish) and abalone ranching. At present, no information is available on the culture methods used and production output from these minor aquaculture activities.

Marine aquaculture production in 1999 amounted to 5,454 metric tons with a farm gate value of RM72.6 million. The production volume in 1999 had increased by 13.4% from 4,810 metric tons in 1998. However, the production value had declined by 33.3% from RM108.9 million in 1998. The increase in the production volume had been attributed by 68.5% increase in dried seaweed production despite a 32.2% decline in shrimp production. The decline in 1999 production value had been attributed by 43.6% decline in shrimp contribution that make respectively 85-87% and 56-57% of the annual marine aquaculture production value and volume in 1997-1999. Overall, marine aquaculture contributed 2.3-2.7% by volume and 8.8-12.8% by value to the overall fisheries production (including from freshwater) in Sabah during the 1997-1999 period. Because of declined shrimp production in 1999, contribution from marine aquaculture had declined by 31.5% by value, from 12.8% in 1998 down to 8.8% in 1999.

In 1998, total marine aquaculture production amounted to 4,810 metric tons with a farm gate value of RM108.84 million. Shrimp culture contributed 56.5% by volume and 86.8% by value to the total production (farm gate price: RM34.8/kg). Cage culture makes up 4.1% by volume and 9.70% by value to the total production (farm gate price: RM53.2/kg). On the other hand, seaweed culture contributed 37.1% by volume but only 3.3% by value to the total production (farm gate price: RM2.0/kg). Oyster and mussel culture contributed respectively 1.7% and 0.6% by volume and 0.2% and 0.05% by value to the total production. Oyster and mussel respectively have a farm gate price of RM2.4/kg and RM1.9/kg based on the 1998 production.

In 1999, total marine aquaculture production amounted to 5,454 metric tons with a farm gate value of RM72.58 million. Shrimp culture contributed 33.8% by volume and 73.5% by value to the total production (farm gate price: RM29.0/kg). Cage culture makes up 8.7% by volume and 17.0% by value to the total production (farm gate price: RM26.1/kg). On the other hand, seaweed culture contributed 55.2% by volume but only 9.1% by value to the total production (farm gate price: RM2.2/kg). Oyster and mussel culture contributed respectively 1.7% and 0.6% by volume and 0.3% and 0.06% by value to the total production. Oyster and mussel respectively have a farm gate price of RM2.0/kg and RM1.4/kg based on the 1999 production.

Except for oyster culture, marine aquaculture in Sabah is SSME-based. About 99.4% of the total shrimp pond area falls within the SSME area, marine cage culture (50.5% cage units), seaweed farming (100% farm area), and mussel culture (65.8% farm area). The SSME area contributed 100% or 3,008 metric tons to the total seaweed production, 99.6% or 1,836 metric tons to the shrimp production, 61.5% or 20.2 metric tons to the mussel production, and 54.5% or 259 metric tons to the marine cage culture production. The non-SSME area contributed 99.9% to the oyster production of 95 metric tons in 1999. Overall, the SSME area contributed 94.0% by volume and 93.8% by value to the total marine aquaculture production in 1999. The SSME area contributed 100% to the seaweed production (RM6.62 million), 99.7% to the shrimp production (RM53.22 millon), 66.7% to the marine cage culture production (RM8.26 million), 43.9% to the mussel production (RM20,460) and only 0.1% to the oyster production (RM250).

Fish processing activities in Sabah are mainly carried out by 51 major commercial processing plants, out of which 15 are primarily involved in shrimp processing. Other processing plants are involved in fish storage, processing fresh/frozen fish, shrimp, crabmeat, squid, fishmeal and seaweed including two seaweed SRC plants established in Tawau and Semporna in early 2001. The focal point of fish processing in Sabah is in the SSME area, with 40 of the processing plants in SSME-1 (5), SSME-2 (12), SSME-3 (23) and non-SSME (11). Most of the processing plants are based in Sandakan (11), Semporna (9), Tawau (8), Kota Kinabalu (6) and Kudat.

Depending on the source of raw materials, shrimp processing facilities in Sabah can be categorised into those mainly processing raw materials from capture fisheries and those processing cultured shrimps, the latter mainly based in Tawau. Processing plants that depend on trawler-sourced wild shrimps are mostly located in Sandakan. Most of the shrimp processing plants in Sandakan are now facing raw material shortages due to the decline of shrimp landings. Landings have steadily declined over the 1991-1999 period, from 6,702 metric tons in 1991 to only 2,880 metric tons in 1999. As a result of raw material shortages, many processing plants in Sandakan have started sourcing cultured shrimp from Tawau. However, cultured production in Tawau, the major shrimp farming area in Sabah, has not been able to make up the shortfall in supply. This has resulted in stiff competition for raw material in Tawau and a corresponding increase in *ex-farm* prices.

Total cold storage capacity in Sabah, mostly in shrimp processing plants, is around 2,600 metric tons. The total ice production capacity by 118 ice plants located throughout the state amounts to around 1,443 metric tons, with 83% in the SSME area. Most of the shrimp processing plants use contact plate freezers for freezing and only a few use air blast freezers. Major product types are block frozen head-on, headless, PUD or PTO shrimp. Few produce semi-IQF product but none of the plants processes cooked shrimp or IQF shrimp.

In 1999, Sabah export and import of fish and fisheries products respectively amounted to 37,480 metric tons (RM319.0 million) and 7,460 metric tons (RM40.2 million). During the last 10 years, fish exports had increased respectively 96.0% and 161.4% by volume and value, from 23,941 metric tons (RM122.1 million) in 1990. On the other hand, fish imports only increased respectively 30.3% and 68.1% by volume and value during the same period, from 5,731 metric tons (RM23.9 million) in 1990. As a whole, Malaysia is a net importer of fisheries products; however, as a State, Sabah is a net exporter of fisheries products. Significant increase in the annual export volume since 1989 was mainly due to fish meal contribution. Fish meal make up respectively 23-44% (mean: 31.5%) by volume and only 2.4-11.0% (mean: 6.7%) by value of the annual fisheries export during the 1990-1999 period.

The export and import prices of fish and fisheries products in 1997-1999 were respectively at RM6.58-8.43/kg (mean: RM7.36/kg) and RM5.39-6.30/kg (mean: RM5.98/kg). The export price had increased by 980%, from RM1.34/kg in 1962 to its peak of RM14.56/kg in 1983, and then declined by 66% down to RM4.95/kg in 1993 before increasing by 70% to RM8.43/kg in 1999. The decline in export prices during the last 10 years was due to cheap fish meal exports that make up 23-44% of the annual export volume. The export price of fish meal ranged between RM0.90-1.63/kg (mean: RM1.25/g) during the 1990-1999 period. On the other hand, the mean import prices had increased by 380%, from RM1.31/kg in 1962 to its peak of RM6.30/kg in 1997, and then declined by 14.5% to RM5.39/kg in 1999. During the 1997-1999 period, fisheries trade was made with export prices (RM7.36/kg) transacted at 24% higher compared to import prices (RM5.94/kg). Fisheries trade in 1997-1999 made a surplus of 111,294 metric tons valued at RM0.76 billion. During the 10-year period, the balance of trade surplus had increased 124% by volume and 184% by value, from 13,579 metric tons (RM98.1 million) in 1990 to 30,371 metric tons (RM278.8 million) in 1999.

In 1997-1999, fish meal make up 31.2% of the annual total fisheries export volume, followed by chilled & frozen fish (25.4%), frozen and miscellaneous processed products (15.24%), frozen shrimp (14.7%), processed crustaceans (4.6%), processed fish products (1.4%), live fish (1.3%), frozen crustaceans (1.0%), canned fisheries products (0.4%) and other miscellaneous products (4.6%). Frozen shrimp make up 57.5% of the annual total export value, followed by frozen and chilled fish (12.8%), frozen and miscellaneous processed products (9.8%), frozen chilled and frozen fish (12.8%), fish meal (6.0%), live fish (5.7%), processed crustaceans (4.6%), frozen crustaceans (1.9%), canned fisheries products (0.2%) and other miscellaneous products (1.3%).

In 1997-1999, canned fisheries products make up 60.4% of the annual total fisheries import volume, followed by frozen and chilled fish (11.7%), fish meal (10.1%), processed crustaceans (3.3%), frozen and processed miscellaneous products (3.3%), frozen shrimp (1.1%), live fish including ornamentals (1.0%), processed fish products (0.7%), frozen crustaceans (0.2%) and other miscellaneous products (8.1%). Overall, canned fisheries products make up 61.1% of the annual total import value, followed by frozen and chilled fish (15.5%), live fish (5.8%), frozen and miscellaneous processed products (3.8%), frozen shrimp (3.0%), processed crustaceans (2.7%), fish meal (2.2%), processed fish (1.1%), frozen crustaceans (1.0%), and other miscellaneous products (4.5%).

Fisheries trade within the SSME area existed since time immemorial. Fisheries trade statistics obtained from the Royal Custom and Excise Department was used in this study. However, the data only comprised of fisheries products declared to customs, and hence might not reflect the actual flow of fisheries products transacted with Indonesia and the Philippines.

Total imports from both countries amounted to 10,560 metric tons valued at RM 52.4million (RM4.96/kg), which represented 18.2% by volume and 17.5% by value of the state total fisheries imports. During the same period, total exports to both countries amounted to 20,791 metric tons value at RM26.1 million (RM1.26/kg), which represented 6.8% by volume and 1.4% by value of the state total fisheries exports.

Indonesia is an important fisheries trading partner for Sabah, ranking only second to Peninsular Malaysia in terms of fish imports during the 1991-1999 period. Imports from Indonesia make up 13-23% (mean 16.4%) of the annual fisheries imports. Except for 1998-1999, fish exports to Indonesia is negligible, representing only 0.02-1.41% (mean 0.29%) of the state annual fish imports.

Fisheries imports from Indonesia can be grouped into four main categories (fish, shrimp, spiny lobster and miscellaneous dried products. Frozen fish comprising of high value species (e.g. pomfret, trevally, threadfin, spanish mackerel, snappers, groupers), make up the bulk of the annual imports, followed by shrimp (frozen or chilled), spiny lobsters and other miscellaneous products (dried or salted forms). The average fisheries import prices fluctuated around RM3.46-7.69/kg during the 1991-1999 period.

During the 1991-1997 period, fisheries exports to Indonesia amounted to 6-380 metric tons annually, which comprised canned fisheries products and other processed fish products that had been imported mainly from Peninsular Malaysia and Thailand. The significant increase in exports in 1998-1999 was attributed by fish meal: 5,252 metric tons (RM8.68 million) in 1998 and 2,460 metric tons (RM0.98 million) in 1999.

Overall, Sabah imported a total of 9,432 metric tons of fish products worth RM50.7 million from Indonesia during the 1991-1999 period. This represents 16.2% by volume and 16.9% by value of the state fisheries imports. During the same period, exports to Indonesia, comprising mainly of fish meal products, amounted to 8,928 metric tons valued at RM10.3 million. This represents only 2.7% by volume andr 0.5% by value of the state fisheries imports.

The official barter trade based in Tawau is the main focal point of fisheries trade with Kalimantan – Indonesia. Trade statistics reported in the DOF Sabah annual statistics were obtained from the Customs and Excise Department. It is generally believed that the official figures reported might be gross underestimates taking into consideration the flow of fisheries products from Indonesia without going through custom declarations. The prices of fish products were negotiated by fish traders on both sides of the border based on current supply and demand or previous mutual agreement. Prices are fixed in the more stable Malaysian Ringgit with payments made, either in Indonesian Rupiah or US dollars, according the current exchange rates. At the present moment, the Malaysian Ringgit is pegged at a stable RM3.80 to the US dollar.

This study also includes interviews with some of the local fish traders based in Tawau. Results from these discussions revealed that the survival of major fish processing plants in Tawau is dependent on the volume and quality of raw materials from Indonesia. A large portion of these raw materials imported officially or otherwise from Indonesia consisted mainly of highly value species targeted for both domestic and international markets including Japan, Hong Kong, Singapore, Taiwan, China, USA and Europe. To ensure regular supply of raw materials from Indonesia, a number of the fish processing plants in Tawau had established sister plants or trading houses with their Indonesian partners in Eastern Kalimantan. Raw materials are obtained from Kalimantan and Sulawesi.

Cummulative fish imports from the Philippines amounted to 1,128 metric tons valued at RM1.7 million during the 1991-1999 period. The annual import price fluctuated around RM0.58-5.74/kg (mean RM1.53/kg). On the other hand, cumulative fish exports to the Philippines amounted to 12,493 metric tons valued at RM15.8 million, with annual export price fluctuating around RM0.97-1.69/kg (mean RM1.26/kg). Based on available statistics, Sabah is considered as a net importer of fisheries products to the Philippines.

Products imported from the Philippines comprised mainly consisted of dried fish products, with annual imports fluctuating between 6-370 metric tons valued at RM0.03-0.39 million. On the other hand, exports to the Philippines comprised mainly of dried anchovies (*ikan bilis*), which represents 5-82% (mean 39%) by volume and 6-86% (mean 38%) by value of the annual fish exports in 1991-1999. In 1996-1997, dried anchovies make up 68-82% by volume and 76-86% by value of annual fisheries imports to the Philippines. Most of Sabah dried anchovy exports were destined for the Filipino market. In 1997-1999, about 96.9-99.7% (mean 98.2%) by volume and 80.3-95.8% (mean 90.1%) of the state dried anchovy exports were exported to the Philippines. These dried anchovies are the main products from the SSME-based *bagang* fishery sub sector. Overall, dried anchovies make up 31.6% by volume and 34.3% by value of the 9-year cumulative fish exports to the Philippines.

The Philippines is the main market for dried anchovies exported from Sabah. During the 1991-1999 period, Sabah exported a total of 3,000 metric tons (RM4.03 million) of dried anchovies to the Philippines, which represented about 75% (18-99%) by volume or 58% (6-97%) by value of its total dried anchovies exports annually. Tunas (mainly yellow fin and skipjack) targeted for the tuna canneries in the Philippines attributed for the high export volumes in 1991 (1,470 metric tons) and 1992 (3,699 metric tons). Tuna exports to the Philippines had declined since 1993 due to the establishment of tuna canneries in Penang and Thailand. It cannot be accertain for the decline in tuna exports to the Philippines and might have been due to better prices being offered by the tuna canneries in Penang and Thailand.

The significance of the Malaysian SSME area in terms of contribution to the state and national fish production is shown in the following tables:

Fisheries Indicators	SSME area	SSME contribution	
		% state	% country
Human population	1,280,708	52.3	5.8
Total land Area (km^2)	48,393	65.2	14.7
Coastal marine waters (km^2)	28,966	56.4	Na
Fishermen	15,120	72.5	18.5
Commercial Fishermen	9,373	73.5	14.2
Traditional Fishermen	5,737	71.0	37.1
Foreign fishermen*	4,561	79.1	34.0
Marine aquaculturists	820	72.6	21.5
Total Fishing Fleet	7,492	71.7	22.8
Non-motorized boats	1,778	70.4	62.3
Inboard engine boats	2,818	85.9	16.3
Outboard engine boats	2,896	62.2	22.8

* including transient fishermen

Fisheries Output (metric ton)	SSME area	SSME contribution	
		% state	% country
Marine fish landings	126,310	64.4	10.4
Traditional Gears	40,688	82.0	27.1
Commercial Gears	85,622	58.4	8.0
Pelagic Landings	60,614	65.7	13.8
Demersal Landings	49,854	63.7	8.5
Shrimp Landings	6,655	79.3	7.6
Misc. Landings	9,188	56.3	9.3
Marine Aquaculture	4,618	96.0	4.6
Pond Culture	2,707	99.6	23.3
Cage Culture	108	54.5	1.8
Seaweed Culture	1,785	100.0	100.0
Mollusk Culture	18	16.4	0.0

At present, the major fishing grounds in both SSME and non-SSME areas are much confined to the inshore portion of the continental shelf. In some areas, further development can still be considered, particularly in non-trawler areas in offshore waters in the non-SSME area, EEZ waters along the Palawan Trench and around the disputed Islands of Ligitan and Sipadan, which by current estimates are still underexploited. In the SSME area, only SSME-3 particularly Semporna had further potential for development, where landing in the SSME-1 and SSME-2 seems to be saturated during the past few years.

Fishing gears that contributed significantly to the development of the marine capture fisheries sector in Sabah, in order of landing contribution, are trawl net, seine net, gill net, hook & line, lift net and miscellaneous traditional gears. Trawl nets contributed the bulk of the landings in the non-SSME and SSME-1 areas, gill nets in SSME-2 and seine net in SSME-3. Trawl net attributed to the gradual “pseudo” increase in landings during the past few years, which include by-catch and trash fish landings as well. Landings from other fishing gears had declined throughout the years with trawl net contribution becoming more significant.

The increasing dependency on trawl net landings is of primary concern because of its non-selective mode of catching fish. Impacts of trawl gears on the demersal fish assemblage and food web in Sabah are unknown but lessons from the Gulf of Thailand and other areas in the region had clearly shown the negative impacts of non-selective gears (Pauly, 1979). Phasing out small trawlers from the present fishery sector is a major step forward to address the negative impacts of these gears on depleting inshore fish resources. New selective and environmentally friendly gears might need to be introduced into the fishery, particularly in under-exploited areas. In the future, purse seines and long lines may become more important particularly if efforts are made to further develop the offshore resources in the non-SSME and SSME-3 areas. Other feasible fishing methods that can be considered in these offshore areas are mid water trawling and pair trawling. Except for *bagang* lift net and hook & line, other traditional gears do not hold much development potential. To a certain extent, R&D can be used to improve their fishing efficiency and gear selectivity to ensure sustainable exploitation.

The pelagic stocks in Sabah are migratory in nature, which are also being shared among coastal states in the Southeast Asian region. Any management measures and policies pertaining to the future development of the pelagic fisheries in Sabah can only be implemented effectively by considering the management of the regional fisheries sector in as a whole. With respect to this, regional collaborative research on the biological aspects, resource assessment and migratory patterns of common shared stocks need to be carried out. At present, SEAFDEC had already identified mackerel (*Rastrelliger* spp.), round scad (*Decapterus* spp.) and tuna being the most common trans-boundary stocks in the region including in the SSME area, and various kinds of collaborative research programs on these species had been identified with some of them already in various stages of implementation by SEAFDEC member countries. The above species formed the backbone of the pelagic fisheries in Sabah, especially in the SSME-3 area.

Large pelagics refers mainly to oceanic tunas and oceanic sharks. In this context, the “large pelagic” fishery refers only to tunas which formed the bulk of the pelagic landings in Sabah. Available data suggested that the small pelagic stocks in the inshore waters are moderately to highly exploited, and resources in the outer shelf area and offshore waters to be lightly exploited. At present, the current pelagic landings of 100,000-odd metric tons are still below the combined MSY of 190,000 metric tons. The current tuna landings amounting to 10,000 metric tons, which include both coastal and oceanic tunas, can be increased significantly if appropriate gears and fishing techniques are used. In particular, the use of FADs in conjunction with purse seining, usage of mid water trawling and the expansion of both hand line and long line operations could enhance future production. However, since the above estimates of resource availability are still preliminary in nature, more rigorous resource assessment will therefore be needed. No information is available on the species breakdown of tuna landings but a substantial portion is believed to comprise mainly of coastal species.

There appears to be some development potential, particularly with respect to the small pelagics scattered over the outer continental shelf of the non-SSME area and in the offshore waters along the Palawan Trench, north of Kudat, and off Semporna. Despite the apparent potential for the further exploitation and pelagic resources on both coastal and EEZ waters, there are certain limitations relating to the relatively low density of these resources and also the longer travelling times required to reach these fishing grounds especially along the Palawan Trench and around Layang-Layang Island. Both these factors may affect the overall viability of exploiting the offshore small pelagic resources. The most abundant small pelagics found in these areas are mainly sardines, small scombrids (e.g. mackerels), neritic tunas and carangids (mainly round scads, hardtail scads and selar scads). Furthermore, the domestic market prices for these species are generally low (wholesale price range: RM 0.50-2.00/kg) and the local market potential is rather small. The use of appropriate gears (e.g. purse seiners with the aid of FADs or *fish aggregating devices*, mid water trawlers, pair trawlers) and larger vessels can improve the economic viability of the fishery, and the development of related processing and canning operations can enhance market potential if sufficient resources are available.

Since the available information on small pelagics in both coastal and offshore waters are rather inconclusive, the most effective management approaches that can be applied at this present moment are as follows:

- Carry out biological studies, resource assessment and stock differentiation of key pelagic species. Since most pelagic species also being shared by other countries in the region, this study should be carried out on a collaborative basis with relevant counterpart researchers in the SSME area.

- Maintain the commercial fishing fleet in the coastal zone at its present fishing effort level until more concrete and rigorous assessment studies can be carried out.

- Encourage/promote a limited entry fishery for the offshore pelagic sector which appears to have the greatest potential for development (e.g. Semporna, Kudat and along the Palawan Trench). This fishery, which could include joint operations with foreign fishing companies, with priority for technology transfer to the local industry, must be strictly controlled and comprehensively monitored for catch per unit (CPUE) data. The CPUE data can be used to assess and estimate the actual potential yield of fisheries resources found in these areas.

From past resource surveys carried out, the most common oceanic tunas found off Semporna and along the Palawan Trench and other offshore waters are yellowfin and bigeye tunas. These species formed the backbone of the *sashimi* fishery in the Indo Pacific region. Since these species fetch a relatively low price on the domestic market, the future development of the tuna fishery in Sabah will therefore depend on the current situation of the international market, particularly with respect to the *sashimi* market in Japan. SAFMA Sdn. Bhd., a local fishing company with state interests, which was actively involved in the exploitation of oceanic tunas in Sabah a few years ago, was forced out of the international *sashimi* market due to high operating costs (incl. high air freight charges) and very stiff competition from other neighboring countries in the region. At present, with the opportunities available under the BIMP-EAGA, this fishery has high potential for further development. It may be necessary to provide certain incentives to both foreign and local fishing ventures to enter the fishery, particularly to exploit the offshore waters in the Malaysian EEZ around Sabah and in the international waters as joint fishing ventures under the BIMP-EAGA.

With regards to the future development of the large pelagic fisheries in Sabah, the following facts should be considered:

- Until now, the deepsea fishing grounds in the Sabah portion of the Malaysian EEZ still remain to be explored. Although data from past resource surveys and oceanographic studies carried out by DOF Malaysia were found to be still insufficient for the thorough evaluation of fisheries resources found in the area, it is generally believed that these areas holds some significant potential for development, particularly for large oceanic tunas and other small pelagics;

- Most of the tunas landed in Sabah, which consisted mainly of coastal species with some oceanic tunas in Semporna, composed primarily of juvenile or immature individuals, where a significantly higher yield on the long run may not be possible with any substantial increase in fishing effort. Therefore, the fishery should concentrate on the exploitation of bigeye and yellowfin tunas found in the offshore waters; and

- In general, tuna resources widely scattered within the coastal and offshore waters of Sabah would limit the overall productivity of these fishing grounds. The wider use of FADs would facilitate fishing efforts by concentrating the resources.

In general, the demersal resources in Sabah are subjected to moderate to heavy exploitation, particularly by trawlers in most coastal areas. The exploitation rate of demersal resources is estimated around 70% based on current landings of 110,000-odd metric tons and combined MSY of 160,000 metric tons. However, this estimate should be taken with great caution pending on more rigorous assessment. However, some areas can still be further exploited using non-trawl gears. A substantial portion of the continental shelf in the non-SSME area is untrawlable because of the presence of rocky obstacles, coral reefs and industrial installation (e.g. oil rigs and pipe lines). Due to fishing technology constraints, the trawlable portion of the outer continental shelf on the west coast is also underexploited. Therefore, it appears that there is still further development potential in these areas provided appropriate fishing gears and techniques are used. In particular, increased hand line and long lining activities in reef-associated and rocky areas may increase the demersal production of high value species (e.g. snapper, grouper, wrasse, trevally) considerably. These species are the preferred targets in the LRFT sector, which had exploited by destructive fishing practices including cyanide fishing. The increase in the supply of these highly value fishes to a certain extent will meet some of the demand from the LRFT sector, thus can reduce pressure from cyanide fishing.

In most areas, the trash component and by-catch of trawlers are presently underutilized, with only a small portion being processed for human consumption. A large portion of the trawl net landings had been used as raw materials for fish meal production, which on the long run is unsustainable and uneconomical. As shown earlier, about 40% of the annual fish landings had been used as raw materials by the fish meal processing sector. Appropriate R&D is therefore needed on downstream processing to utilize this wasted component for other higher value products, thus can further enhance the development of the demersal fisheries sector in the state.

Based on the temporal trends and subsequent analysis of the shrimp-trawler fishery CPUE data during the last 30-odd years, suggested that shrimp resources in Sabah are intensively exploited beyond the upper limits of sustainable production, and therefore there will be no further more development opportunities in this sector. Discussions made with trawl operators confirmed the significant reduction in catch returns for the last 10-odd years. The future of many shrimp and fish processing plants in Tawau and Sandakan depends on the imports of raw materials from Indonesia. Some processing plants in Sandakan are now sourcing raw materials from Tawau in view of serious decline in shrimp landings during the last 5-odd years. Within BIMP-EAGA, sustainable trade opportunities may be available on joint-venture downstream processing activities with Indonesia. There is compelling evidence to support a further reduction in the fishing effort that could not only enhance the present catch per unit effort but could also resulted in modest increase in the future shrimp landings. It is therefore pertinent to suggest that steps should be made to limit the number of small shrimp trawlers in operation, particularly trawler of less than 40 GRT in size, until more comprehensive and rigorous assessment studies can be carried out to estimate current shrimp stock sizes and determine the optimum fishing effort. One best option to increase shrimp production in Sabah is through the development of more culture areas. However, there are a number of issues that need to be addressed, including earmarking suitable idle non-mangrove areas into ADAs (aquaculture development area), supply of quality fries, high production costs, institutional and marketing constraints, environmental issues and establishing appropriate code of farming practices based on the FAO CCRF (code of conduct for responsible fisheries). Sabah used to be one of the very few areas in the region that had been free from any harmful shrimp diseases, until in 1999 when shrimp farms in Tawau had been seriously devastated by white spot outbreaks that had resulted in high shrimp mortalities. It is estimated that about RM42 million had been lost in foreign exchange earnings through exports based on the 1,200 metric tons decline in production.

Blood cockles (*Anadara granosa*) formed the bulk of the wild bivalve production in the state, with most of the landings from Tawau in the SSME-3 area. Landings of other bivalves may have been substantial but no information is presently available on their actual contribution to this fishery. Most seafood restaurants served varieties of these bivalves and gastropods at current prices at RM15/kg shell-on upwards. Middlemen purchased these bivalves including selected gastropods from fishermen at cheap prices from as low as RM0.50/kg in the case for Semporna. One of the possible coastal community-based resource management programs can include the development of grow out and holding culture of these shellfish, targeting both domestic and overseas markets. The artificial propagation and sea ranching of giant clams (*Tricdana* spp.), abalone (*Haliotis* spp.) and pearl oyster is another area that needs to be explored further.

Cephalopods formed a significant portion of the trawl net landings in Sabah. More resource assessment, work and research into the distribution, abundance and general biology of major cephalopod species is needed before decisions can be made concerning the future development of this fishery. The intensive use of more species-specific gear types and techniques (e.g. light attractants, jigging gear) may result in substantial increases in landings.

The jellyfish fishery in Sabah is still in its initial development phase compared to neighboring Sarawak, where jellyfish landings make up about 10% of the annual fish landings. At present, the fishery is concentrated in Kota Marudu involving a few seasonal operators. In 1991, Sarawak had exported about 1,254 metric tons of processed jellyfish valued at RM14.2 million. Little is known of jellyfish population dynamics, distribution, abundance and general biology in Sabah waters. Past surveys had indicated that the offshore waters along the west coast holds some development potential prospects. Overall, the jellyfish fishery has ample potential for investment in the sub sector.

It is generally believed that a substantial portion of lobster landings in Sabah originated from neighboring countries. This fishery is mainly concentrated in areas with extensive coral reefs and rocky shoals, with most the lobster production coming in from Semporna, Lahad Datu Kudat and certain districts in the non-SSME area. In view of the fact that a significant portion of the reefs in Sabah is severely damaged due to destructive fishing practices, particularly dynamite and cyanide fishing, it is unlikely that there is any substantial development of this fishery. The establishment of both MPA (marine protected area) or MMA (managed marine area) including habitat creation and enhancement through the development of artificial reefs in suitable areas, followed with the artificial propagation of spiny lobsters and subsequent releases in these areas may result in some minor increase in production.

The main components of the crab fishery in Sabah are mangrove crab (*Scylla serrata*) and pelagic crab (*Portunus pelagicus*). Overall, mangrove crabs fetches better prices (RM 4-6/kg) compared to pelagic crabs (RM 2-3/kg). Most of the mangrove crab production comes from the SSME-2 area. The crab fishery in Sabah is targeted for both domestic and export markets. Pelagic crabs are mainly caught by trawlers, while mangrove crabs are caught using static traps in mangrove and estuarine areas. The US-based Philips Seafood (East Malaysia) Sdn. Bhd. had established a pelagic crabmeat canning plant in Tawau, with raw materials sourced from nearby districts and perhaps Indonesia as well. This plant has cold storage facilities of 200 metric tons. At least 40 metric tons of canned crabmeat had been sent to USA since it started operations in late 2000.

Juvenile or unmarketable mangrove crabs are also reared in ponds for fattening and grow-out purposes prior being sold to local seafood restaurants or exported out of the state. At present, crab landings are relatively stable and to a certain extent reflect the level of fishing effort exerted. In view of the saturation of trawler effort and also the gradual destruction of mangroves, no further development potential is to be seen for this fishery.

In conclusion, the most appropriate strategies in the management of the demersal resources in Sabah may include the following:

- Carry out biological studies and resource assessment of key finfish, shrimp and other invertebrate species;
- Maintain or reduce the commercial fishing effort level, trawlers in particular, until more concrete and rigorous assessment studies can be carried out;
- R&D on downstream m and value-added processing of demersal by-catch including trash fish from trawl landings;
- Discourage the establishment of new fish meal processing plants, including the gradual phasing out existing plants;
- Establishment of MMA, MPA and artificial reefs in critical areas including habitat and stock enhancement/rehabilitation programs;
- Awareness and public education programs to combat destructive fishing practices; and
- Develop community-based integrated marine aquaculture projects as alternative or supplementary livelihoods for coastal communities – including those involved in destructive fishing practices.

Present State and Federal government development policies are favorable to the development of coastal aquaculture in Sabah. These policies give high priority to alleviating poverty among the coastal communities and an emphasis on the development of coastal aquaculture as a means of income generating activity, employment and for generating foreign exchange through exports. Coastal aquaculture is a recent development in Sabah, and whilst growth over the past 5 years has been quite rapid (average increase in production of 24 percent per annum), there are a number of constraints to the development of the industry that need to be addressed.

Environmental conditions along the coastline are generally favourable for coastal aquaculture development, however, there are a number of issues that need to be considered in the development of an environmentally sound industry including:

- Risks to aquaculture from harmful algal blooms and water pollution in areas;
- Site selection to avoid impacts on coastal mangroves;
- Need to treat shrimp pond effluent; and
- Need for sustainable harvesting and management for wild marine fishes.

Until today, coastal aquaculture has not given rise to significant environmental impacts, and any future problems can be mitigated through appropriate technology and farming system, good site selection and zoning, and the development of optimum management practices. There is growing competition with other coastal resource 'users' and integrated approaches to coastal resource management need to be adopted.

There is good potential for expansion of coastal aquaculture to meet export and domestic demand. However there are a number of constraints to be addressed:

- Shrimp processors, suffering from declining raw material availability and plant over-capacity, need to implement effective quality control measures;
- Live marine fish trade is constrained by limited wild stock availability that had been further depleted due to destructive fishing practices;
- Heavy reliance on one market in Hong Kong, with high fluctuation in prices determined by current supply and demand; and
- Fluctuating prices for seaweed.

Mollusc farming faces few marketing constraints at present, although attention to the impact of harmful algal blooms (red tide) and product quality will be essential for future expansion. Sabah aquaculture marketing strategy requires attention to quality and diversification of markets and products.

Economic returns from shrimp culture are highly favourable and there are still some investment opportunities available in the sector. However, the future expansion and sustainable development of this sector need to address various certain issues:

- Hatchery management to supply high quality healthy shrimp post-larvae;
- Water quality and environmental management in pond farms;
- Supporting infrastructure (electricity, roads and water supplies);
- Code of Practices;
- Zoning of shrimp culture areas to allow development to proceed in harmony with other coastal resource users; and institutional support; and
- Institutional support (financing, technical services & R&D).

Marine fish culture (mainly cage culture) in Sabah comprises a mixture of larger scale farming operations which are primarily for holding live marine fish before export, and small-scale cage farms involved in both culture and holding operations. The attractive prices offered for high value reef fishes in the LRFT offers wide investment opportunities. However, at present marine fish culture is severely constrained by the shortage of fish fingerlings, where virtually almost all marine finfish farming relies on capture of wild fingerlings. There is an urgent need for:

- Zoning of suitable culture areas in lagoons and sheltered areas including ADAs;
- Development of hatchery sourced fish fingerlings;
- R&D on suitable culture systems including offshore cage culture farming;
- Improving disease & fish health management;
- Improving feed and feeding strategies which are less reliant on trash fish; and
- Implementation of effective resource management measures for the sustainable exploitation of wild fishery resources of high value marine fish species.

Mollusc culture in Sabah is still in its infancy. Government efforts to enhance production from this sector include the provision of training, extension and incentives in the form of seeds and farm materials. The target species are mussels (*Perna viridis*) and oysters (*Crassostrea* spp.). It is expected that molluscs culture will play important roles in the development of the aquaculture sector in the near future including supplementing the incomes of coastal communities. In order to enhance production, there are certain issues that need to be addressed:

- Zoning of suitable culture areas including ADAs in the SSME area;
- Development of hatchery sourced seed supply;
- Code of Practice;
- Presence of HABs (harmful algal blooms);
- Marketing and downstream processing; and
- Investment

Seaweed farming (*Eucheuma* spp.) has grown rapidly during the 10-odd years and is currently providing profitable and significant socio-economic benefits to some 600 small-scale coastal households in Semporna. Coastal communities in Banggi Island are also expected to benefit from seaweed farming in the near future. Seaweed farming is a simple low investment culture method with few constraints. The establishment of two SRC plants in Semporna and Tawau is expected to encourage more investment in this sub sector. However, there are certain issues that need to be addressed:

- Zoning of suitable culture areas including ADAs
- Cyclical global market demand leading to fluctuating prices;
- Need for farming systems diversification;
- Improved farm management to optimize farm output and productivity;
- Disease and predator control;
- Labour constraints;
- Investment

Among major issues and challenges faced by the aquaculture in Malaysia and Sabah in general include the following:

- *Economic*: In aquaculture, limited accessibility to suitable land and water bodies, competition from alternative land use and pollution are major constraints to further development of the industry. In addition, heavy dependence of the aquaculture industry on imported fish fry and feed may threaten the long-term viability of the industry.

- *Technology*: The industry relies on labor-intensive technology for most operations from farm preparation, culture activity, harvesting and post-harvest. There are limited R&D activities to develop appropriate aquaculture technologies to exploit resources. Furthermore, there is inadequate research on nutrition and genetic manipulation for fast growth and disease resistant species, seed and fry production, hatchery, feed and post-harvest technology for aquaculture. In addition, inadequate and lack of coordination of R&D activities restrict the exploitation of the vast marine biodiversity for development of new products.

- *Infrastructure and institutional support*: At the present moment, existing infrastructure and supporting facilities are inadequate and not integrated to meet the present needs of the industry. Aquaculture ventures need high capital investment. Financial institutions perceive aquaculture as high risk and are reluctant to finance such investments. In addition, the lack of basic infrastructure and public facilities have also led to higher investment which affect the overall competitiveness of the industry.

- *Marketing*: In marketing, stringent international food quality standards pose an additional challenge to expand and diversify markets. The undeveloped market as well as inadequate networking for freshwater fish limits consumer demand and reduce the overall efficiency of fish marketing.

- *Skilled workers*: There is acute shortage of specialized, skilled and semi-skilled workers for aquaculture. Insufficient expertise coupled with poor adoption of sustainable aquaculture practices has affected the development of aquaculture.

At present there are several constraints faced by the downstream processing sector in Sabah that need to be addressed before any significant development can be be seriously considered:

- Raw material shortage: This had lead to unhealthy competition between fish processing plants. Uncertainty in supplies resulted in reluctance of processing plants to expand their operations with more modern equipment.

- Low downstream processing technology: At present, only minimum value-added processing of raw materials is involved.

- Inadequate sea and air linkages: High freight charges and handling costs involved.

- Limited local marketing potentials. The population in Sabah is low and widely dispersed.

- Poor road network system: Coast to coast transportation of raw materials is time-consuming which attributed to quality deterioration.

- High operation costs: This involved packaging materials sourced only from Peninsular Malaysia, freight charges, handling costs, etc.

- Poor utilities services: Including ffrequent electricity blackouts and cut in water supplies.

- Poor implementation or non-existence of standard food handling: This include FIQC (*Fish Inspection and Quality Control*) or HACCP (*Hazard Analysis Critical Control Point*);

- Poor post harvest handling: Usage of ice in long fishing trips coupled with usage of unhygienic storage facilities resulted in poor quality of raw materials upon arrival at port.

Among common key issues faced in the management of fisheries in the SSME area include the following:

- **Destructive Fishing Practices and Live Reef Fish Trade**

Destructive fishing practices are among the main cause of coral reef and marinelife degradation in the SSME area. Destructive fishing activities include blast fishing, poison fishing (cyanide and plant poisons), muro ami, trawling and coral mining. In the case of Sabah, destructive fishing practices involves blast fishing and cyanide fishing, and to a certain extent non-selective using using trawl nets. However, trawling is the most important component of the coastal fisheries in Sabah, contributing more than 40% to the annual fish landings. Blast fishing is primarily driven by the subsistence needs of small-scale transient fishermen. Financiers or taukehs in the fishing business are also involved in blast fishing activities. Cyanide fishing is driven by the lucrative but unregulated LRFT with most supplies of high value reef fishes mainly destined for the Hong Kong, China and Taiwan markets. It had been reported that cyanide fishing is now widespread causing severe damages to coral reefs in the Philippines, Indonesia, Papua New Guinea, Vietnam, Thailand, Malaysia, Maldives and in most of the Pacific Islands.

- **Overfishing and Food Security**

The coastal fisheries in the SSME area is very complexed and difficult to manage because of its multi-gear cum multi-species capture fishery characteristics. In most cases, fishing activities are carried out in limited inshore coastal waters, with both traditional and commercial fishermen competiting with each other for the same resources. In the case of Sabah, trawling in particular formed the backbone of the coastal fisheries industry contributing more than 40 per cent to the annual landings. In many cases, the decline in catches had also lead to trawlers encroaching into restricted fishing grounds of traditional fishermen. The use of non-selective gears coupled with destructive fishing practices had lead to overfishing and severe toll on aquatic ecosystems critical to fisheries productivity. Coral reefs, sea grass communities and mangrove habitats provide fishery resources that represent a critical source of food and income for both traditional and commercial fishermen.

- **Land-based Pollution**

Land-based sources of marine pollution pose some of the greatest threats to marinelife including mangroves, coral reefs and sea grass beds. In Sabah, land-based sources of pollution include run-off from coastal development, agricultural activities mainly from palm oil cultivation in the SSME area, industrial activities and forest deforestation.

I. INTRODUCTION

Regional Overview

Fisheries play a very important role in terms of food security, employment and trade and in the economies of countries in the Southeast Asian region (see **Table A1** in appendices). The region is a major contributor to the world supply of fish and home to 6.4% of the world population that is rapidly increasing. It is reported that over 70% of the population in Southeast Asia lives along the coastal zone, resulting in a high level of exploitation of natural resources including fisheries (Soegiarto, 1994). The highly productive coastal zone characterized with the presence of rich and diverse habitats supports coastal fisheries, which is the main source of fish in the region.

In Southeast Asia, the fisheries sector can be categorized into small-scale and coastal fisheries. FAO Fishing Area 71 that include Southeast Asia, is characterized by a large continental shelf area, bordered in the north by Southeast Asian countries and in the southeast by Indonesia and Australia. A large portion of the shelf area is within the EEZ of Southeast Asian countries. It supports one of the world's largest varieties of reef fishes, as well as commercial and traditional fisheries, as evident by the presence of rich fishing grounds for various types of demersal fish (including reef fishes and penaeid shrimps) and coastal to oceanic pelagic fishes in the area.

In 1993, the combined fish landings of Indonesia, Thailand, Philippines, Malaysia, and Vietnam account for 94% of the total fish production in Southeast Asia or 97% of the total fish production in Fishing Area 71 (FAO, 1997). The total fish production of Southeast Asia was about 13 million metric tons, with 75% contributed by marine fisheries, aquaculture (17%) and inland fisheries (8%). It was reported that Southeast Asian countries exported over five billion US dollars/year from marine fisheries alone (Sugiarto, 1994).

Sulu Sulawesi Marine Ecoregion

The Sulu Sulawesi Marine Ecoregion (SSME), covering a marine area over 600,000 km^2 between the coordinates 1^{o}30'-12^{o}00' N and 117^o-127^{o}00' W, represents a large portion of the Southeast Asian region. Comprising of the Sulu Sea in the north and the Sulawesi Sea in the south, the SSME area is defined as a semi-enclosed large marine ecosystem or LME (Sherman, 1993). This semi-enclosed LME is bordered by the Sabah State (Malaysia) on the northern tip of Kalimantan Island, island chains of the Philippines, and Sulawesi and Sangihe-Talaud Islands of Indonesia.

The Sulu Sea, covering an area of about 260 000 km^2, is a semi-enclosed oceanic basin with a mean depth of 1,140 meters and maximum depth of 5,580 meters. It is bordered on the north by the Island of Mindoro, on the south by the northeastern coast of the state of Sabah (Malaysia) and the Sulu Archipelago, on the east by the islands of Mindanao, Panay and Negros, and on the west by Palawan Island.

It is characterized by presence of rich fishing grounds on the shelf area (within the 200-m depth) along its perimeter and bathyal features in the middle portion. The widest bathyal zone in the SSME is found in the Sulu Sea. The extensive continental shelf area is mainly distributed on the northeast portion of Sabah, central Visayas and northeastern Palawan. The Malaysian portion of the SSME area in the Sulu Sea has diverse coastal and marine habitats ranging from extensive mangrove swamps along the eastern part, and coral reefs and sea grass beds on the northeast. The Selingan Islands are important feeding and nesting sites for marine turtles in the SSME area. The presence of the endangered dugong, Irrawady dolphins, manta rays and migrating whale sharks are also reported in the area.

The Sulawesi Sea, covering an area of about 290,000 km^2, is an oceanic basin with mean depth of 3,290 meters and maximum depth around 6,220 meters. It is bordered on the north by the Sulu Archipelago and southern coast of Mindanao Island, on the west by the east coast of Kalimantan and state of Sabah – Malaysia, on the south by the Minahasa Peninsula, and on the east by Sangihe-Talaud Islands.

The most productive part of the Sulawesi Sea mostly lies in the shallow coastal areas (within the 200-meter depth) on the northeastern portion of Kalimantan, which is shared between Indonesia and Malaysia (SSME3). This area is characterized by the presence of various coastal and diverse marine habitats ranging from numerous river estuaries and extensive mangrove swamps – which are important shrimp trawling grounds, extensive sea grass beds along the coast – important feeding and nursery grounds for marine turtles and marine mammals, and extensive coral reefs on the northern portion.

The Malaysian portion of the SSME in the Sulawesi Sea is the most important fishing ground for both demersal and pelagic fish including reef fish in the State of Sabah. Off Semporna, the fishing grounds are characterized by a steep depth gradient near the coastline, seamounts (e.g. Sipadan Island) and a deep oceanic trench, which is an important fishing ground with abundant pelagic resources from small pelagics to oceanic tunas and billfishes. The Sulawesi Sea has a surface productivity in the region of 135 gr.C/m^2/yr (Wyrtki, 1961), with complex oceanographic processes that could enhance local upwelling and gyres (Munro, 1986).

Fisheries Contribution

Strategically located within the center of the Indo Pacific area that has one of the world's highest marine biodiversity, the SSME area contributes a large portion of the marine fish production in the Southeast Asian region (**Tables A1-A2**). In 1993, fish landings from Indonesia, Philippines and Malaysia contributed 57% of the total marine fish landings in Southeast Asia (**Figure 1**), and a significant portion of it is generally believed to come from the SSME area. The SSME area is also known for its tourism potential. Its is reported to be home to at least 2,500 species of fish, more than 450 species of corals (as compared to only 60 species in the Caribbean), 6 of the world's 8 species of marine turtles, large migrating populations of whale sharks and manta rays, and also 22 species of marine mammals – including the endangered dugong.

Blessed with warm, humid, tropical climate and high rainfall, the SSME region allows productive ecosystems to flourish along the coastline. The important ecosystems in the SSME area are:

- Estuaries, common within the mouths of larger river systems
- Mangroves, associated with low laying coastlines, estuaries and rivers;
- Coral reefs, associated with islands and coastal areas lacking large inputs of freshwater or sediments from river systems.

Estuaries, mangroves and coral reefs are among the most productive ecosystems known to man as measured by both primary productivity and biomass yields (Soegiarto and Polunin, 1981). The production and export of organic materials in estuaries contribute to estuarine, coral reefs and offshore fishery nutrition. It was reported that the leaf litter production of mangroves is strongly correlated with fish production within the mangrove system, represented by fish, bivalves and crustaceans, and by the diverse fisheries production in nearby estuaries, coral reef, and sea grass communities. Coral reefs are very efficient in recycling nutrients and utilization of nutrients from adjacent systems, which support sizeable fisheries for numerous organisms that are harvested by coastal people and provide a significant portion of their protein consumption (Gomez, 1980; Murdy and Ferraris, 1980).

Figure 1. Marine fish production in Southeast Asia during the 1993 period (9,727,634 metric tons)

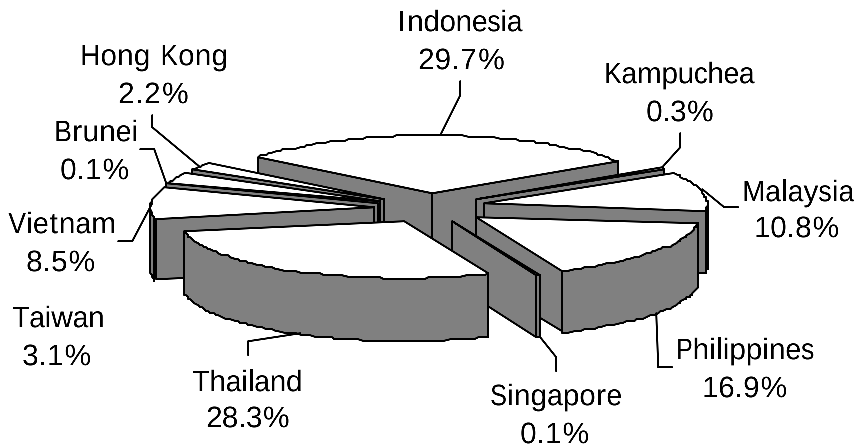
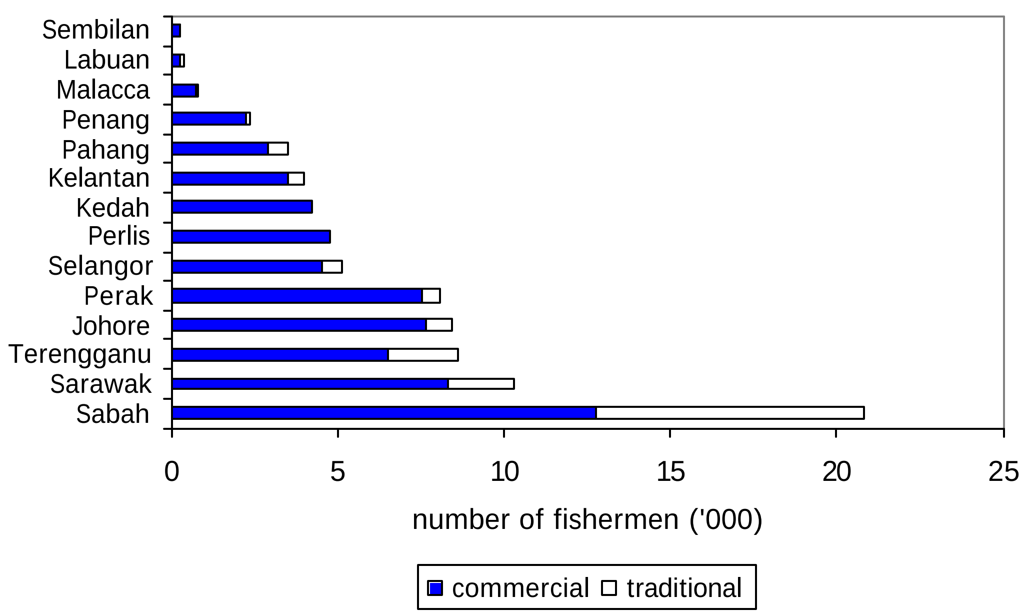


Figure 2. Spatial distribution of fishermen in Malaysia, 1998



Environmental Issues

The marine and coastal environment in the SSME area harbors a valuable resource base. Overuse of marine resources has implications for their long-term viability. The pursuit of economic advantage and uncontrolled coastal zone development coupled with the pressure from its rapidly increasing human population in the SSME area has created gross overexploitation of fisheries resources and a decline of environmental integrity in the region. This could create tensions and conflicts between policies for developing marine and coastal resources on one hand, and conserving and protecting them on the other. Estuaries, bays, and lagoons, the systems with immediate inputs from land, are extremely vulnerable to actions taking place on land. Factors affecting these areas include fertilizers, sewage effluents, chemicals, runoff, water extraction, deforestation, and atmospheric deposition. Constraints faced in managing a multi-gear (species) fishery are a huge problem for countries in the region. Overfishing coupled with use of destructive fishing practices (cyanide fishing, blast fishing and non-environmental friendly gears) and uncontrolled coastal zone development had lead to the gradual degradation of fisheries resources in many parts of the region. National fisheries management in the region is also hampered by ineffective law enforcement, inadequate regulatory regimes and increasing social conflicts between commercial and traditional fishermen.

Coral reefs in Southeast Asia are severely threatened or degraded due to destructive fishing practices, international trade in coral reef organisms, overfishing, land-based sources of pollution, coral bleaching events, mangrove deforestation, and coastal population pressures. Most of these coral reefs are in the SSME area. According to the 1998 *Reefs at Risk* report prepared by World Resources Institute or WRI[1], over 80% of the reefs in the Southeast Asian region are at risk from human activities, with over half (56%) at high risk. It was also concluded in the report that there is a pressing need in the region is to stop the spread of destructive fishing practices, such as use of cyanide and explosives to catch fish from coral reefs; large areas of reef are being destroyed and key species of large fish are threatened by these illegal-fishing practices.

The Third United Nations Conference on the Law of the Sea[2] (or UNCLOS III) provides countries within the SSME area an important opportunity to avoid and to settle amiably resources disputes in an international framework. UNCLOS III opted for coastal states to manage their fisheries within the 200 nm EEZ (Exclusive Economic Zone). The great endeavor in fisheries diplomacy encompassed by UNCLOS III was designed to improve the management of world fishery resources. At the same time, it was with the good intention to ensure that marine fisheries be managed properly and effectively to benefit all types of States, be they coastal States, distant water fishing States, geographically disadvantaged States, or even land-locked States. Within the context of the SSME area, this is apparent from the relevant provisions of the UNCLOS III, namely:

- Article 61 (conservation of the living resources in the EEZ)
- Article 62 (utilization of the living resources in the EEZ)
- Article 63 (cooperation regarding shared stocks and straddling stocks)
- Article 64 (cooperation regarding highly migratory species)
- Article 123 (cooperation of States bordering an enclosed or semi-enclosed sea on the management, conservation, exploration and exploitation of the living resources of the sea).

The Malaysian portion of the SSME encompasses 56% of the highly productive coastal zone (within the 0-200 meter depth of the shelf area) in the state of Sabah. It is also home to about

[1] http://www.wri.org/indictrs/pdf/reefs.pdf

[2] http://www.un.org/Depts/los/losconv1.htm

52% of the total state population (6% of country population). The SSME area formed the backbone of the fisheries industry in Sabah, contributing at least 65% and 95% to the annual marine capture and marine aquaculture production.

The coral reefs in Sabah are in various stages of degradation, among others, caused by pollution, sedimentation, and most of all by destructive fishing practices including blast and cyanide fishing (Chua and Mathias, 1978; Oakley et al., 1997a; 1997b, 1997c, 1999; Pilcher and Oakley, 1997; Pilcher and Cabanban, 2000).

The main reason why blast fishing is rampant in Sabah and in the region is just basic economics – it is a profitable venture. The seas around Sabah being so wide in area coupled with a long coastline that the chances of being caught red handed are very slim indeed. Blast fishing paraphernalia are easily discarded overboard in the event that an enforcement vessel is seen approaching. A fish bombs is simple enough to make – just a used dark coloured bottle, a short fuse and a cap. One only have to fill the bottle with *Ammonium Nitrate*, cap it, attach the fuse and *voila* !!! you have a complete useable fish bomb. Except for the cap and fuse, *Ammonium Nitrate* is easily available on the open market for agricultural purposes. While the cap and fuse, being easily concealed or thrown away, are smuggled items from the Philippines[3]. Catching fish by this method is illegal and punishable under the Malaysian Fisheries Act 1985. As far as the Malaysian law is concerned, severe penalties are imposed upon conviction – either a RM20,000 fine, or a two-year jail sentence or both[4]. However, convicting offenders in court is a long and tedious legal process – where in most cases, fish bombers are seldom caught red-handed with their “trade tools” as such are easily discarded into the sea upon seeing an enforcement vessel approaching. Having the “bombed” fish alone as evidence had also proven to be insufficient in the court of law. For a charge of "possession of bombed fish" alone one needs to prove *mens Rea*.

Exports of groupers to Hong Kong, 1998

Country	Q metric ton	V HK$ million	Average Price HK/kg
Indonesia	1,134	114.32	85
Philippines	483	37.27	77
Malaysia**	394	27.01	69
Others	4,337	225.79	52
TOTAL	6,555	404.38	62

Source: Adapted from Sudari Pawiro (Trends in major Asian markets for live grouper)
URL: http://www.enaca.org/grouper/Research/Economics/1999/07/MK991001.htm

Note: ** a large portion of Malaysian exports comes from Sabah

Cyanide fishing is extensively used in the Philippines, Indonesia and Malaysia (Sabah) to catch high value fish including various species of coral groupers and humphead wrasse. In Malaysia, catching fish using this method is illegal and punishable under the Fisheries Act 1985. However, it is difficult to prove in court that such fishes are caught using poisons. Furthermore, there is no cyanide testing centers in Sabah. Some preliminary discussions between International Marinelife Alliance (IMA) and DOF Sabah had been initiated to look into the possibility of funding a Cyanide Detection Test (CDT) Centre in Sabah.

[3] According to some veteran *blast fishing* fishermen interviewed in Kudat, supplies of blast fishing paraphernalia can be easily brought in by barter trade boats through Karakit (Banggi Island) from the Philippines (Palawan Island)

[4] The State Government of Sabah is now in the process of drafting a proposal to the Federal Government to amend the Malaysian Fisheries Act 1985, where the penalties for the possession of “bombed fish” will be a fine of RM 1 million, or a five-year jail sentence, or both.

BOX 1: DEAL TO PROTECT MARINE RESOURCES

New Straits Times
Thursday, 29th March 2001: pg 21

BANGKOK, Wed. -The United Nations today said the seven nations bordering the South China Sea and Gulf of Thailand had signed their first agreement to protect the region's marine resources. The nations have agreed to take action on environmental degradation along the coastlines and after a study of sensitive sites, they hope to enact national legislation to prevent further damage.

United Nations Environment Programme executive director Klaus Toepfer said the preservation of the coastlines was vital for the protection of the region's rich fisheries industry. "It is one of the most important programmes we have for international seas," he said after unveiling the agreement between the Governments of Cambodia, China, Indonesia, Malaysia, the Philippines, Thailand and Vietnam.

Toepfer said 80 per cent of the region’s coral reefs were at risk from climate change, coastal development, pollution, over-exploitation and cyanide and dynamite fishing. "Tuna and shrimp are outstanding products... earning a lot of money for people. Therefore, it is very difficult and there are a lot of economic pressure that make it difficult to stop or change (these practices)."

He said only a third of the region's mangrove forests remain, with around 65 per cent lost to settlements, industrialisation, tourism, or conversion into shrimp farms. The effects of increased sedimentation and nutrients as well as destructive fishing practices were also being felt in the region's other major habitat, sea grass communities, of which 20-25 per cent is thought to be degraded.

Another major concern is the pressure exerted by the 270 million people living along the coastlines, a population expected to double within the next three decades. Toepfer said the new agreement would produce a programme of action and a recommended network for regional co-operation in the management of the environment of the South China Sea.

Under a five-year, US$32 million (RM121.6 million) project, committees will be set up in each country to select nine areas for extensive pilot studies, particularly on the coral reefs, mangrove forests and sea grass fields. - AFP

Source: http://agrolink.moa.my/dof/Fisheries_News/Newspaper/NST290301pg21.html

BOX 2: MOVE TO CHECK BOMBING OF FISH

New Straits Times
Wednesday, 14th March 2001: pg 6

KOTA KINABALU, Tues. - "Masterminds" of unlawful fish bombing activities in Sabah will beheld under restricted residence if the recommendation by the State Fisheries Department is enforced by the police. Its director Rayner Stuel Galid said such enforcement would help curb fish bombing activities which were rampant in the State and causing tremendous damage to the ecology of its treasured coral reefs.

These masterminds are normally locals who pay illegal immigrants to use explosives to kill the fish and profit from the harvest. Rayner said the department had a list of suspected masterminds, but found it hard to convict them due to the difficulty in getting evidence. The department, he said, would also recommend an amendment to the Fisheries Act 1985 to impose heavier penalties on those using or having explosives to kill fish. At present, the penalty is a fine of not more than RM1 million or two years' jail, or both, for foreign offenders, while Malaysian offenders would face a fine of not more than RM20,000 or two years' jail, or both. Rayner said the department hoped to increase the fine for locals to RM50,000 and extend the prison sentence.

A study carried out by Universiti Malaysia Sarawak recently showed that 90 per cent of the State's 129 coral reefs had been damaged by fish bombing. A bomb can damage about 1,000 square metres of coral reefs. Rayner said the department had seized 12 tonnes of bombed fish in the last seven years. They were mainly jacks and fusiliers which are "reef dwellers". "We believe this is only the tip of the iceberg." He said the State's fisheries industry was valued at RM40 million annually. Rayner believed that fish bombing activities would be reduced significantly if consumers refused to buy these two species of fish.

Source: http://agrolink.moa.my/dof/Fisheries_News/Newspaper/NST140301pg6.html

BOX 3: CAMPAIGN AGAINST FISH BOMBING

10 March, 2001

Kota Kinabalu: An anti-fish bombing campaign is scheduled to be launched in Sabah on Wednesday, aimed at promoting greater public awareness on the dangers of using explosives. Such activity would not only endanger lives, but also gradually destroy the State's marine ecology, particularly the exotic coral reefs along the coastal waters. The campaign, to be launched by Federal Agriculture Minister Datuk Effendi Norwawi at Hyatt Regency Kinabalu, will involve distribution of posters and stickers reminding the people against indiscriminate fish bombing activities in Sabah.

Announcing this here, State Fisheries Director Rayner Datuk Stuel Galid said other promotional activities had also been planned. He regretted that Sabah had been tagged as Malaysia's Number One fish-bombing State, committed by fishermen who are mainly illegal immigrants. However the real culprits were said to be locals who not only finance the activities but also act as middlemen for distribution of bombed fish in the local market. According to him, the campaign is the second to be organised after the first in the 1980s. There will also be seminars and workshops on related issues aimed at creating greater public awareness on the importance of safeguarding the coral reefs and the marine ecology in general.

SOURCE: http://www.dailyexpress.com.my/news.cfm?NewsID=1379

BOX 4: FORMATION OF ANTI FISH BOMBING PANEL HAILED

07 April, 2001

Kota Kinabalu: The Sabah Tourist Association (STA) and Malaysian Sport Diving Association (MSDA) Friday welcomed the State Government's decision to set up an anti-fish bombing panel.

STA Chairman Clement Lee said the announcement by Chief Minister Datuk Chong Kah Kiat on the formation of the panel is timely. It is to be headed by Datuk Abu Talib Harun, Director of the Federal Special Task Force for Sabah and Labuan.
"We would like to congratulate the State Government for addressing this critical issue as priority and we at STA and MSDA would like to offer our full support to this panel," said Clement, who is also MSDA Vice President.

He said through researches, workshops, forums and reports from institutions like UMS and Unimas, "we are all aware that the dynamiting issue has reached a critical stage in Sabah."

He said while fish bombing may mean an earning to some selfish group of people, the real issue is that it destroys the environment, the very source of income and the devastated corals may take 20 or more years to grow.
"This means it also destroys the natural habitat of the marine life and the eco cycle."

Clement said fish bombing activities was discussed at length at the Padi Director Training Course (CDTC) Friday because it relates to the environment which is promoted by the PADI Project AWARE (Aquatic World Awareness Responsibility and Environment.

"Top diving professionals from all over the world are gathering in Kota Kinabalu for the CDTC conducted by Padi and they have all highlighted their support to this Panel and salute the Sabah Government for taking this very important step to address the problem," he said.

Clement said the two bodies will initiate efforts to meet up with this Panel as soon as possible and offer their contributions. "We are positive that the problem of fish bombing will be eventually eradicated and we shall be able to substitute the income through tourism and a professional fishing industry," he said.

SOURCE: http://www.dailyexpress.com.my/news.cfm?NewsID=2113

BOX 5: NEED FOR HARSHER PENALTIES TO CRIPPLE FISH BOMBING ACTIVITIES IN SABAH

New Straits Times
Wednesday, April 25, 2001 : pg 2

THE unprecedented move some months ago to place masterminds of fish bombing activities in Sabah under restricted residence was a relief to many. The decision shows the authorities are determined to combat the problem which has been haunting Sabah for far too long.
It must be noted that Sabah is the first State in Malaysia to use the Restricted Residence Act against such people. It is expected to be implemented this year. The idea was proposed by the State Fisheries Department and it was agreed by the Maritime Operations Committee chaired by the National Security Council director-general.

It is high time that such action be taken against the culprits as the fish bombing problem is serious. People held under restricted residence are banished to an isolated place where their movements can be monitored closely by police.

While the authorities, particularly the Fisheries Department, deserve to be commended for coming up with the idea, some wonder if the punishment is harsh enough to be a deterrent. "How long can a person be placed under restricted residence? After the banishment is over, they will be back at fish bombing again," said Sabah Environmental Protection Association secretary-general S.M. Muthu. Muthu questioned the effectiveness of restricted residence, considering the availability of modern communication technology. "No matter where the masterminds are banished, they will still be able to communicate with their people and give instructions to carry out illegal activities," he said.

Describing the masterminds of fish bombing as the nation's enemy, Muthu said the action not only killed fish but also destroyed coral reefs, which are habitat of marine life as well as tourist attraction. Echoing Muthu's sentiment, Consumer Association of Sabah president Patrick Sindu said harsher punishment, such as confiscating the assets of the masterminds, should be imposed. Like dadah traffickers, their possessions should be deemed as having been acquired through money derived from illegal activities. Masterminds are people who financed fish bombing activities and profited from the illegal harvest. They are mostly locals, while the bombers are recruited from among the illegal immigrants in the State.

State Fisheries director Rayner Stuel Galid said the restricted residence was just one of measures being considered by the department to stop the rampant fish bombing which had caused tremendous damage to the ecology. "We have a list of suspected masterminds but it is difficult to convict them because of the difficulties in gathering evidence," he said.
Except for the detonator, the chemicals for making a fish bomb are easily available in the State. All one needs is a bottle and the correct mix of ammonium, nitrate and diesel. A fish bomb costs only about RM4 but it can kill one tonne of fish and destroy several hundred square metres of coral reefs.

Besides restricted residence, the department should also look at enhancing the penalties for fish bombers. Rayner said the department would amend the Fisheries Act 1985 to enhance the penalties under Section 26 on the usage of explosives with the intent to bomb fish and possession of bombed fish.

Currently, the section carries a penalty of not more than RM1 million fine or two years' jail or both for foreign offenders, while Malaysian offenders face a fine of not more than RM20,000 or two years' jail or both. "We may be able to calculate the amount of fish lost to bombing activities but it is impossible to do so for our coral reefs," said Rayner.
A study carried out by Universiti Malaysia Sarawak recently showed that 90 per cent of the State's 129 coral reefs had been damaged by fish bombing. Over the last seven years, the Fisheries Department has seized 12 tonnes of bombed fish, mainly jacks and fusiliers which are reef dwellers.

Rayner said it could be only the tip of the iceberg, adding that the State's fisheries industry was valued at RM14 million annually. Sindu believed that there would be no fish bombing if consumers refrained from buying bombed fish. He suggested that the Fisheries Department conduct regular checks at the fish market. What matters most is for the authorities to implement the decisions made to combat fish bombing.

Source:
http://agrolink.moa.my/dof/Fisheries_News/Newspaper/NST250401pg2.html

II. OVERVIEW OF THE FISHERIES INDUSTRY IN MALAYSIA

General

Geography

Malaysia, located in the heart of Southeast Asia between the coordinates 1-7^o North and 100-120^o East, has a total land area of 330,000 km^2. Geographically separated by the South China Sea, Malaysia is divided into two regions: Peninsular Malaysia – which lies south of Thailand, and East Malaysia – which lies north of Indonesia on the island of Borneo. Administratively, Malaysia is divided into thirteen states and three federal territories (including FT Putra Jaya in early 2001). Malaysia has a combined coastline of 4,675 km, with 2,068 km and 2,607 km in Peninsular Malaysia and East Malaysia (Sabah and Sarawak) on Borneo Island respectively. The City of Kuala Lumpur, which is part of FT Kuala Lumpur (land area of 243 km^2, total population of 1.3 million people), is the administrative capital of Malaysia.

Government System

The Federation of Malaysia was created in 1963 through the merging of Malaya (independent in 1957), Singapore (seceded in 1965), Sabah and Sarawak. Malaysia is a federal parliamentary democracy headed by a constitutional monarch or *Duli Yang Di Pertuan Agong*, a post is elected and rotated among the nine hereditary ruler of states (*sultans*) except for the states of Malacca, Penang, Sabah, and Sarawak which is headed by a state governor (*Yang Di Pertua Negeri*) appointed by the Government.

The powers of state governments are limited by the federal constitution. Under terms of the federation, Sabah and Sarawak – which are self governing states retain certain constitutional prerogatives (among others, the right to maintain their own immigration controls), with defense, foreign affairs, internal security, and other powers delegated to the federal government.

Malaysia has three branch levels of government: Executive, Legislative and Judicial. The Executive Branch is headed by a Prime Minister and cabinet members appointed by the Prime Minister from among the members of Parliament with consent of the paramount ruler. The Legislative Branch is the Malaysian Parliament that consists of elected House of Representatives (*Dewan Rakyat*) and appointed Senate (*Dewan Negara*) members. The Judicial Branch comprised of the Supreme Court with judges appointed by the *Duli Yang Di Pertuan Agong* on the advice of the Prime Minister. The legal system practiced in Malaysia is based on English common law, with judicial review of legislative acts in the Supreme Court at request of supreme head of the federation. Until now, Malaysia has not accepted compulsory ICJ jurisdiction.

Religion

Islam is the official religion of Malaysia. Malaysia practices the freedom of worship, where among other religions practiced are Buddhism, Daoism, Hinduism, Christianity, Sikhism, Confucianism, Taoism and tribal religions.

Language

Bahasa Melayu is the official language of Malaysia. Other dialects spoken are English, various Chinese dialects, various Indian dialects, Thai and many other tribal languages. In East Malaysia, several indigenous languages are spoken including Iban and Kadazan. Sabah has 54 tribal languages.

Population

According to the 2000 Census[5], Malaysia has 4.91 million households with a total population of 23.3 million people (**Table A4**). This includes 1.23 million non-Malaysian citizens enumerated according to their place of residence in Malaysia during the 2000 Census. Some official estimates in 1999 put the figure at about 1.6 million or 7% of the total population[6]. The population growth rate for the country is estimated at 2.60 per cent per annum for the 1991-2000 period.

By ethnic background, bumiputeras[7] that include Malays and other indigenous races formed the bulk (66.1%) of the population, followed by Chinese (25.3%), Indians (7.4%) and other races (1.2%).

The top five states with the highest population are: Selangor (3.95 million), Johore (2.57 million), Sabah (2.45 million), Perak (2.03 million) and Sarawak (2.01 million). The most rapid population increase noted for the 1991 - 2000 period is for the states of Selangor (AAGR 6.02%), Sabah (AAGR 3.83%) and FT Labuan (AAGR 2.92%).

The rapid increase in population size for Selangor is mainly due to development and the vast advancement of industries, increase in housing areas and in-migrants workers from other states. On the other hand, the high increase in population size for Sabah and FT Labuan is due to the in-migration of foreigners or transient population from Indonesia and the Philippines.

BOX 6: ILLEGAL IMMIGRANTS ISSUE IN SABAH[8]
"………….The migration of immigrants particularly from the Philippines has increased tremendously from just a few hundred in the 1970s…… … According to official figures disclosed by the Prime Minister Department on July 2000 in Parliament, some 600,000 foreigners were staying in Sabah based on the regularization exercise carried out in 1997. Of this, 413,832 are registered workers, 57,197 are refugees and some 100,000 illegal immigrants. No other official figures could be obtained since, and according to some sources, it is believed that their numbers had since doubled because of their mobility……."
Source: Daily Express PPH/8/12/2001 Vol. XXXVIII: Wednesday, 16th May 2001

Economy Setting

The economy of Malaysia can be described as developing, with a dominant primary commodity export base (**Tables A3-A8**). Malaysia has undergone rapid economic growth since the 1970s and this growth is expected to continue into decades ahead, given the strong economic fundamentals and increasing internal strength and resilience of the economy. Malaysia is well endowed with natural resources and its main exports consist of primary commodities such as timber, palm oil, rubber, petroleum, tea, pepper, copra and cocoa. The main industries are rubber and palm processing, manufacturing and mining. The main export commodities are machinery and transport equipment, petroleum, natural gas, palm oil, rubber, timber and tin. While the main import commodities are machinery and transport equipment, basic manufactures, chemicals, food and live animals. It is now one of the most advanced countries in the Third World, and has in recent years experienced one of the highest growth rates of about 8% per

[5] Preliminary estimates of Malaysia Population and Housing Census 2000

[6] http://www.thestar.com.my/news/story.asp?file=/2001/5/23/nation/2315pkmi&newspage=Search

[7] Indigenous people of Malaysia– bumiputera means "sons of the soil"

[8] http://www.dailyexpress.com.my/news.cfm?NewsID=3073

annum. From a basic primary producing economy, with rubber, tin, palm oil and timber as its staple products and exports, Malaysia now is emerging as an industrializing economy, with 27% of its GDP emanating from the manufacturing sector. Manufacturing contributed 60% to annual exports and is now the engine of growth for the economy. The national GDP in 1999 amounted to RM132.57 billion, with an increase of 10.2% from RM120.27 billion in 1995. The agricultural sector (including forestry and fisheries) contributed 12% to the national GDP, second after the manufacturing sector (32%), with fisheries making up 13% of the agriculture GDP. Current per capita income in Malaysia stands at RM7,403 (US$2,938), and is one of the highest in the Third World and compares favorably with those of the Newly Emerging Economies (e.g. Taiwan, Korea, Hong Kong).

Fisheries Management

With the 200-nm ZEE declaration in 1984, fishing grounds in Malaysia had increased by almost 3.5-fold from 47,000 square nautical miles to 162,000 square nautical miles. At the federal level, there are two government institutions dealing with marine fisheries, namely the Department of Fisheries Malaysia (DOF Malaysia) and Lembaga Kemajuan Ikan Malaysia (LKIM) or Malaysian Fisheries Development Board. Both agencies are under the Ministry of Agriculture Malaysia[9].

DOF Malaysia is entrusted with the development and management of the fisheries industry in the country. On the other hand, LKIM is entrusted to increase the living standards of small-scale fishing communities in the country including provisions of infrastructure for fish landing, eco-tourism, marketing of fish and fishery products and licensing for imports and exports. Except for Sabah, the development and management of fisheries falls under the jurisdiction of DOF Sabah[10] (Department of Fisheries Sabah) under the state Ministry of Agriculture and Food Industry of Sabah[11]. In Sarawak, marine fisheries affairs are under the purview of DOF Malaysia except for inland and estuarine fisheries, which is a concurrent state matter that comes under the state Department of Agriculture. With regards to the development and management of fisheries in the country, among the responsibilities of DOF Malaysia include the following:

- Formulation of national policies and strategies for fisheries management and development;
- Enforcement of the Fisheries Act 1985 and Exclusive Economic Zone Act 1984;
- Management and conservation of fishery resources;
- Fishery research;
- Provision of training and extension service;
- Development and management of inland fisheries and aquaculture;
- Development and management of marine parks and recreational fisheries;
- Fish health management and quarantine.

Fisheries management and conservation in Malaysia is governed mainly by the Fisheries Act 1985 (revised 1993)[12], which has provisions for the conservation, management and development of fisheries. It is a federal law for the conservation, management and development of maritime and estuarine fishing and fisheries in Malaysian waters. Under this act, provisions pertaining to fishing effort regulation include limited entry through licensing, minimum mesh sizes, minimum

[9] http://agrolink.moa.my/

[10] http://www.fishdept.sabah.gov.my/

[11] http://www.sabah.gov.my/madfi/

[12] http://agrolink.moa.my/dof/Regulation/Fisheries_Act/fisheries_act.html

harvesting of cockles, prohibition of destructive fishing gears and fishing zones defined by vessel size, engine power and method of fishing. The Act also contains provisions for the establishment of marine parks and reserves aimed at the conservation and rehabilitation of fish stocks and the environment.

While the management and development of fisheries in Sabah is strictly a state matter, the Fisheries Act 1985 has certain provisions for the management and conservation of fisheries in Sabah. The Malaysian Fisheries Act 1985 is in accordance with the mandatory obligations of coastal state embodied in the United Nations Convention of the Law of the Sea[13] (UNCLOS) (Chong, 1994), which was ratified by Malaysia in 1996 (Teo, 1998). The objective of the Fisheries Act 1985 is to provide for better conservation, management and development of fisheries in Malaysia in light of Malaysia's commitment towards UNCLOS. The Act covers the following:

- Administration of fisheries in Malaysia;
- Licensing and management of local maritime/estuarine fishing operations;
- Control of fishing by foreign fishing vessels in Malaysian fisheries waters;
- Offences, and prohibition and control of certain methods of fishing;
- Establishment of marine parks and marine reserves; and
- Offences and legal procedures relating to the implementation of the Act.

Other laws and regulations applicable for fisheries development, management and conservation in Malaysia, among others, include the following:

- Fisheries (Cockle Conservation and Culture) Regulations 1964;
- Fisheries (Maritime) Regulation 1967;
- Fisheries (Maritime) Sarawak Regulation 1967;
- Fisheries (Prohibition of Import, etc., of Fish) Regulations 1980;
- Fisheries (Prohibition of Methods of Fishing) Regulation 1980;
- Fisheries ((Marine Culture System)) Regulations 1990;
- Fisheries (Maritime) Licensing of Local Fishing Vessels Regulation 1985;
- Fisheries (Prohibition Areas) Regulation 1994; and
- Fisheries (Rantau Abang Prohibition Fishing Area) Regulation 1991

Other laws and regulations that are applicable to the management of aquatic resources and activities especially in the coastal waters of Malaysia include the Wildlife Act 1972: with provisions for the establishment, alteration and extinction of wildlife reserves and sanctuaries; Town and Country Planning Act 1976; Environmental Quality Act 1974: with provisions for spill or accidental discharge and environmental impact assessment; Land Conservation Act 1960 (revised 1989); Local Government Act 1976; National Land Code 1965; Street, Drainage, Buildings Act 1974; Customs Act 1967; Merchant Shipping Ordinance 1952; Uniform Building By-Laws 1986; and National Land Code 1965.

Fisheries Industry

Fisheries play an important role in the economic development of Malaysia, with regards to the provision of employment; especially in rural areas (including some 81,550 fishermen and 23,800 fish farmers), and in the support it provides to economic growth, foreign exchange through fish trade surplus and most important is its role in the provision of fish as food for its increasing human population (**Tables A8-A9**). Its contribution to the national economy has now become increasingly more important as food security after the 1997 East Asian financial crisis that had devalued the country currency from RM2.65 to RM6.00 to the US Dollar (USD1.00 is now pegged

[13] http://www.un.org/Depts/los/unclos/preamble.htm

at RM3.80). Fish constitute 40% of the total protein intake with a per capita consumption of 35 to 45 kg per annum, and is estimated to increase up to 55 kg per annum in 2010 (**Table A8**). In 1999, fisheries contributed about 1.6% to the national GDP.

The fisheries industry in Malaysia can be divided into three (3) sectors: marine fisheries, marine and freshwater aquaculture, and public water bodies. At present, production from public water bodies has insignificant role in the fisheries industry, where more than 99% of the annual fish production contributed by marine fisheries and aquaculture. For management purposes, the marine fisheries sector in Malaysia is categorized into two (2) sub sectors: inshore and deep-sea.

The inshore fishery sub sector is already heavily exploited with compelling evidence to show that fishing is over-saturated beyond sustainable levels in many areas especially in Peninsular Malaysia. However, the deep-sea fishery sub sector has further potential for development, especially off Sarawak and Sabah which has extensive fishing grounds that are still under exploited.

The aquaculture sector offers bright prospects for further development and expansion, and is thus given special attention and focus under the 3rd National Agriculture Policy[14] (NAP3: 1999-2010). Based on the present resource potential, further development is geared towards the deep-sea fishery and aquaculture sub sectors while sustaining production from the inshore fishery sector at its present fishing effort levels. Most of the potential areas for marine aquaculture in Sabah are located in the Malaysian portion of the SSME area.

Fishermen

In 1998, there are a total of 81,547 fishermen in Malaysia (**Figure 2** & **Table A10**). About 84% of them are Malaysians, comprising of 60.3% *bumiputera*, 22.90% Chinese, 0.3% Indians and 0.06% Portuguese. *Bumiputera* fishermen comprised mainly of Malays and other indigenous races in Sabah and Sarawak.

Foreigners make up 16% of the total, comprising of 54% Thais and 46% under the "others" category. About 94% of fishermen under the "others" category are in Sabah, comprising of Indonesian and Filipino immigrants. Overall, about 81% of the total fishermen population in Malaysia is involved in commercial fishing – with 40% in gill net fishing, 33% in trawling and 27% in seine net fishing. For traditional fishermen, about 50% of the fishermen are involved in hook & line fishing, 11% in trap fishing, 10% in lift net fishing and 29% in various traditional gears. The breakdown of fishermen by fishing region is given in *Table 1* below:

Table 1: *Breakdown of fishermen distribution by fishing region in Malaysia, 1998*

FISHERMEN POPULATION	% REGIONAL SHARE (1998 period)					TOTAL
	Peninsular East	Peninsular West	Sarawak	FT Labuan	Sabah	
% Commercial	25.1	42.6	12.6	0.4	19.3	66,053
% Traditional	23.8	10.6	12.7	0.7	52.2	15,494
% Combined TOTAL	24.9	36.5	12.6	0.5	25.6	81,847

Sabah has the highest fishermen population (25.6%), followed by Sarawak (12.6%), Terengganu (10.6%), Johore (10.3%) and Perak (9.8%). In West Peninsular, about 60% of the fishermen are in the states of Perak, Selangor and Perlis. On the other hand, about 43% of the fishermen in East Peninsular are based in Terengganu.

[14] http://agrolink.moa.my/dpn/dpn3/dpn/

Fishing Fleet

In 1998, there are 32,846 vessels of various sizes involved in fishing. These vessels can be categorized into three groups: non-powered fishing boats (8.7% total), fishing boats equipped with outboard engines (38.7% total) and fishing vessels equipped with inboard engines (52.6%) (**Tables A11-A13**). Sabah has the largest number of fishing vessels in the country, i.e. almost 32% (10,456 units) of the total fishing fleet (**Figure 3**). However, most of these vessels are small sized boats used to operate traditional fishing gears confined to the inshore coastal waters. The breakdown of fishing fleet type by fishing region is given in *Table 2* below:

Table 2: *Breakdown of fishing fleet type by fishing region in Malaysia, 1998*

FISHING FLEET TYPE	% REGIONAL SHARE (1998 period)					TOTAL
	Peninsular East	Peninsular West	Sarawak	FT Labuan	Sabah	
% non-powered	1.1	10.4	0.1	0.0	88.4	2,856
% outboard engine	11.4	45.4	6.1	0.5	36.6	12,718
% inboard engine	24.8	47.1	9.0	0.1	19.0	17,272
% motorized fleet	19.1	46.4	7.8	0.3	26.4	29,990
% Combined TOTAL	17.5	43.3	7.1	0.2	31.8	32,846

Non-powered boats including dugouts are mainly used for traditional fishing confined to inshore coastal waters. Some of them are also used for transportation and support boats of commercial fishing vessels. About 88% of the 2,856 non-powered boats in the country are based in Sabah – with a large portion of the fleet operating in the SSME area.

There are a total of 12,718 outboard-engine fishing vessels in Malaysia that represents 42% of the motorized fishing fleet in the country. These vessels are used in commercial and traditional fishing, inter-island transportation as well as support boats of commercial fishing vessels.

Sabah has the biggest motorized fishing fleet in Malaysia, i.e. 26.4% (7,932 units) of the total fleet that comprised of 5,488 units of outboard-engine and 3,279 units of inboard-engine fishing vessels in the country (**Figure 4**). Other states with large motorized fishing fleets include Johore, Perak, Selangor, Sarawak and Terengganu. In general, most of the engines used by the outboard-engine fishing fleet are less than 150 HP, with 54% of them within the 10-40 HP class. About 77% of the outboard engine fishing fleet in Sabah falls under this HP category – with most of them operating in the SSME area.

Inboard-engine fishing vessels represent 58% (17,272 units) of the motorized fishing fleet in the country. These vessels are used mainly in commercial fishing (trawling, purse seining and long lining) in both coastal and offshore waters. A number of them are also used as fish carriers in Peninsular Malaysia. Sabah has the largest inboard-engine fishing fleet (19% total), followed by Perak, Terengganu, Selangor, Sarawak, Johore and Kedah (**Figure 4**). The breakdown of the fishing fleet (engine type and gear usage) by fishing region is given in *Tables 3-6* below:

Table 3: *Breakdown of outboard engine fishing fleet by fishing region in Malaysia, 1998*

OUTBOARD ENGINE VESSELS	% REGIONAL SHARE (1998 period)					TOTAL
	Peninsular East	Peninsular West	Sarawak	FT Labuan	Sabah	
< 20 HP	13.8	54.0	3.7	0.1	28.4	8,373
20-40 HP	6.9	29.3	3.3	0.3	60.2	3,079
40-60 HP	7.4	27.1	29.0	2.8	33.7	1,071
> 60 HP	0.5	34.4	27.7	5.6	31.8	195
% Combined TOTAL	11.4	45.4	6.1	0.5	36.6	12,718

Figure 3. Total fishing fleet spatial distribution by vessel type in Malaysia (1998 period)

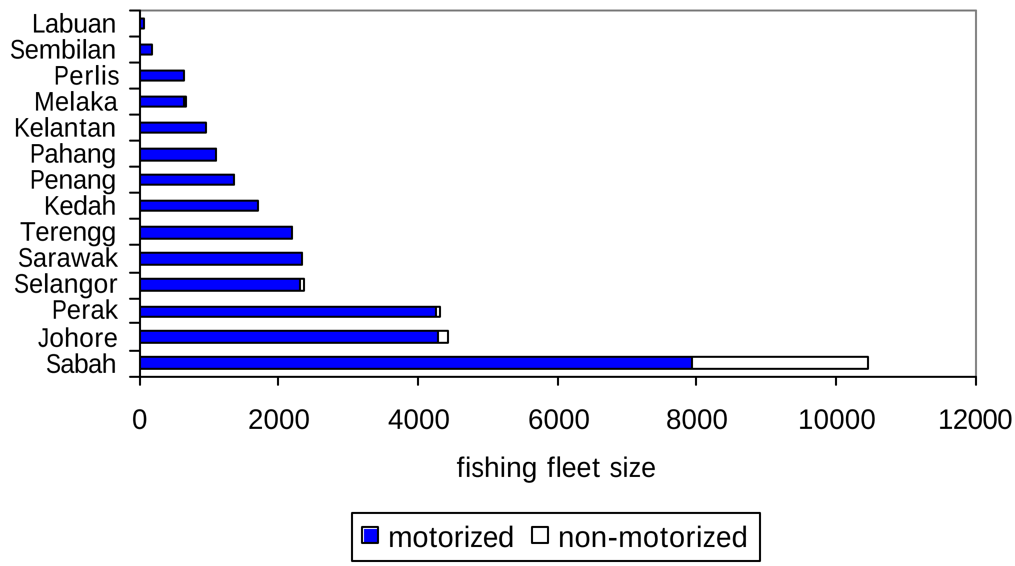


Figure 4. Total fishing fleet spatial distribution by motorized vessel type in Malaysia (1998 period)

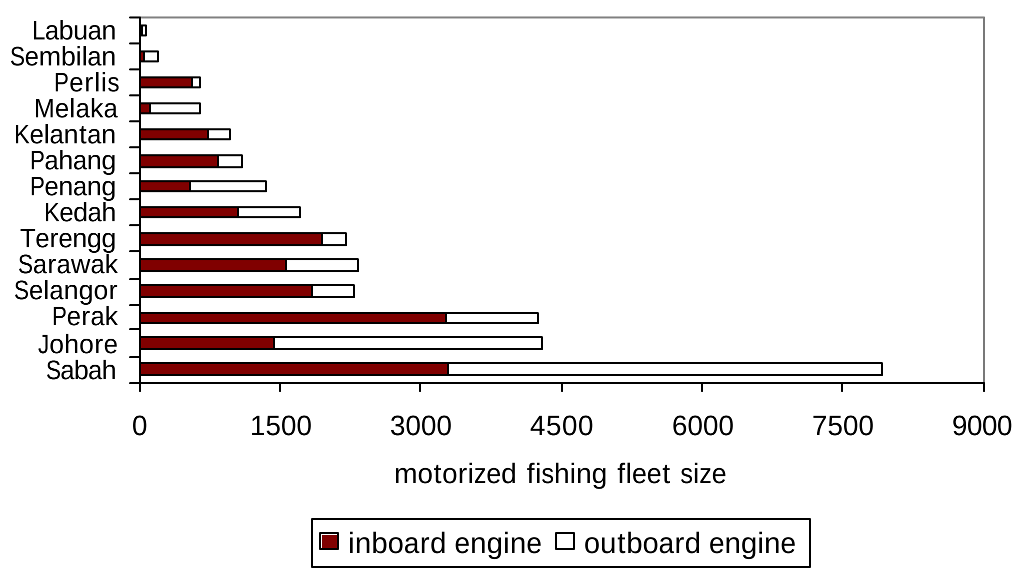


Table 4: *Breakdown of inboard engine fishing fleet by fishing region in Malaysia, 1998*

INBOARD ENGINE VESSELS	% REGIONAL SHARE (1998 period)					TOTAL
	Peninsular East	Peninsular West	Sarawak	FT Labuan	Sabah	
< 20 HP	33.0	29.1	16.4	0.0	21.6	3,095
20-40 HP	40.2	43.4	12.0	0.1	4.3	3,815
40-60 HP	6.5	69.0	2.5	0.1	21.9	2,749
60-100 HP	23.9	47.9	8.5	0.1	19.5	1,410
100-250 HP	14.3	50.7	6.3	0.1	28.5	3,668
> 250 HP	26.9	45.1	6.9	0.4	20.7	2,535
% Combined TOTAL	24.8	47.1	9.0	0.1	19.0	17,272

Table 5: *Breakdown of commercial fishing fleet by fishing region in Malaysia, 1998*

FISHING FLEET USING COMMERCIAL GEARS	% REGIONAL SHARE (1998 period)				TOTAL
	Peninsular	Sarawak	FT Labuan	Sabah	
% trawling	66.1	9,8	0.1	24.0	5,928
% fish purse seining	82.6	2.2	0.8	14.4	862
% anchovy purse seine	72.0	0.0	0.0	28.0	150
% other seine net	92.9	0.0	0.4	6.7	836
% gill netting	66.5	8.2	0.1	25.2	17,299
% fish carriers	100.0	0.0	0.0	0.0	58
% Combined TOTAL	68.0	8.0	0.1	23.9	25,133

Table 6: *Breakdown of traditional fishing fleet by fishing region in Malaysia, 1998*

FISHING FLEET USING TRADITIONAL GEARS	% REGIONAL SHARE (1998 period)				TOTAL
	Peninsular	Sarawak	FT Labuan	Sabah	
% lift netting	17.0	0.0	1.4	81.7	436
% hook & line	36.2	1.1	0.8	61.8	4,421
% bag netting	63.1	36.9	0.0	0.0	523
% trapping	49.4	1.2	0.7	48.7	868
% shellfish collecting	48.1	0.0	0.0	51.9	258
% barrier netting	39.1	55.4	0.0	5.4	92
% scoop netting	24.0	76.0	0.0	0.0	25
% others	26.4	0.0	0.0	73.6	1,092
% Combined TOTAL	37.4	4.2	0.6	57.8	7,715

In terms of vessel size, almost 75% or 12,354 units of the commercial fishing fleet in the country are below 20 GRT, 5.0% between 20-25 GRT, 10% between 25-40 GRT, 7.7% between 40-70 GRT and 3.0% for vessels above 70 GRT. Fishing vessels above 40 GRT (10.7%) are normally engaged in purse seining, trawling, tuna long lining or as fish carriers.

About 50% of these vessels are less than 10 GRT, with the main fleet under this category based in Perak (20.2%), Sabah (15.8%), Selangor (12.9%), Terengganu (11.1%), Johore (9.3%) and Sarawak (8.2%). Fishing vessels between 40-70 GRT represents 7.4% of the commercial fishing fleet, with the main fleet (76.3%) based in Perak (26.0%), Pahang (10.8%), Sarawak (10.3%), Johore (10.1%), Kedah (10.1%) and Selangor (9.0%). Fishing vessels above 70 GRT only represents 2.9% of the commercial fishing fleet, with the main fleet (83.1%) based in Sarawak (24.3%), Pahang (15.1%), Perak (14.5%), Kedah (9.6%) and Terengganu (8.6%).

There is a total of 681 vessels or 21% of the total number of inboard-engine fishing vessels of unknown GRT in Sabah. Most of these vessels are small-sized baby trawlers of less than 5 GRT or fishing boats equipped with modified motor engines (locally known as *pump boats*). Most of these boats are unlicensed and used for fishing in shallow waters or inter-island transportation.

In general, the engines used by large fishing vessels are closely related to vessel size, type of gear used and fishing sector. The distribution of engine horsepower of fishing vessel given in **Table A12** reflects the commercial fishing effort scenario in Malaysia.

In Peninsular Malaysia, licenses for vessels fishing within 20 nautical miles from the shore had been frozen to prevent depletion of inshore fisheries resources. However, licenses for deepsea boats operating beyond the limit of 20 nautical miles are still being issued. In Sabah, DOF Sabah is phasing out all trawlers below 10 GRT and has frozen all applications for trawling licences.

In general, about 9% of the fishing fleet operates in inshore waters, 84% in the coastal zone and 7% in the offshore zone. In Sarawak, only 0.1% of the fishing fleet operates in inshore waters, 60% in the coastal zone and 40% in the offshore zone. In the case of Sabah, 24% of the fishing fleet operates in inshore waters, 75% in the coastal zone and less than 1% in the offshore zone. In Peninsular Malaysia, 2% of the fishing fleet operates in inshore waters, 91% in the coastal zone and 7% in the offshore zone.

Fishing Gears

In normal cases each fishing vessel is licensed to operate only one type of fishing gear. However, there are also certain fishing operations where more than one-licensed fishing gears are being used or licensed fishing vessels being issued more than one fishing gear licence at the same time or at different seasons (months) of the year. The number of fishing licenses will therefore sometimes exceed the number of fishing vessels licensed. Likewise, late renewal of fishing gear licenses in a particular year and carried forward to the next might show that the number of fishing licenses less than the total number of licensed fishing vessels.

During the 1998 period, a total of 25,451 fishing licenses had been issued for various kinds of commercial and traditional gears in the country (**Table A14**). Most of the fishing licenses issued are for gill net (14.5%), followed by trawl net (11.8%), hook & line (4.5%), traps (1.7%), seine net (1.6%) and lift net (1.5%) and purse seine (1.5%). Commercial gears make up 83% or 21,064 units of the total number of fishing licenses issued in 1998 – of which about 66% are for gillnets, 24% for trawl nets and 10% for seine nets. Out of the total number of commercial gear licenses issued, Sabah ranked third (12.2%) after Johore (18.2%) and Perak (17.1%). Sabah ranked third (14.7%) in terms of the total number of fishing gear licenses issued after Johore (16.8%) and Perak (16.2%). The breakdown of licensed fishing gears by fishing region is given in *Table 7* below:

Table 7: *Breakdown of licensed fishing gears by fishing region in Malaysia, 1998*

LICENSED FISHING GEARS	% REGIONAL SHARE (1998 period)					TOTAL
	Peninsular East	Peninsular West	Sarawak	FT Labuan	Sabah	
% traditional gears	38.5	25.4	10.0	1.1	25.0	4,387
% commercial gears	18.9	59.8	9.0	0.2	12.2	21,064
% Combined TOTAL	22.2	53.9	9.2	0.3	14.4	25,451

For licensed trawlers (5,702 units), Sabah ranked second (21.2%) after Perak (24.0%). In 1998, it is estimated that a total of 1,442 trawlers are in operation in Sabah of which about 84% had been issued fishing licenses. For licensed fish purse seiners (783 units), Sabah ranked second (21.8%) after Terengganu (39.8%). Most of the fish purse seiners in Sabah comprised of medium-size to large fishing vessels operating in both coastal and offshore waters. As for gill nets that make up about 66% or 13,878 units of the total number of licensed commercial fishing gears in the country, Sabah ranked fifth (8.4%) after Johore (24.3%), Perak (13.1%), Selangor (9.9%) and Sarawak (9.42%) (**Table A14**).

Figure 5. Spatial and temporal distribution of marine capture fisheries landings in Malaysia (1993-1998 period) ('000 metric ton)

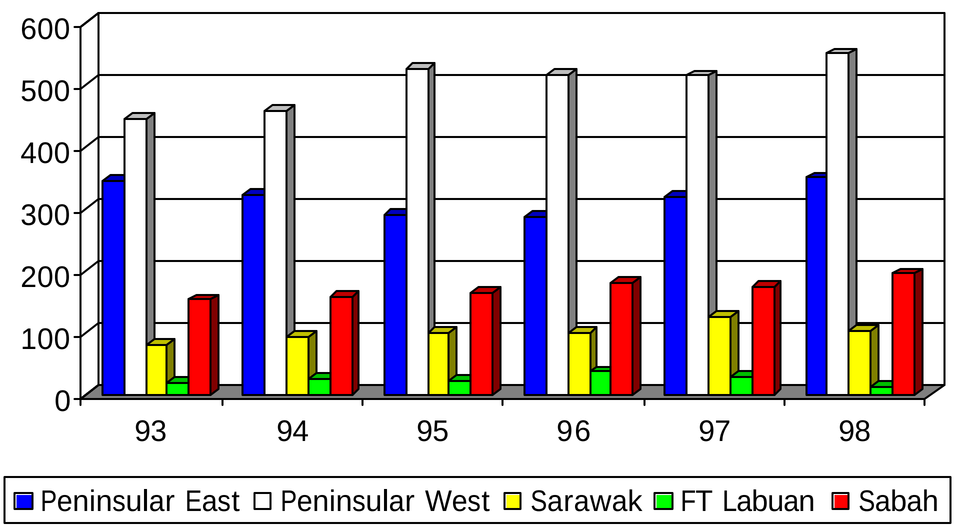
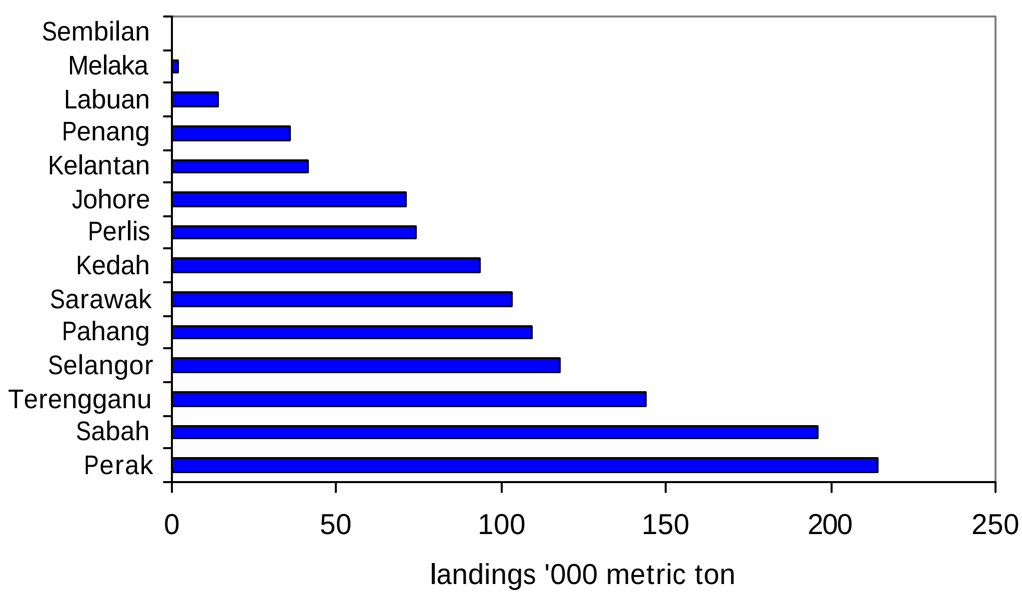


Figure 6. Spatial marine fish landings in Malaysia (1998 period)



Traditional gears make up 17% or 4,387 units of the total number of fishing licenses issued in 1998 – of which about 46.7% are for hook & line, 19.1% for trap, 10.9% for bag net, 5.9% for lift net, 3.0% for barrier net, 2.8% for shellfish collector and 0.3% for push scoop net. Other miscellaneous gears make up 11.3% of the total issued for traditional gears. In terms of number of fishing licences issued, Sabah ranked third (14.4%) after Johore (16.4%) and Perak (15.9%). Terengganu and Sabah has the highest number of licensed hook & line gears, making up about 64% of the country total. In the case of Sabah, the number of hook & line gears in operation might be at least 4-5 fold more than the present number of licensed gears (473 units).

Total Fish Production

In 1998, the total fish production amounted to 1,353,197 metric tons valued at RM4.53 billion, up 5.64% by volume and 4.14% by value over the previous year (**Table A15**). Its contribution to the agriculture and national GDP both increased to 13.22% and 1.62% respectively from 12.57% and 1.57% in 1997. Marine fisheries contributed 1,215,060 metric tons valued at RM3.81 billion (89.8% by volume) to the total production. While the aquaculture sector contributed 133,647 metric tons valued at RM654 million or 9.9% by volume of the total fish production. Public water bodies (inland fisheries) contributed only 4,344 metric tons (0.3% of total fish production). The freshwater ornamental fish sector produced 325 million tails valued at RM70.4 million that represents 1.68% of the total fish production value.

Marine Fish Landings

The temporal and spatial trend of marine fish landings in Malaysia is given in **Figure 5**. During the 1993-1998 period, Peninsular Malaysia – West Coast contributed about 44.9% of the annual fish landings, followed by Peninsular Malaysia – East Coast (28.6%), Sabah (15.3%), Sarawak (9.0%) and FT Labuan (2.2%). In terms on state contribution to the total fish landing in 1998, Sabah ranked second (16.2%) after Perak (17.6%). Combined with 50% of the fish landings in FT Labuan[15], makes Sabah on par with Perak as the top marine fish contributor in the country (**Tables A16 - A18** & **Figure 6**).

The temporal landing breakdown by gear type is given in **Figure 7**. In general, trawling is the most dominant gear used, contributing more than 50% of the total landings (**Figure 8**). This is evident also from the high percentage of demersal finfish and shrimp in the annual marine fish landings that are mostly caught by this gear. Pelagic fishes that make up more than 30% of the total marine fish landings annually are caught mainly by purse seine nets, gill nets and lift nets. During the 1993-1998 period, both commercial and traditional gears contributed 85% and 15% respectively to the total annual fish landings. The breakdown of fish resource landings by fishing region is given in *Tables 8-9*.

Demersal finfish make up 46% of the annual landings, followed by pelagic fish (36%), shrimp (8%), mollusks including cephalopods (7%) and other miscellaneous invertebrates (3%). Overall, demersal resources (including shrimp and mollusks) make up about 62% of the total fish landings in 1996-1998. In 1998, Sabah contributed 14% and 21% to the total demersal and pelagic landings respectively – with overall contribution of 16% of the total fish landings in the country. The average breakdown of fish landings by resource group and fishing region for the 1996-1998 period is given in **Figure 9**. In Peninsular Malaysia and Sarawak, demersal fishes dominated the total landings. However, in FT Labuan and Sabah, pelagic fishes are dominant in the annual landings.

[15] It is generally believed that a substantial percentage of the fish landings in FT Labuan (trawler contribution and miscellaneous gears) are caught from Sabah territorial waters.

Figure 7. Temporal distribution of marine capture fisheries landings by gear type in Malaysia (1993-1998 period) ('000 metric ton)

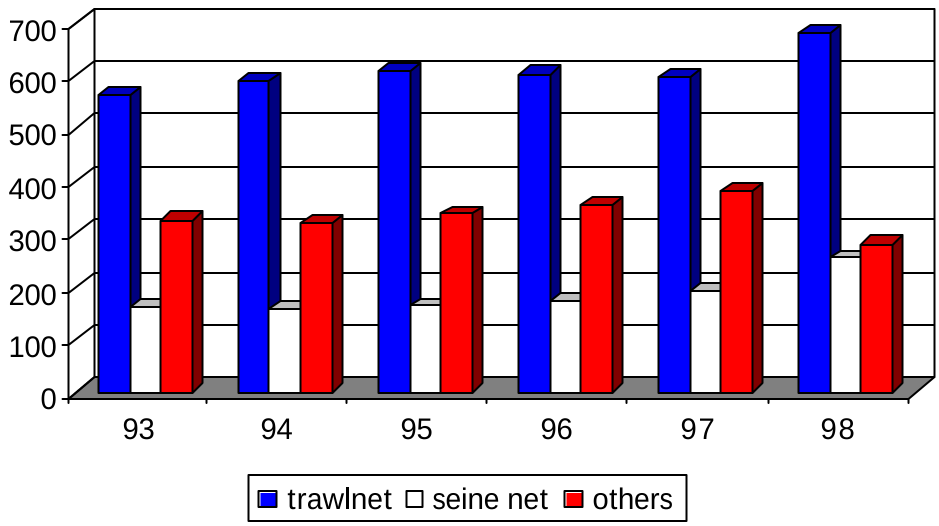


Figure 8. Spatial distribution of marine capture fish landings by gear group, Malaysia (1996-1998 period) (% total landings)

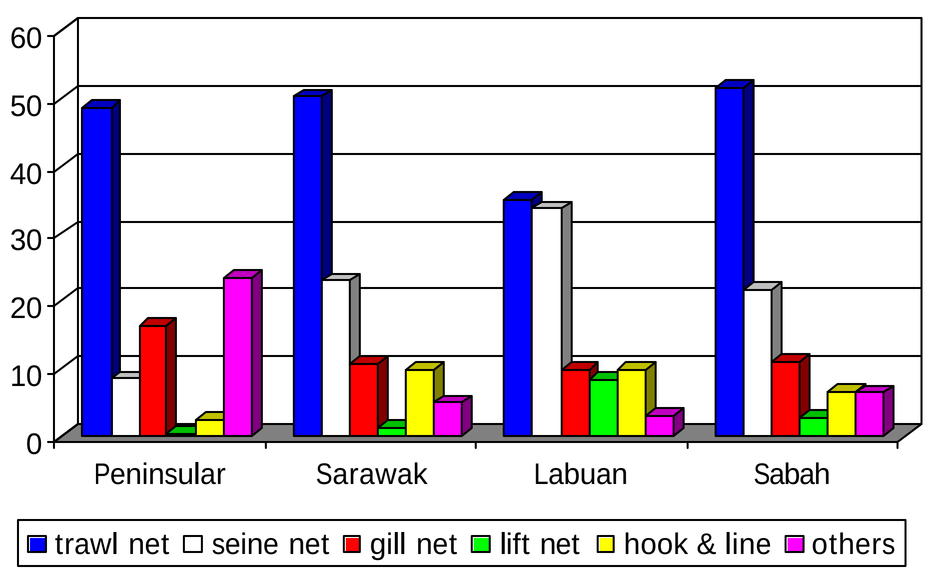


Figure 9. Spatial distribution of marine capture fish landings by resource group, Malaysia (1996-1998 period) (% total landings)

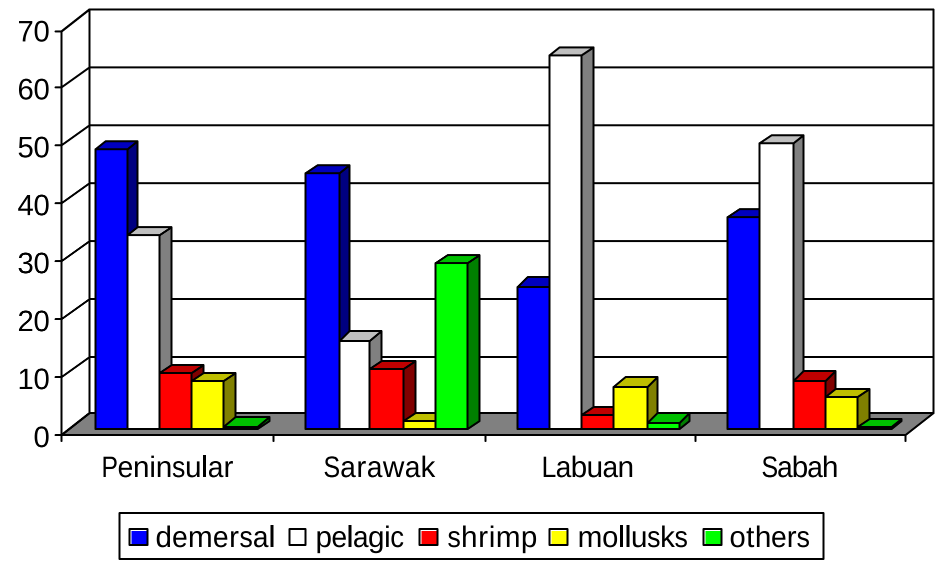


Figure 10. Temporal and spatial distribution of inshore fisheries landings in Malaysia (1993-1998 period) ('000 metric ton)

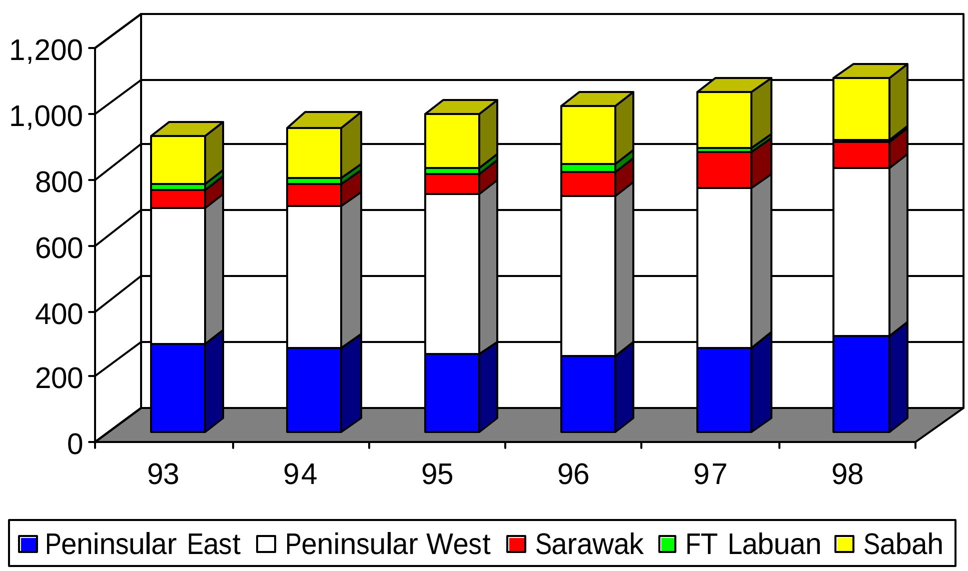


Table 8: *Fishing region share breakdown of fish resource landings in Malaysia, 1998*

FISHING REGION	% RESOURCE SHARE (1998 period)					TOTAL metric ton
	Demersal Finfish	Pelagic Finfish	CRUS	CEPH	others	
% Peninsular East	49.0	42.4	2.2	6.4	0.0	350,751
% Peninsular West	50.1	31.7	11.4	5.7	1.2	551,182
% Sarawak	52.8	21.8	12.8	2.5	10.1	103,213
% FT Labuan	26.9	64.8	5.8	2.5	0.0	13,833
% Sabah	40.5	46.5	7.5	4.9	0.5	196,227
% Combined TOTAL	48.2	36.7	8.2	5.4	1.5	1,215,206

Table A9: *Breakdown of resource landings by fishing region in Malaysia, 1998*

RESOURCE TYPE	% REGIONAL SHARE (1998 period)					TOTAL metric ton
	Peninsular East	Peninsular West	Sarawak	FT Labuan	Sabah	
% demersal finfish	29.4	47.1	9.3	0.6	13.6	585,695
% pelagic finfish	33.3	39.2	5.0	2.0	20.5	446,137
% crustaceans	7.9	63.1	13.3	0.8	4.8	99,343
% cephalopods	33.7	47.4	3.8	0.5	14.6	66,225
% others	0.0	35.7	58.6	0.0	5.6	17,806
% Combined TOTAL	28.9	45.4	8.5	1.1	16.1	1,215,206

The combined landings of Indian mackerel (*Rastrelliger* spp.), round scad (*Decapterus* spp.), tunas (neretic and oceanic), sardine and anchovy account for 63% of the total pelagic landings in 1998. These fishes formed the backbone of the pelagic fisheries in Malaysia, with 19% landed in Sabah. The breakdown of these selected pelagic species by fishing region is given in *Table 10*.

Among fisheries resources that are of important interest within the context of Sabah's significant contribution to the national fish production (refer to the following table) are barramundi (*Lates calcarifer*), lobster, billfish (marlin and sailfish), snapper (*Lutjanus* spp.), grouper (Serranidae), elasmobranchs (shark and rays) and penaeid shrimps. In Sabah, a large portion of these species is landed in the SSME area. It is also noted that trash fish represents a significant portion (27%) of the total landings in 1998 – with 6% landed in Sabah. The trash fish component with 93% landed by trawlers are used as raw materials for fishmeal plants[16] and feed for aquaculture farms. The fish landing composition by gear type and ISSCAAP group is given in **Table A16**. The landing breakdown of these selected groups by fishing region is given in *Table 11*.

Table 10: *Fishing region share breakdown of selected pelagic landings in Malaysia, 1998*

RESOURCE TYPE	% REGIONAL SHARE					TOTAL metric ton
	Peninsular East	Peninsular West	Sarawak	FT Labuan	Sabah	
% Indian Mackerel	9.6	77.8	3.5	0.4	8.7	102,072
% Round Scad	50.6	24.7	0.4	0.1	24.2	53,426
% Mixed Tunas	45.6	17.9	3.8	14.3	18.3	52,517
% Sardine	49.9	7.1	5.1	0.2	37.8	46,315
% Anchovy	29.3	58.2	0.1	0.0	12.4	25,651
% Combined TOTAL	32.6	42.9	2.9	2.9	18.6	279,981

[16] There are 31 fishmeal plants in Malaysia – with a total production of 76,000 metric tons in 1998. About 66% contributed by Sabah (27,200 metric tons – 8 plants) and Perak (23,000 metric tons – 6 plants).

Table A11: *Breakdown of selected pelagic landings by fishing region in Malaysia, 1998*

RESOURCE TYPE	% REGIONAL SHARE					TOTAL metric ton
	Peninsular East	Peninsular West	Sarawak	FT Labuan	Sabah	
% barramundi	0.8	49.9	0.0	0.0	49.3	1,880
% lobster	50.5	1.2	1.1	7.4	39.8	1,037
% billfishes	4.9	0.0	0.0	0.3	94.8	324
% snapper	25.9	2.8	21.3	3.8	46.3	8,361
% grouper	24.1	15.0	5.2	1.5	54.3	10,601
% trash fish	29.0	59.5	5.5	0.4	5.7	331,702
% Shark and Rays	33.9	22.6	17.3	0.9	25.2	23,943
% Penaeid Shrimps	6.8	63.3	17.1	1.0	11.8	72,727

In 1998, commercial gears make up 1,065,260 metric tons or 87.7% of the total marine fish landings (**Table A16**). In terms of commercial gear landings – trawlers contributed 63.9%, fish purse seine (20.5%), gill net (12.2%), anchovy purse seine (1.8%) and other seine net (1.5%). The breakdown of commercial gear landings by fishing region is given in *Table 12*.

Table 12: *Breakdown of commercial gear landings by fishing region in Malaysia, 1998*

COMMERCIAL GEARS	% REGIONAL SHARE (1998 period)					TOTAL metric ton
	Peninsular East	Peninsular West	Sarawak	FT Labuan	Sabah	
% Trawl Nets	51.0	48.2	9.3	0.7	11.4	681,223
% Seine Nets	41.6	36.4	1.3	3.1	17.5	253,708
% Gill Nets	9.6	56.7	14.9	0.1	18.6	130,329
% Total Commercial	28.7	48.2	8.1	1.2	13.8	1,065,260

Trawlers landed a total of 681,223 metric tons in 1998, which represent about 56% of the total combined gear landings in the country. The bulk of the landings consist of demersal finfish, crustaceans including shrimps, cephalopods, various invertebrates and pelagic fish. In terms of state contribution, Sabah ranked third (11.4%) after Pahang (12.0%) and Perak (22.4%). Trawling formed the backbone of the marine fisheries sector, contributing 40% of the total fish landings in 1998. The increasing trends of trawl landings in recent years is due to a large portion of the trash by-catch[17] being brought back to shore either as feed for aquaculture farms (marine cage culture and shrimp farms) or as raw materials to meet the increasing demand from fish meal processing plants in Kuala Penyu, Kota Kinabalu, Kudat, Sandakan, Tawau and Kunak.

Seine nets landed a total of 253,708 metric tons in 1998, which represent 21% and 24% to the total combined and commercial gear landings respectively. Sabah contributed 17.5% to the total seine net landings in the country, ranking second after Terengganu (23.8%). The bulk of the landings comprised mainly of small pelagic fish and coastal tunas.

Fish purse seine contribute 85.9% of the total seine net landings, followed by anchovy purse seine (7.6%) and other seine nets (6.5%). The anchovy purse seine is only used in Peninsular Malaysia, with 76% of the total landings in the country from the west coast. For "other seine net", 84.7% of the landings come from the west coast of Peninsular and 15.3% from Sabah.

Gill nets (including drift nets) landed a total of 130,329 metric tons in 1998, which represent about 11% of the total landings. Main species landed include both demersal and pelagic fish including shrimps caught by trammel nets. About 55% of the gear landings is contributed by 3 states in the following order: Perak (21.6%), Sabah (18.6%) and Sarawak (14.9%).

[17] Previously discarded at sea due to marketing problems

In 1998, traditional gears make up 12.3% (or 149,946 metric tons) of the total marine fish landings. In terms of traditional gear landings – hook & line contributed 42.0%, followed by lift net (14.8%), Bag net (14.1%), push scoop net (10.2%), traps (9.8%), shellfish collector (3.6%) and barrier net (1.3%). Other miscellaneous gears contributed 4.1%. Sabah contributed the highest gear landings (33.1%), followed by Terengganu (19.3%), Selangor (14.8%), Sarawak (11.6%), Perak (5.8%), Kelantan (5.7%) and other states contributing less than 5%. The breakdown of traditional gear landings by fishing region is given in *Table 13*.

Table 13: *Breakdown of traditional gear landings by fishing region in Malaysia, 1998*

TRADITIONAL GEAR	% REGIONAL SHARE (1998 period)					TOTAL metric ton
	Peninsular East	Peninsular West	Sarawak	FT Labuan	Sabah	
% Hook & Lines	39.2	9.0	6.2	1.0	44.5	62,907
% Lift Nets	42.6	na	na	0.2	57.2	22,230
% Bag Nets	6.4	76.2	17.4	0.0	0.0	21,184
% Push Scoop Nets	na	42.9	57.1	0.0	0.0	15,358
% Fish Traps	63.2	8.1	5.0	0.0	23.7	14,741
% Shellfish Collector	na	94.9	0.02	0.0	5.1	5,397
% Barrier Nets	0.0	87.2	12.6	0.0	0.2	1,960
% Miscellaneous Gears	0.9	16.2	0.1	0.0	82.8	6,169
% Total Traditional	29.9	25.0	11.6	0.5	33.1	149,946

Hook & line gears landed a total of 62,907 metric tons in 1998, which represent about 5% of the total combined gear landings in the country. The main species landed by this gear are tunas and various kinds of finfish (reef, demersal, small pelagic and tuna). Sabah contributed the highest landings (44.5%), and followed by Terengganu (29.2%), Selangor (6.5%), Sarawak (6.2%) and Kelantan (4.8%). Tuna long line, which is in principal a commercial gear, is a component of the deep sea fishery sub sector. In 1998, deep-sea fishing vessels using tuna long lines in East Malaysian waters landed 426 metric tons (0.3% of the total deep-sea landings) – with Sarawak contributing 47%, Sabah (46%) and Labuan (7%). The main long lining ground in Sabah is in Semporna, where the main species caught are yellowfin tuna, billfishes and oceanic sharks.

Lift nets (mobile and static types) landed a total of 22,230 metric tons in 1998, which represent about 1.8% of the total combined gear landings in the country. The main species caught are small pelagics and cephalopods. In Peninsular Malaysia, lift nets are only operated in the east coast with the fishery contributing 40.5% of the total lift net landings – Kelantan (24.4%) and Terengganu (16.1%). Sabah is the main contributor (57.2%) to the total lift net landings, where this gear is an important component of the local artisanal fishery that contribute the bulk of small pelagics landed by traditional gears. This gear is also the main contributor of anchovy landings in the state – principally in the SSME area (*will be discussed in the next chapter*).

Bag nets landed a total of 21,184 metric tons in 1998, which represent about 1.8% of the total combined gear landings in the country. This gear is only operated in 6 states, with Selangor contributing the bulk (57.0%), followed by Sarawak (17.4%), Johore (13.3%), Perak (6.6%), Penang (3.3%) and Kedah (2.4%). The target species of bag nets are shrimps. In the case of Sarawak, this gear is also used to catch jellyfish.

Push scoop nets landed a total of 15,358 metric in 1998, which represent about 1.3% of the total combined gear landings in the country – of which, 92.8% is contributed by Sarawak (57.1%) and Perak (35.3%). In Peninsular Malaysia, this gear is primarily used to catch *Acetes* shrimps in both inshore and estuarine waters. On the other hand, this gear is used in Sarawak to catch jellyfish. Sarawak has the largest jellyfish fishery in Malaysia with push scoop nets as the primary fishing gear. Jellyfish is caught almost throughout the year with peak seasons between January to March (*contributed 83% of the annual landing in 1998*). In 1998, about 10,431 metric tons (10% of state total marine fish landing) of jellyfish were landed in Sarawak, with 83% landed by push scoop nets, followed bag net (16.5%) and barrier net (0.5%). Jellyfish represents 98.5% of the total push scoop landings in 1998.

Traps landed a total of 14,741 metric tons in 1998, which represent about 1.2% of the total combined gear landings in the country. This gear (portable and stationary types) is operated in both inshore and estuarine waters targeting fish, cephalopods and crabs. About 71% of the gear landings came from Terengganu (47.4%) and Sabah (23.7%).

Shellfish collectors landed a total of 5,397 metric tons in 1998, which represents 0.4% of the total combined gear landings in the country. This gear is used to collect cockles (*Anadara* spp.) and other shellfish from natural spat falls in mud flats and shallow waters. In Peninsular Malaysia, the operation of this is limited to the west coast – mainly from Selangor up to Kedah in the north. In 1988, Selangor contributed almost 71%of the total gear landings, followed by Kedah (14.6%) and Perak (9.0%). Sabah contributed about 5.1% of the total landings, with the main fishery in the SSME area (Labuk Bay – Sandakan and Cowie Bay – Tawau).

Barrier nets landed a total of 1,960 metric tons in 1998, which represents about 0.2% of the total combined gear landings in the country. This gear is mainly used in the west coast of Peninsular Malaysia, Sarawak and Sabah. The target species comprise a wide range of fish and crustaceans including jellyfish (Sarawak). In 1998, Selangor contributed about 61% to the total barrier net landings, followed by Sarawak (12.6%), Perak (9.7%), Penang (8.3%) and Kedah (3.7%). While miscellaneous gears landed a total of 6,169 metric tons in 1998, which represent about 0.5% of the total combined gear landings. This category comprised of a wide range of traditional gears not listed under other gear groups.

Inshore Fisheries

The inshore fishery sub sector comprised of fishing vessels of below 70 GRT operating various types of gears in inshore and coastal waters. The temporal and spatial trend of fish landings of the inshore fishery sub sector is given in **Figures 10-11**. In 1998, about 1,079,953 metric tons of fish was landed, with an increase of 19.76% from 901,802 metric tons in 1993 (**Table A18**). Overall, inshore fisheries contributed 89% of the total landings. However, no significant increase in fish landings is expected from this sub sector where annual landings seems to have stagnate around the 1.1 million metric ton level, where except for Sabah and Sarawak, where there is still some room for development especially for pelagic exploitation.

In 1998, West Coast of Peninsular Malaysia contributed about 508,464 metric tons, followed by East Coast of Peninsular Malaysia (294,362 metric tons), Sabah (190,992 metric tons), Sarawak (81,874 metric ton) and FT Labuan (4,271 metric tons) to the total inshore fish landings. Inshore fisheries contributed RM3.45 billion in 1998 or 90.41% of the total wholesale value marine fish landings. Overall, the inshore fisheries had increased by value to 63.51% in 1998 from RM2.11 billion in 1993.

Deep-sea Fisheries

The deep-sea fishery sub sector includes fishing vessels of more than 70 GRT which uses various types of gears including trawl net, purse seines, long lines, drift gill nets and operate a distance of above 30 nautical miles from the coast. The temporal and spatial trend of landings from the deep-sea fishery sub sector during the 1993-1998 period is given in **Figures 12-13**.

Figure 11. Temporal and spatial distribution of inshore fisheries landings in Malaysia (1993-1998 period) (% annual)

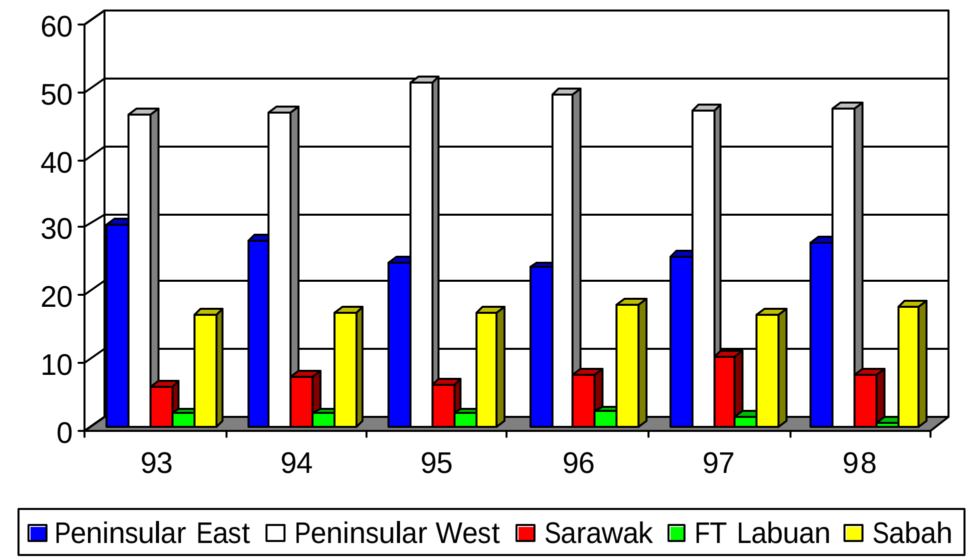


Figure 12. Temporal and spatial distribution of deepsea fish landings in Malaysia (1993-1998 period) ('000 metric ton)

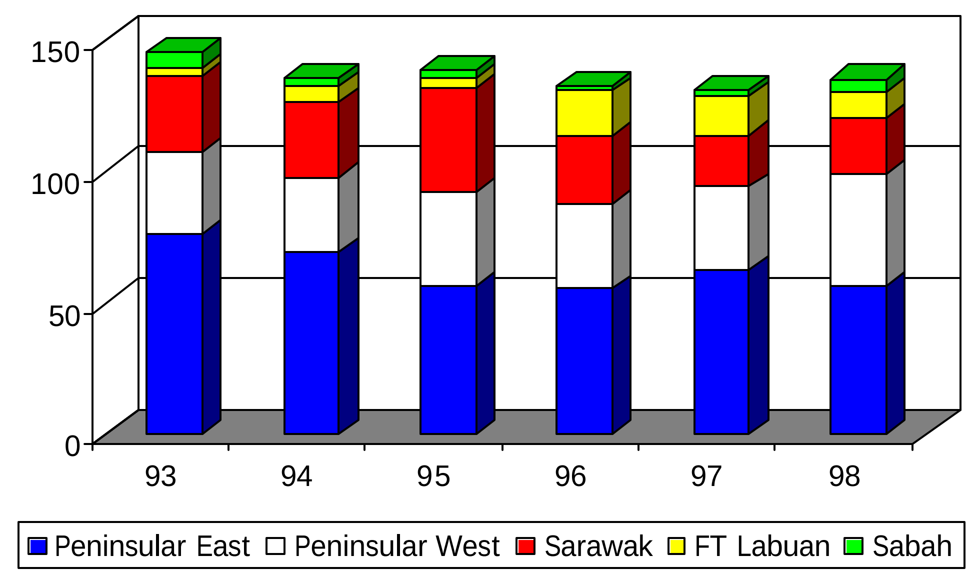


Figure 13. Temporal and spatial distribution of deepsea fish landings in Malaysia (1993-1998 period) (% annual)

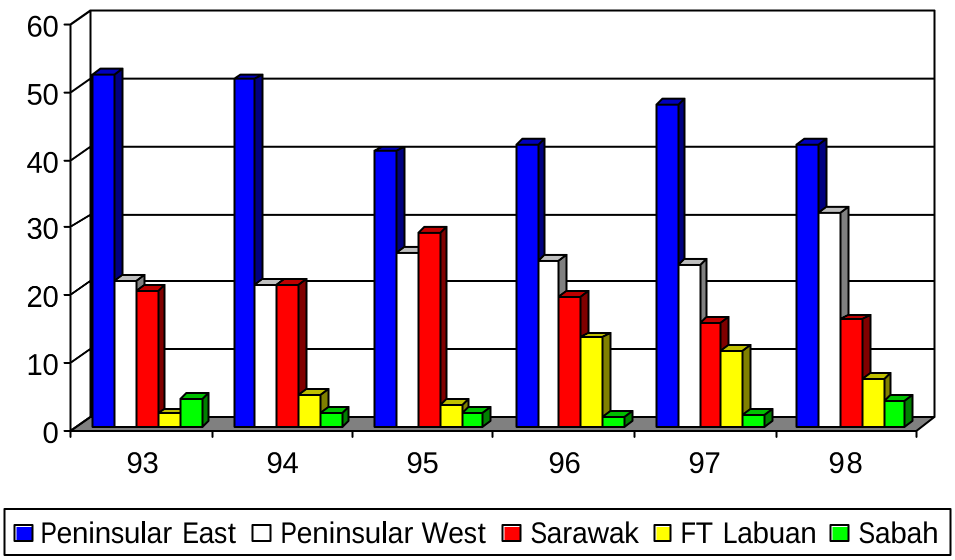
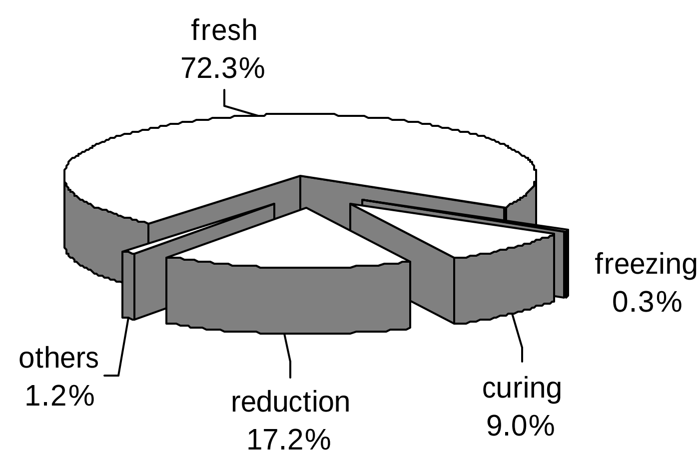


Figure 14. Disposition of fish landings in Peninsular Malaysia (after 1998 figures) - refer to Table A19



In 1998, deep-sea fisheries landed 135,253 metric tons or 11% of the total landings, showing a decline of 7.07% compared to 1993 (145,549 metric tons) (**Table A18**). The decrease in fish landings was due to the declining number of deep-sea fishing vessels in operation as well as other unknown internal and external factors.

Landings by trawlers contributed the bulk (63.5% or 85,831 metric tons) of the deep-sea fish landings, followed by fish purse seines (36.2% or 48,996 metric tons) and long line (0.3% or 426 metric tons). For trawl landings, about 37.4% is landed in the east coast of Peninsular Malaysia, followed by west coast of Peninsular Malaysia (34.8%), Sarawak (23.8%) and FT Labuan (3.9%) with no landings recorded in Sabah.

For fish purse seine landings, east coast of Peninsular Malaysia contributed almost 50%, followed by the west coast of Peninsular Malaysia (26.2%), FT Labuan (12.6%), Sabah (10.3%) and Sarawak (1.4%). Long line landings make up only 0.31% of the total deep-sea fish landings, with fishing operations confined to the waters off East Malaysia – Sarawak (46.7%), Sabah (46.0%) and FT Labuan (7.3%).

In 1998, the east coast of Peninsular Malaysia contributed 56,399 metric tons, followed by west coast of Peninsular Malaysia (42,718 metric tons), Sarawak (21,399 metric tons), FT Labuan (9,562 metric tons) and Sabah (5,235 metric tons) to the total deep-sea fish landings. Deep-sea fisheries contributed RM0.37 billion in 1998 or 9.59% of the total value of marine fish landings. Deep-sea fisheries had increased by value to 37.07% from RM0.27 billion in 1993.

In summary, the breakdown of fish landings and fishery returns by fishing sector and region in 1998 are shown in *Tables 13-15*.

Table 13: *Breakdown of fishery sector landing volume by fishing region in Malaysia, 1998*

MARINE FISHERIES PERFORMANCE	% REGIONAL SHARE (1998 period)					TOTAL metric ton
	Peninsular East	Peninsular West	Sarawak	FT Labuan	Sabah	
% Inshore	27.3	47.1	7.6	0.4	17.7	1,079,953
% Deep Sea	41.7	31.6	15.8	7.1	3.9	135,253
TOTAL (metric ton)	350,751	551,182	103,213	13,833	196,227	1,215,206

Table 14: *Breakdown of fishery sector landing value by fishing region in Malaysia, 1998*

MARINE FISHERIES PERFORMANCE	% REGIONAL SHARE (1998 period)					TOTAL RM million
	Peninsular East	Peninsular West	Sarawak	FT Labuan	Sabah	
% Inshore	24.0	48.2	8.3	0.8	18.6	3,451,203
% Deep Sea	42.5	30.9	14.2	7.7	4.7	366,021
TOTAL (RM million)	983.96	1,777.29	338.61	57.28	660.08	3,817,224

Table 15: *Breakdown of fishery returns by fishing region in Malaysia, 1998*

MARINE FISHERIES PERFORMANCE	REGIONAL SCENARIO (1998 period)					MEAN RM/kg
	Peninsular East	Peninsular West	Sarawak	FT Labuan	Sabah	
Fish Price (RM/kg)	2.81	3.22	3.28	4.14	3.35	3.14
MT/fisherman	17.30	18.52	10.03	36.69	9.41	14.90
RM/fisherman	48,535	59,711	32,917	151,948	31,666	46,810

** based on 1998 fishermen population distribution by state

In summary, the production performance of the marine capture fisheries in Malaysia during the 1993-1998 period can be summarized below:

Table 16: *Comparison of marine capture fish production, Malaysia 1993-1998*

MARINE	1993		1998		% change 1993-1998	
CAPTURE	Q	V	Q	V	Q	V
Inshore	901.81	2,109.21	1,079.95	3,451.20	19.75	63.63
Deep Sea	145.55	269.40	Period	366.02	-7.07	35.86
TOTAL	1047.36	2,378.61	1,215.20	3,817.22	16.03	60.48

Mean Wholesale Fish Prices			
	1993 RM/kg	1998 RM/kg	% change 1993-1998
Inshore	2.34	3.20	36.63
Deep Sea	1.85	2.71	46.21
TOTAL	2.27	3.14	38.32

Returns to Fishing Industry			
	1993 MT/fisherman	1998 MT/fisherman	% change 1993-1998
TOTAL	13.05	14.90	14.22
	1993 RM/fisherman	1998 RM/fisherman	% change 1993-1998
TOTAL	29,630	46,810	57.98

* Q in '000 metric ton, V in RM million

Downstream Processing

There are a total of 3,412 establishments involved in food processing in Malaysia, of which 96% are categorized as small and medium-scale industries (SMIs) (Department of Statistics Malaysia, 1997). SMIs are defined as entities with annual sales turnover of not more than RM25 million and number of workers not exceeding 150 persons. However, there are no published figures for the number of SMIs under the fish-manufacturing sector. There are a total of 158 ice factories in Malaysia (58 in Sabah) with a daily production capacity of 4,846 metric tons (**Table A19**).

The fish processing industry in Malaysia is dominated by the small and medium-scale operators. Most of the processing establishments are small and mainly located along the coastal zone, close to fish landing points except for bigger establishments that process canned, frozen, *surimi* and *surimi*-based products.

Traditional fish products processed in Malaysia can be broadly categorized into fish snacks, salted and dried, *surimi* and *surimi*-based, fermented and miscellaneous products. Most are operated at both small scale or cottage level using traditional methods and the market is limited in most cases for local consumption. These industries produce products such as dried salted fish, fish crackers, shrimp paste, fermented anchovies, fish satay, fish ball and fish cake. R&D efforts in Malaysia are now focused on upgrading production efficiency and development of new products (Wan Rahimah *et al*., 1994; Wan Rahimah, 1998). The disposition of marine fish landings and breakdown of processed fish products in Peninsular Malaysia in 1998 are given in **Tables A20-21** and **Figures 14-15**. No detailed information is available for Sabah and Sarawak at this present time.

<u>Fish meal</u>:

Fish meal makes up the bulk of the total fish products processed in the country, with a significant large portion being contributed by fish meal processing establishments based in Sabah.

Figure 15. Breakdown of processed fish products in Peninsular Malaysia (after 1998 figures) - refer to Table A20

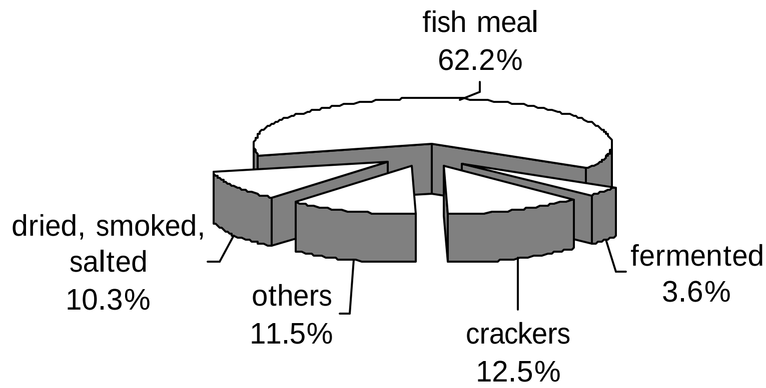
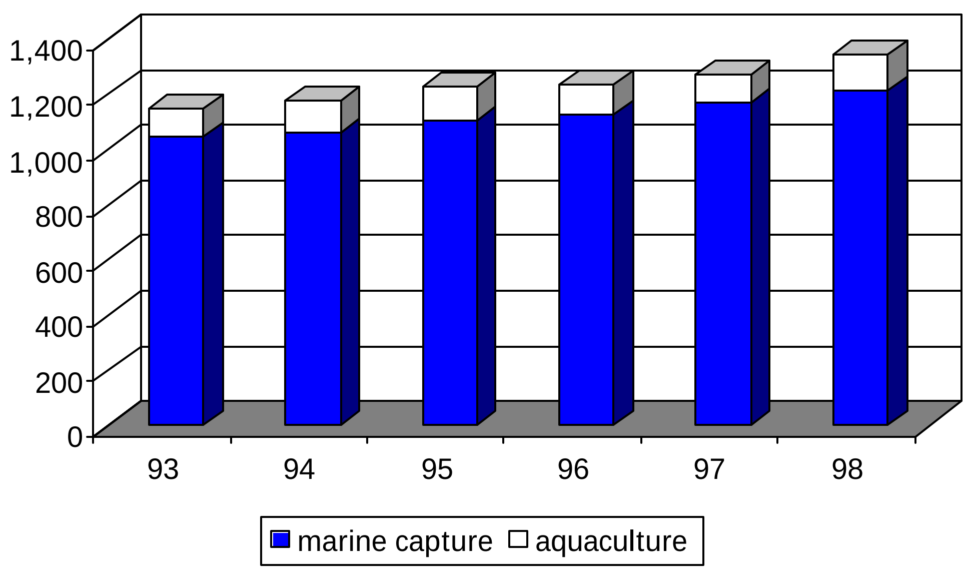


Figure 16. Temporal trends of total fish production, Malaysia (1993-1998 period) ('000 metric ton)



Dried Salted Products:

Dried salted fish products make up the second largest component of the total processed fish products in the country. Salting and drying are amongst the oldest forms of fish preservation that involved both traditional-based activities of coastal communities and commercial operations. In 1998, about 10,534 metric tons of dried salted products was produced in Peninsular Malaysia. These comprised mainly of dried or salted products made from fish, anchovies, jellyfish, shellfish, cuttlefish, sea cucumber or shark fin.

This figure might be an underestimate considering that salting and drying of fish products is a cultural based activity of the indigenous population in the country. The number of individuals or establishments involved is unknown but could probably be in the order of more than 100,000 odd (including women folk of 80,000 odd fishing households of coastal-based communities).

Fish Snacks:

Fish snacks make up the third largest component of the total processed fisheries products in Peninsular Malaysia. In 1998, about 12,888 metric tons of fish snacks were produced from various marine species in Peninsular Malaysia. These comprise of crackers or *keropok* and fish *satay*. *Keropok* is made by gelatinization of formed dough made from fish, cuttlefish or shrimp that is later sliced to the desired thickness prior to drying. While fish satay is made from fish or cuttlefish, which is prepared by the drying of fish or cuttlefish dressed butterfly style, followed by rolling, dipping in sauce and roasting to a crispy texture.

In 1998, there are approximately 350 small to medium-scale *keropok*-processing establishments with production capacity ranging between 40 kg to 40 metric tons per month in Peninsular Malaysia. While the number of fish *satay*-processing establishments is not yet known but could probably be in the order of 100-200 such establishments.

Surimi and Surimi-Based Products:

Surimi and *surimi*-based processing is technology-based with commercial operations governed by existing local government by-laws and health regulations. Up to May 2001, there are 29 fish-based establishments, including those involved in *Surimi* and *surimi*-based based products, have been certified under the Ministry of Health certification programme. At present, there are 27 small to medium-scale establishments involved in the processing of *surimi* and fish mince, with products targeted both for domestic and export market. Depending on the scale of operation, the production capacity range between 0.5 to 380 metric tons per month. In 1988, about 8,396 metric tons of *Surimi* and *surimi*-based fish products were produced in Peninsular Malaysia. This comprised mainly of fish ball (from fresh fish), cuttlefish ball, and *surimi*-based fish ball. The main species used are threadfin bream, bigeye snapper, barracuda, croaker, lizard fish and other trawl-sourced by catch. Several companies in Malaysia are now exporting *surimi*-based products to Europe and Asia including Australia, Japan, Taiwan, Hong Kong and Indonesia (Law *et al*., 1994). Some establishments including from Sabah are also exporting raw materials (mainly threadfin bream and lizard fish) to *surimi* processing factories in Taiwan.

Fermented Products:

In 1998, about 138 metric tons of fermented fish products were produced in Peninsular Malaysia (an underestimate?). Despite its low production volume, fermented fish products are in great demand at all levels of society because of being necessary in the recipe of most popular Malaysian dishes. These are in the form of shrimp paste (*belacan*), fermented anchovies (*budu*), pickled shrimp (*cincaluk*) and pickled fish (*nonsom* and *pekasam*).

Belacan the most widely accepted fermented fish product nationwide is traditionally prepared by the fermentation of *Acetes* shrimp – its unique flavor is resulted from the autolysins of the tissues and involvement of microorganisms. While *budu*, a traditional fish sauce, is mainly made from the liquefaction of anchovies. This product is more popular among the population on the east coast states of Peninsular Malaysia. *Cincaluk* is a product of *Acetes* shrimp, cooked rice and salt fermented for a certain period of time. It is a popular dish among the indigenous population normally consumed as a side dish garnished with chili and lime. *Cincaluk* is also used as a main ingredient in many local delicacies. In Sabah, *nonsom sada* made from the fermentation of fish (including freshwater), rice, salt and grinded kernel seed of the *Pangium edule* is a popular dish among the KadazanDusun-Murut community. In Peninsular Malaysia, *pekasam* is a product made from the fermentation of freshwater fish, roasted rice and salt.

Other Products:

Other traditional products produced by small-scale processors or coastal community households in the country include fish paste, boiled and smoked fish. However, such products are processed on a very small scale and their contribution to the industry is very small.

Aquaculture Sector

The aquaculture sector in Malaysia is in its developing phase. In terms of operation scale, small fish farms tend to be more dominant with only a small percentage considered to be commercially oriented in practice. There are several fish culture systems that have already been successfully operated and/or being developed in Malaysia. These systems include:

- Mollusks culture (cockle, mussel culture, oyster);
- Freshwater fish culture (earthen ponds, ex-mining pools, cage, concrete ponds and pens);
- Brackish earthen pond culture (finfish and shrimp);
- Marine finfish cage culture; and
- Marine seaweed culture (in Sabah)

Aquaculture contributed 9.3% by volume and 12.2% by value to the annual fish production during the 1993-1998 period[18] (**Figures 16-17**). In 1998, aquaculture production (excluding freshwater ornamental fish) increased by 27% to 133,648 metric tons from 105,237 metric tons in 1993. In terms of production value, it increased by 124% from only RM292 million in 1993 to RM654 million in 1998 (**Figure 18**). Data on existing practices and production output by culture system are given in **Table A22-A24** and **Figures 19-20**.

The major cultured species are: (a) freshwater species: red and black tilapia (*Oreochromis* spp.), catfish (*Clarias* spp., *Pangasius* spp.), giant freshwater prawn (*Macrobranchium rosenbergi*), Javanese carp, bighead carp, grass carp, common carp, freshwater eels, various local cyprinids, snakehead, marble goby; (b) marine and brackish water species: cockle (*Anadara granosa*), mussel (*Perna viridis*), oyster (*Crassostrea* spp.), shrimp (*Penaeus monodon, P. mergueinsis*), seabass (*Lates calcarifer*), groupers (*Epinephelus* spp.), snappers (*Lutjanus* spp.), seaweed[19] (*Eucheuma cottonii*), mangrove crabs and various species of reef fishes[20].

[18] Excluding seaweed production from Sabah (1,785 metric tons worth RM3.575 million in 1998)

[19] Seaweed (*Eucheuma cottonii*) is only farmed in Sabah, the culture of *Glacilaria* spp. in brackish water ponds is still in the experimental stage

[20] Including *short term transit culture* for the live reef fish trade – humphead wrasse, highfin coral grouper, mouse grouper, etc. (the “culture” of these species is mainly carried out in Sabah)

Figure 17. Temporal trends of total fish production, Malaysia (1993-1998 period) (% annual)

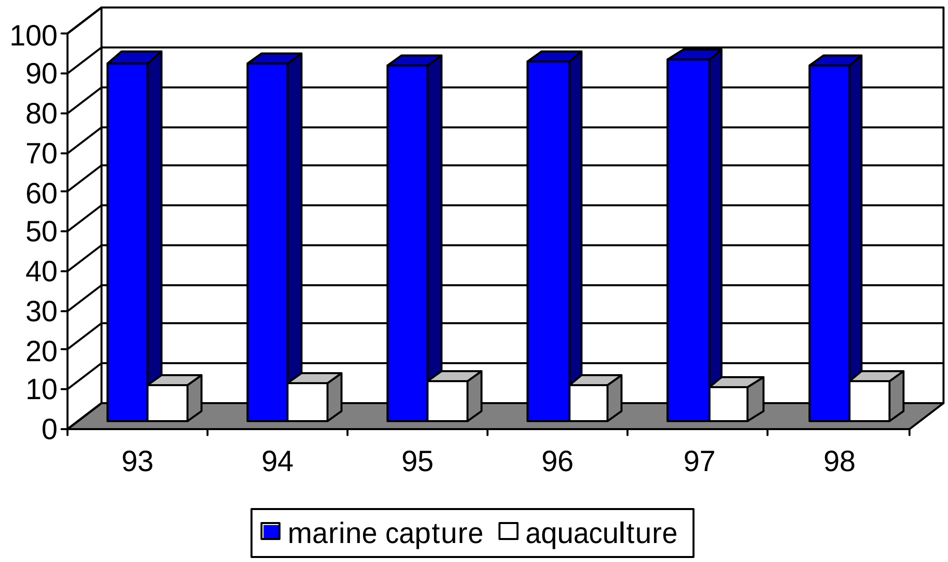


Figure 18. Temporal trends of total fish production, Malaysia (1993-1998 period) (RM billion)

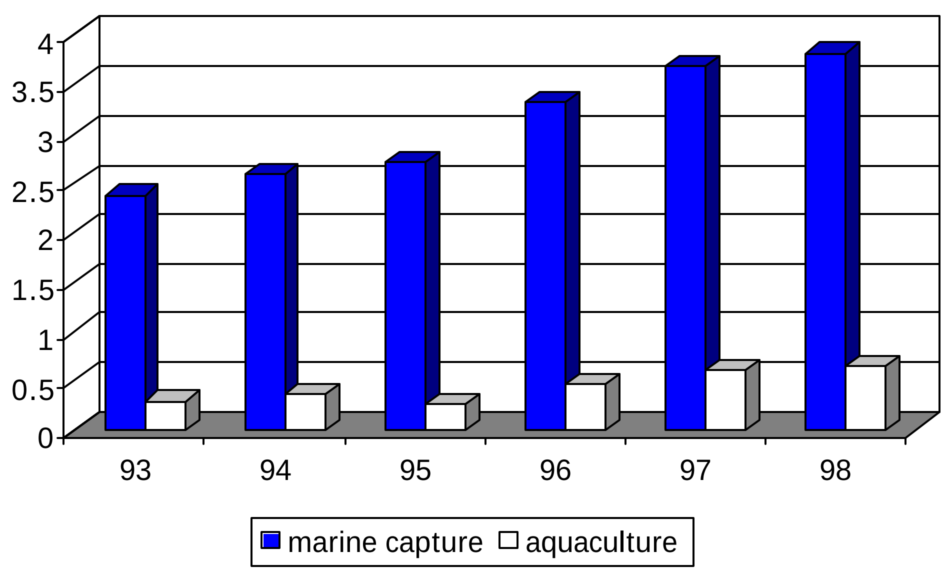


Figure 19. Temporal trend in aquaculture production, Malaysia (1993-1998 period) ('000 metric ton)

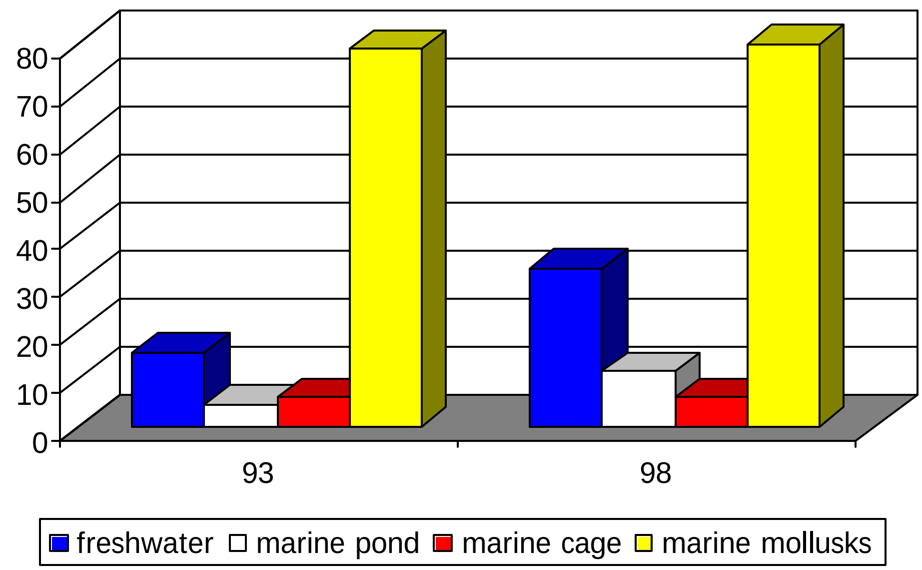
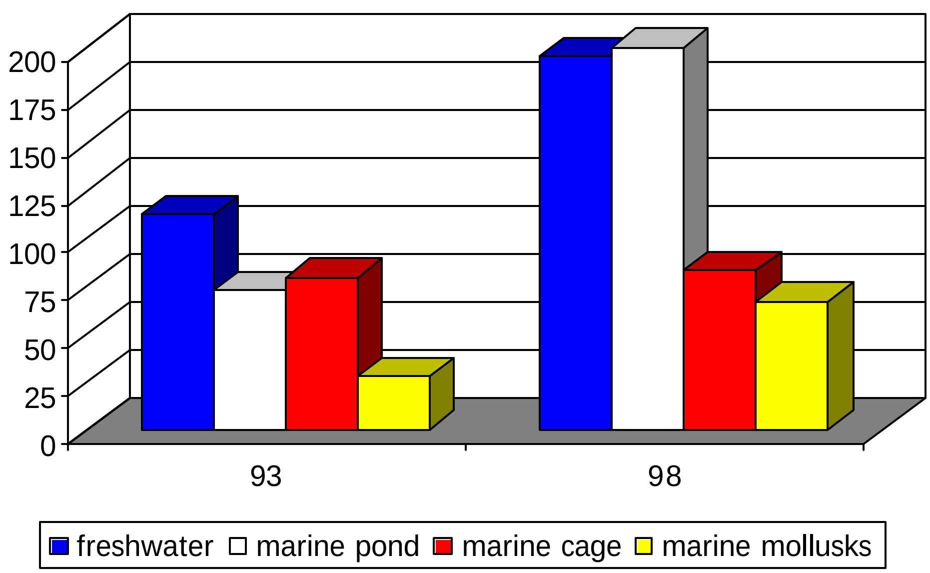


Figure 20. Temporal trend in aquaculture production, Malaysia (1993-1998 period) (RM million)



There are a total of 22,266 fish farmers[21] involved in aquaculture in 1998, with an increase of 51% over the 1993 period (14,783) – with freshwater fish farmers make up 80.3% of the total, followed marine fish culture (14.0%), mollusks culture (3.1%) and seaweed farming (2.5%). The percentage breakdown of fish farmers by culture system and region in 1998 are given in *Table 17* below:

Table 17: *Regional breakdown of fish culture system production in Malaysia, 1998*

AQUACULTURE SECTOR PERFORMANCE	% REGIONAL SHARE (1998 period)				TOTAL
	Peninsular East	Peninsular West	Sarawak	Sabah	
Freshwater Culture	35.5	27.7	9.2	27.5	17,884
Brackish Water Culture	12.8	49.1	25.3	12.8	3,124
Marine Mollusks Culture	5.6	64.3	0.0	30.1	692
Seaweed Culture	0.0	0.0	0.0	100.0	566
TOTAL	6,792	6,937	2,443	6,094	22,266

In 1998, out of the 135,433 metric tons production worth RM658 million (including 1,785 metric tons of seaweed worth RM3.6 million from Sabah), mollusks[22] contributed 61.2% to the total aquaculture production, followed by freshwater earthen ponds[23] (19.5%), brackish water ponds[24] (8.6%), marine fish cages[25] (4.4%), ex-mining pools[26] (2.7%), freshwater fish cages[27] (1.5%), seaweed culture (1.3%), freshwater cement tanks[28] (0.6%) and freshwater fish pens[29] (0.2%).

In terms of production value, brackish water ponds contributed 46.9%, followed by freshwater earthen ponds (25.4%), marine fish cages (12.7%), mollusks (10.2%), ex-mining pools (1.9%), freshwater fish cages (1.7%), seaweed (0.5%), freshwater cement tanks (0.5%) and freshwater fish pens (0.2%). Excluding mollusks and seaweed, marine fish including crustaceans contribute 35% by volume and 67% by value to the total aquaculture production in 1998.

The comparison of the aquaculture performance by culture systems in Malaysia for the 1993-1998 period is given in *Table 18.* The summary of the national aquaculture production and economic performance by culture system and region for the 1998 period are shown in *Tables 19-26*. It can be clearly shown that Sabah plays an important and critical role in the development of the aquaculture sector in the country.

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[21] Including farmers involved in seaweed farming in Sabah (566 in 1998 and 150 in 1993)

[22] 82,841 metric tons comprising of 98.6% cockle, 1.2% mussel and 0.2% oyster

[23] 26,465 metric tons comprising 33.3% of tilapia, 19.7% catfish, 8.5% eels, 6.1% Javanese carp and other species 32.4%

[24] 11,600 metric tons comprising of 83.5% *Penaeus monodon*, 14.0% barramundi, 1.3% *Penaeus mergueinsis*, 0.2% mangrove crab, 0.16% red tilapia, 0.12% red snapper and 0.7% others

[25] 6,023 metric tons comprising of 50.0% snappers (*Lutjanus* spp.), 33.0% barramundi, 7.7% groupers, 3.5% mangrove crab, 0.3% tilapia and 5.5% others

[26] 3,618 metric tons comprising of 44.9% tilapia, 21.3% bighead carp, 6.8% grass carp, 4.3% eels, 4.1% Javanese carp, 2.8% common carp and 15.8% others

[27] 2,040 metric tons comprising of 64.0% tilapia, 33.6% river catfish and 2.4% others

[28] 763 metric tons comprising of 84.8% tilapia, 12.9% catfish and 2.3% others

[29] 296 metric tons comprising of 63.7% tilapia, 11.3% catfish, 10.6% Javanese carp and 14.4% others

Table 18: *Comparison of aquaculture production in 1993-1998, Malaysia*

AQUACULTURE	1993		1998		% change 1993-1998	
SYSTEMS	Q	V	Q	V	Q	V
Marine*	89,770	179,896	100,464	459,008	11.9	155.2
Freshwater	15,468	112,465	33,184	195,287	114.5	73.5
TOTAL	105,238	292,361	133,648	654,295	27.1	123.7
FRESHWATER PRODUCTION					change 1993-1998	
Culture System	Q	V	Q	V	Q	V
Earthen Pond	13,323	103,830	26,465	167,178	98.6	61.0
Cage	786	3,855	2,040	11,153	159.7	189.3
Ex-Mining Pool	951	3,071	3,618	12,345	280.4	302.0
Concrete Pond	408	1,778	764	3,320	87.4	86.7
Pen	-	-	296	1,292	-	-
MARINE PRODUCTION					change 1993-1998	
Culture System	Q	V	Q	V	Q	V
Earthen Pond	4,601	72,590	11,600	308,483	152.1	325.0
Cage	6,194	79,699	6,023	83,579	-2.8	4.9
Cockle	77,755	26,788	81,717	63,099	5.1	135.6
Mussel	1,182	468	986	591	-16.5	26.2
Oyster	37	350	138	3,256	270.9	829.7
Seaweed	850	850	1,785	3,575	110.0	320.6
FISH FARMERS	1993		1998		change 1993-1998	
Marine**	1,637		3,124		90.8	
Freshwater	14,633		17,884		22.2	
TOTAL	16,270		23,006		41.4	
FARM GATE PRICE RM/kg						
Freshwater Aquaculture						
Culture System	RM/kg		RM/kg		change 1993-1998	
Earthen Pond	7.79		6.32		-18.9	
Cage	4.91		5.47		11.4	
Ex-Mining Pool	3.23		3.41		5.7	
Concrete Pond	4.36		4.34		-0.4	
Pen	na		4.36		Na	
Marine Aquaculture						
Culture System	RM/kg		RM/kg		change 1993-1998	
Earthen Pond	15.78		26.59		68.6	
Cage	12.87		13.88		7.9	
Cockle	0.34		0.77		124.1	
Mussel	0.40		0.60		51.3	
Oyster	9.43		23.64		150.7	
Seaweed	1.00		2.00		100.0	

Q in metric ton, V in RM ‘000; * excluding seaweed; ** excluding mollusk & seaweed culture farmers

Table 19: *Regional breakdown of fish culture production performance in Malaysia, 1998*

AQUACULTURE SECTOR PERFORMANCE	% fish farmers	% production volume	% production value	mt/ farmer	RM/ farmer
Freshwater System	80.3	24.5	29.7	1.86	10,920
Marine System	14.0	13.0	59.6	5.64	125,500
Marine Mollusks Culture	3.1	61.2	10.2	119.71	96,742
Seaweed culture	2.5	1.3	0.5	3.15	6,316
TOTAL	22,266 farmers	135,433 mt	RM658 million		

Table 20: *Regional breakdown of freshwater culture production performance in Malaysia, 1998*

FRESHWATER AQUACULTURE	% fish farmers	% production volume	% production value	mt/ farmer	RM/ farmer
Earthen Pond Culture	85.0	79.8	85.6	1.74	10,999
Cage Culture	7.1	6.2	5.7	1.60	8,740
Ex-Mining Pool	1.5	10.9	6.3	13.50	46,064
Concrete Pond	1.7	2.3	1.7	2.52	10,957
Pen Culture	4.7	0.9	0.7	0.35	1,542
TOTAL	17,884 farmers	33,183 mt	RM195 million	1.86	10,920

Table 21: *Regional breakdown of freshwater culture production economics in Malaysia, 1998*

FRESHWATER AQUACULTURE	% REGIONAL SHARE (1998 period)				TOTAL
	Peninsular East	Peninsular West	Sarawak	Sabah	
% Fish Farmers (nos)	27.7	35.5	9.2	27.5	17,884
% Production Volume (metric ton)	47.1	30.0	2.3	20.6	33,184
% Production Value (RM million)	31.2	41.4	2.2	25.1	195
Returns to Farmer					mean
mt/fish farmer	3.15	1.57	0.47	1.39	1.85
RM/fish farmer	12,304	12,738	2,639	9,956	10,920

Table 22: *Regional breakdown of marine culture production performance in Malaysia, 1998*

MARINE AQUACULTURE	% fish farmers	% production volume	% production value	mt/ farmer	RM/ farmer
Brackish water Ponds	26.8	11.2	66.3	9.88	262,762
Marine Cage Culture	44.5	5.8	18.0	3.09	42,861
Cockle Culture	6.5	79.0	13.6	286.73	221,400
Mussel Culture	5.8	1.0	0.1	3.88	2,327
Oyster Culture	3.5	0.1	0.7	0.90	21,279
Seaweed Culture	12.9	2.9	1.4	3.15	6,316
TOTAL	4,382 farmers	102,249 mt	RM463 million	23.33	105,564

Table 23: *Regional breakdown of marine culture production economics in Malaysia, 1998*

MARINE AQUACULTURE	% REGIONAL SHARE (1998 period)				TOTAL
	Peninsular East	Peninsular West	Sarawak	Sabah	
% Fish Farmers (nos)	45.1	10.0	18.1	26.8	4,382
% Production Volume (metric ton)	93.4	1.1	0.7	4.8	102,249
% Production Value (RM million)	66.8	4.4	4.5	24.3	463
Returns to Farmer					mean
mt/fish farmer	48.35	2.46	0.92	4.17	23.33
RM/fish farmer	156,122	46,793	26,521	95,616	105,564

Table 24: *Regional breakdown of marine culture production economics in Malaysia, 1998*

MARINE AQUACULTURE Excluding seaweed and mollusk	% REGIONAL SHARE (1998 period)				TOTAL
	Peninsular East	Peninsular West	Sarawak	Sabah	
% Fish Farmers (nos)	49.1	12.8	25.3	12.8	3,124
% Production Volume (metric ton)	73.4	5.9	4.2	16.5	17,623
% Production Value (RM million)	62.5	5.1	5.4	27.1	392
Returns to Farmer					mean
mt/fish farmer	8.44	2.59	0.92	7.29	5.64
RM/fish farmer	159,765	50,089	26,521	265,323	125,500

Table 25: *Regional breakdown of brackish water pond culture economics in Malaysia, 1998*

BRACKISH WATER POND CULTURE SUB SECTOR	% REGIONAL SHARE (1998 period)				TOTAL
	Peninsular East	Peninsular West	Sarawak	Sabah	
% No. ponds (units)	8.9	61.9	6.3	22.9	6,382
% pond acreage (ha)	5.5	47.1	2.2	45.2	5,848.48
% Fish Farmers (nos)	16.9	58.9	13.8	10.4	1,174
% Production Volume (metric ton)	8.4	62.4	5.8	23.4	11,600.10
% Production Value (RM million)	6.3	56.2	6.7	30.8	308.483
Returns to Farmer/Owner					mean
mt/fish farmer	16.07	13.42	4.17	22.27	9.88
RM/fish farmer	318,997	327,003	126,806	779,467	262,762
mean pond size (ha/pond	0.56	0.70	0.31	1.81	0.92
mean farm size (ha/farm)	3.43	5.26	0.78	21.69	4.98
Farm output mt/ha[30]	2.54	2.96	5.35	1.03	1.98
Farm output RM/ha	51,135	66,636	162,932	35,935	52,746
Farm Gate Price (RM/kg)	20.93	23.56	30.42	35.00	26.59

Table 26: *Regional breakdown of marine cage culture economics in Malaysia, 1998*

MARINE CAGE CULTURE SUB SECTOR	% REGIONAL SHARE (1998 period)				TOTAL
	Peninsular East	Peninsular West	Sarawak	Sabah	
% No. cage (units)	3.0	93.7	1.4	1.9	62,467
% culture area (in '000 m^3)	4.2	90.2	1.1	4.4	707.23
% Fish Farmers (nos)	10.4	43.1	32.3	14.3	1,950
% Production Volume (metric ton)	1.1	94.7	0.9	3.3	6,023.12
% Production Value (RM million)	0.8	85.5	0.5	13.2	83.578
Returns to Farmer/Owner					mean
mt/fish farmer	0.33	10.50	0.09	0.71	6.01
RM/fish farmer	3,313	136,851	682	39,691	80,856
mean cage size (m^3/unit)	13.22	12.48	9.37	25.85	13.35
mean farm size (m^3/farm)	107.54	1,029.71	12.82	111.77	616.76
Farm output (kg/m^3) [31]	3.92	20.80	6.92	6.37	13.78
Farm output (RM/m^3)	41.53	255.13	54.02	355.12	187.53
Farm Gate Price (RM/kg)	10.08	12.75	7.81	55.73	15.15

Fisheries Trade

The total export volume of fishery commodities in 1998 amounted to 144,540 metric tons of fish (RM1.23 billion), with an increase of 34% by volume and 31% by value compared to 1997 (**Table A25**). Imports of fishery commodities in 1998 amounted to 249,860 metric tons (RM0.91 billion), with a decrease of 16% by volume and 7% by value compared to 1997 – showing a deficit trade balance volume of 105,320 metric tons and surplus trade balance value of RM324 million. The fisheries trade of balance for the 1994-1998 period is shown in *Table 27.*

[30] Low values for Sabah due to some ponds still under construction; factors leading to high values for Sarawak are unknown – most farms are using highly intensive culture methods might be a possibility. Please note that farms in Sabah and Sarawak deals mainly in shrimp (*Penaeus monodon*) culture, while some farms in Peninsular Malaysia are involved in both shrimp (including *P. merguiensis*) and finfish culture.

[31] Cage culture production in Sabah deals with highly value reef fishes targeted for the Live Reef Fish Trade (LRFT) including groupers and Napoleon Wrasse (38% grouper priduction from Sabah). In Peninsular Malaysia and Sarawak, cage culture deals with much lower value finfish and mangrove crabs including barramundi, snappers and red tilapia. In Sarawak, cage culture deals mainly with barramundi (almost 90% production). Please note that the production for Sabah in 1998 (198 metric tons) reported in the DOF Malaysia annual statistics are probably underestimates – Sabah exported 527 metric tons (RM15.3 million) and 586 metric tons (RM20.3 million) of live marine fish respectively in 1998 and 1999 (from cage culture production), with 77.2% by volume exported to Hong Kong, Peninsular Malaysia (15.6%), Taiwan (4.8%).

Table 27: *Balance of fisheries trade, Malaysia 1994-1998*

Balance of Trade (BOT)	1994	1995	1996	1997	1998
BOT ('000 metric ton)	-29.16	-12.73	-164.98	-190.14	-105.32
BOT (RM million)	57.79	63.79	-60.61	-39.65	323.89

The average value of exported fisheries products had increased by 142.9% from RM3.51/kg in 1994 to RM8.53/kg in 1998. Correspondingly, the value of imported fisheries products also increased at a much lower 24.1% from RM2.93/kg in 1994 to RM3.64/kg in 1998 (*Table 28-29*). During that period, Malaysia's annual fisheries imports and exports averaged 276,798 metric tons (RM882 million) and 176,332 metric tons (RM951 million) respectively. The annual fisheries trade trend during the 1994-1998 period is shown in **Table A25** and **Figures 21-22.**

Table 28: *Change in export prices (RM/kg)*

Destination	1994	1998	% change
Japan	4.87	15.31	214.37
Singapore	2.31	5.60	142.42
Italy	2.27	18.35	708.37
Netherlands	11.85	18.84	58.99
Hong Kong	11.47	13.50	17.70
China	14.33	3.33	-76.76
USA	12.44	13.68	9.97
Australia	9.66	14.83	53.52
U Kingdom	9.55	19.90	108.38
Belgium	15.18	28.55	88.08
Spain	14.90	17.72	18.93
Thailand	0.45	1.20	166.67
Others	5.83	7.37	26.42
Total	3.51	8.53	143.02

Table 29: *Change in import prices (RM/kg)*

Origin	1994	1998	% change
Thailand	1.68	1.84	9.52
Indonesia	4.60	5.14	11.74
India	5.20	7.97	53.27
Taiwan	4.09	5.16	26.16
New Zealand	3.84	8.72	127.08
Chile	2.17	4.45	105.07
U Kingdom	3.89	6.80	74.81
Myanmar	14.00	8.45	-39.64
Others	4.97	7.40	48.89
Total	2.93	3.64	24.23

Malaysia's main export partners are Thailand, Japan and Singapore. In 1994, 76% of Malaysia's total fish exports were to these countries: Thailand (32%), Japan (22%) and Singapore (22%). However in recent years (from 1995 onwards), Malaysia had found new niche markets in Europe, USA and other parts of Asia (**Figures 23-24**). This also corresponded with decreasing exports to Thailand, Japan and Singapore during that particular period. Exports to Japan had decreased by 67% from 55,320 metric tons in 1994 to 18,310 metric tons in 1998. While fish exports to Singapore had decreased by 62% from 54,110 metric tons in 1994 to 20,390 metric tons in 1998. Fish exports to Thailand decreased by 66% from 77,530 metric tons in 1994 to 26,540 metric tons in 1998. Overall, fisheries exports to Japan, Singapore and Thailand represented only 45% of Malaysia's total export volume in 1998 (*Table 30*).

Figure 21. Temporal trend of fisheries trade volume, Malaysia (1994-1998 period) (in '000 metric ton)

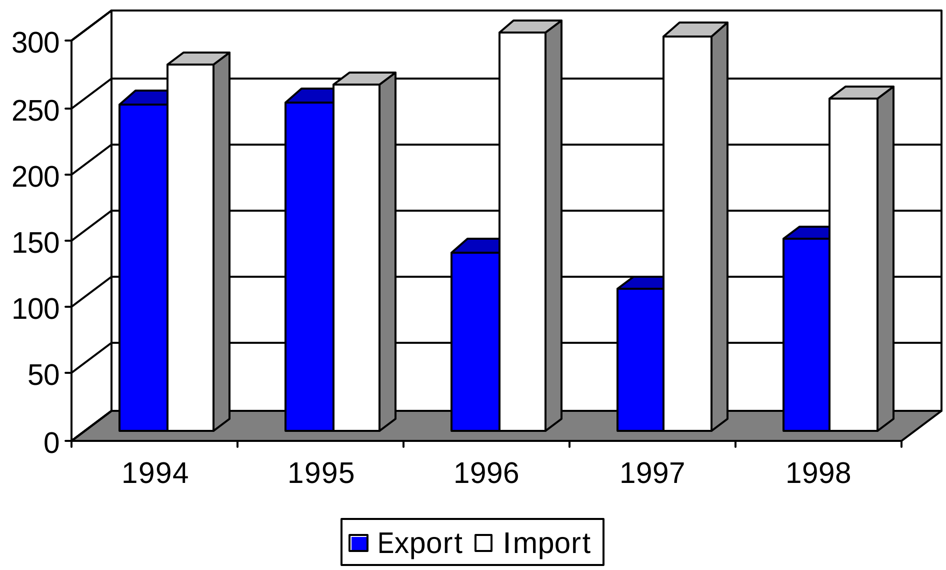


Figure 22. Temporal trend of fisheries trade value, Malaysia (1994-1998 period) (in RM billion)

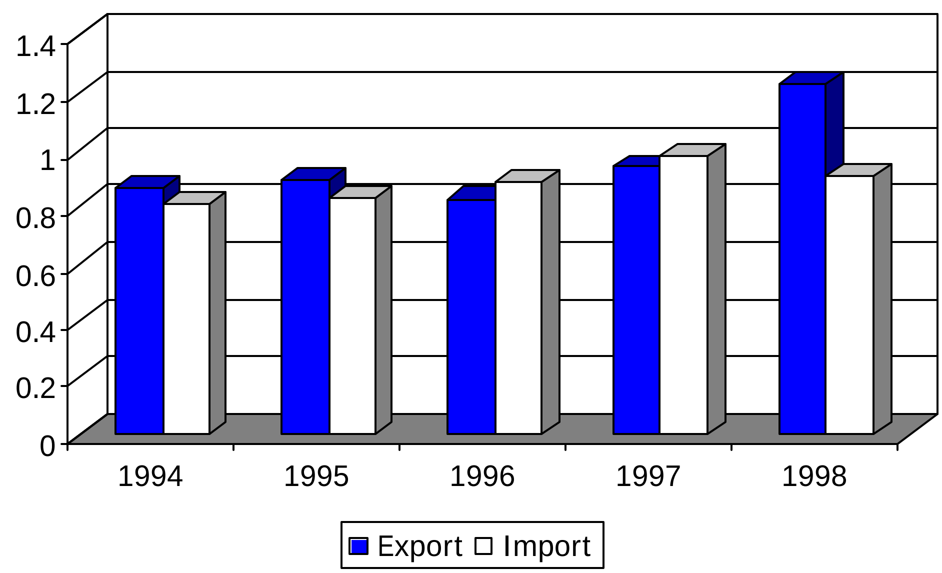


Figure 23. Fisheries exports to selected countries during the 1994-1998 period, Malaysia (in '000 metric ton)

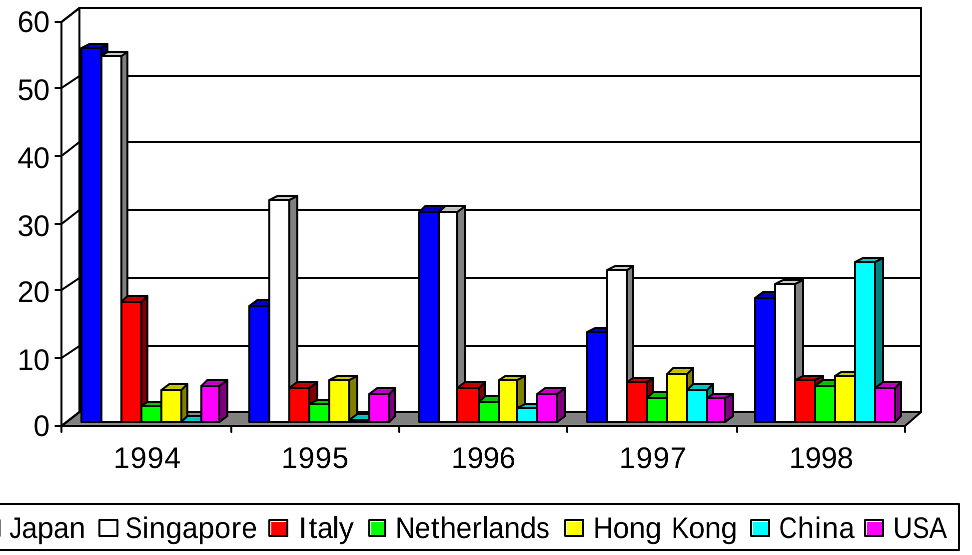


Figure 24. Fisheries exports to selected countries during the 1994-1998 period, Malaysia (in RM million)

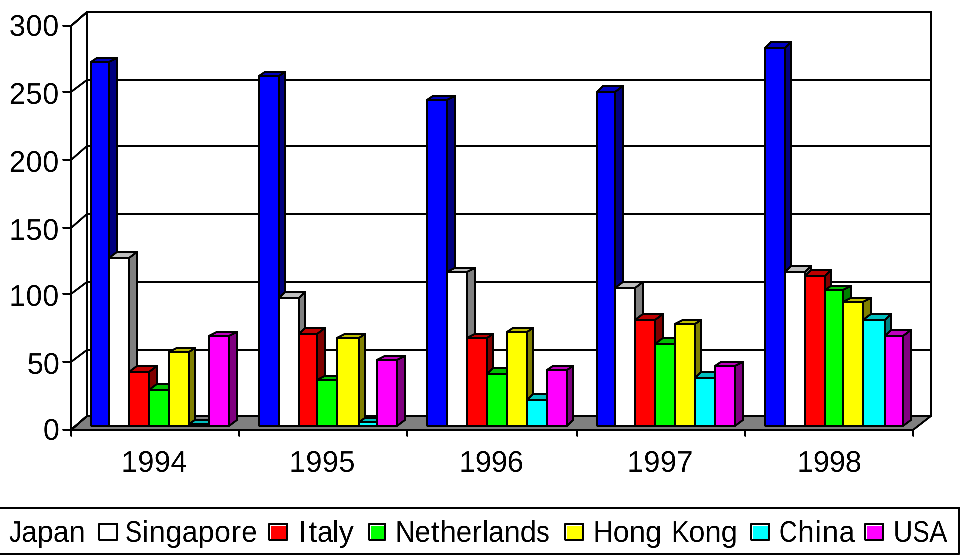


Table 30: *Comparison of Malaysia's exports to major trade partners, 1993-1998*

DESTINATING	1993		1998		% change 1993-1998	
COUNTRIES	Q	V	Q	V	Q	V
Thailand	77.53	35.06	26.54	31.72	-65.8	-9.5
Japan	55.32	269.27	18.31	280.43	-66.9	+4.1
Singapore	54.11	124.84	20.39	114.10	-62.3	-8.6
Others	59.76	436.76	79.30	806.02	+32.7	+84.6
TOTAL	246.72	865.93	144.54	1,232.27	-41.5	+42.3

* Q in '000 metric tons, V in RM million

Malaysia's traditional import partners are Thailand and Indonesia. In 1998, about 77.5% by volume (56.0% by value) of Malaysia's total fish imports were from Thailand (147,352 metric tons, RM271.14 million) and Indonesia (46,172 metric tons, RM237.31 million) (*Table 31*). Other countries that contribute to Malaysia's fisheries imports are India, Taiwan, New Zealand, United Kingdom, Myanmar and Chile (**Figures 25-26**).

Table 31: *Comparison of Malaysia's imports from Thailand and Indonesia, 1993-1998*

IMPORTING	1993		1998		% change 1993-1998	
COUNTRIES	Q	V	Q	V	Q	V
Thailand	156.81	263.83	147.35	271.14	-6.0	+2.8
Indonesia	35.56	163.61	46.17	237.31	+29.8	+45.1
Others	83.51	380.7	56.34	399.93	-32.5	+5.1
TOTAL	275.88	808.14	249.86	908.38	-9.4	+12.4

* Q in '000 metric tons, V in RM million

The commodity breakdown of fisheries trade during the 1995-1998 period is given in **Table A26**. Crustaceans and mollusks – in fresh, chilled, frozen, salted and dried forms, make up 54% by value (33% by volume) of the total exports in 1998 (**Figures 27-28**). While fish – in fresh, chilled and frozen, make up 60% by value (75% by volume) of the total imports (**Figures 29-30**). The temporal trends in the fisheries trade commodities for the 1995-1998 period is given in **Figures 31-34**.

Fisheries trade with Indonesia and the Philippines[32]

Fisheries trade with Indonesia and the Philippines is shown in **Table A27**. Fish imports from Indonesia in 1998 amounted 46,172 metric tons, up by 30% compared to 35,557 metric tons in 1994. This translated into 12.9% and 18.5% of the total imports in 1994 and 1998 respectively. Fish exports to Indonesia are less than 2,000 metric tons annually and comprised mainly of canned products and other fish products that had been imported from other countries including Thailand – with substantial increase noted in 1998-1999 due to fish meal imports from Sabah. Existing official records indicated negligible trade volume with the Philippines (**Table A27**) and it is mainly due to most of the fish trade transacted between Sabah and the Southern Philippines not being documented. Imports from the Philippines consisted of dried fish products. While exports to the Philippines consisted of canned fish and other dried products including dried anchovies from Sabah.

[32] Fisheries trade with Indonesia and the Philippines will be discussed in-depth in the following chapters

Figure 25. Fisheries imports from selected countries during the 1994-1998 period, Malaysia (in '000 metric ton)

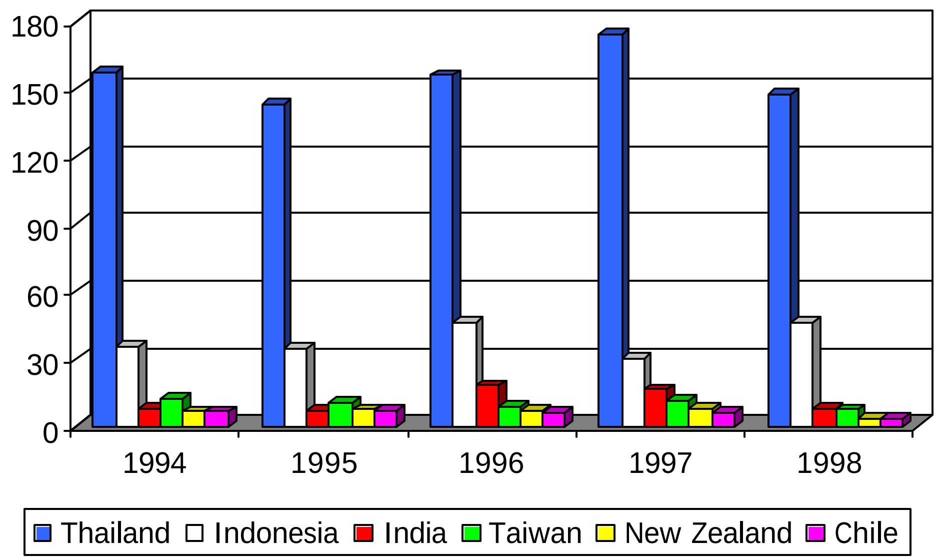


Figure 26. Fisheries imports from selected countries during the 1994-1998 period, Malaysia (in RM million)

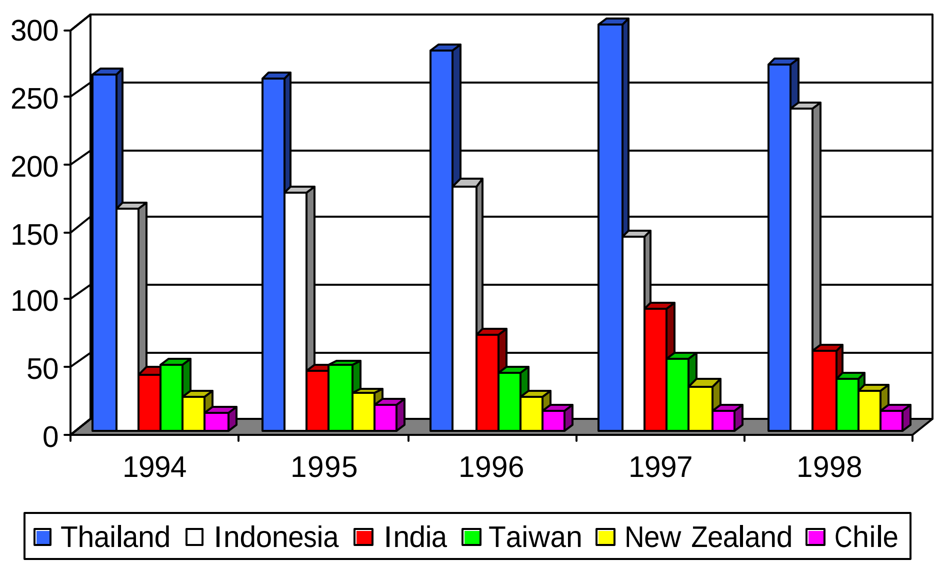


Figure 27. Breakdown of fisheries export volume in 1998, Malaysia (144,539.71 metric tons)

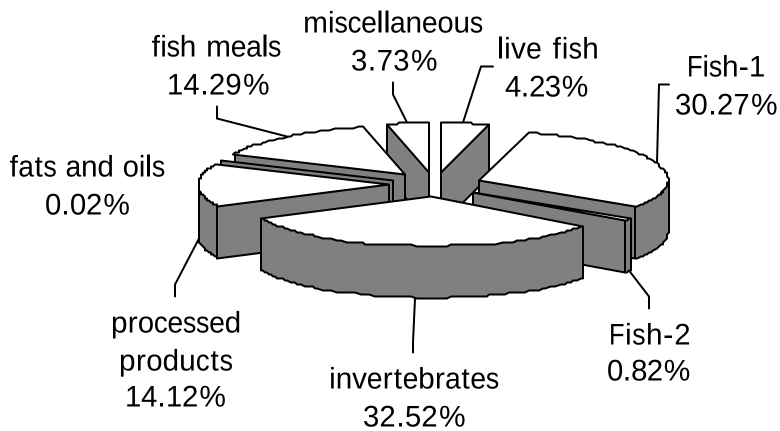


Figure 28. Breakdown of fisheries export value in 1998, Malaysia (RM1.232 billion)

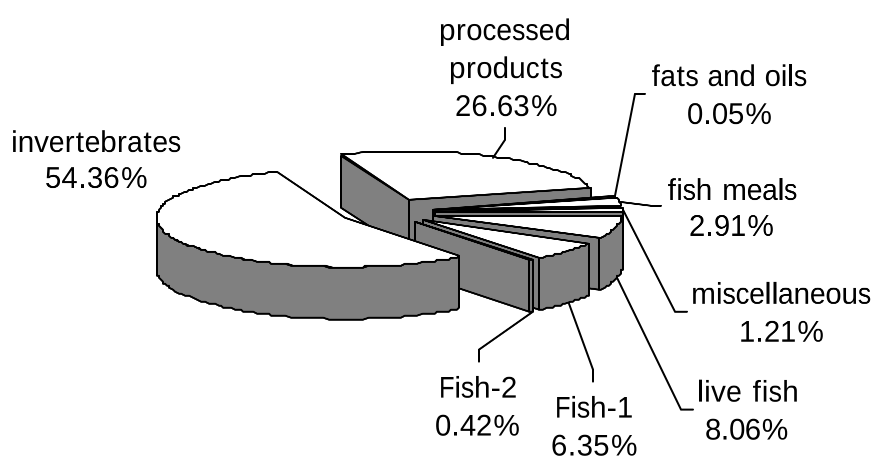


Figure 29. Breakdown of fisheries import volume in 1998, Malaysia (249,856.49 metric tons)

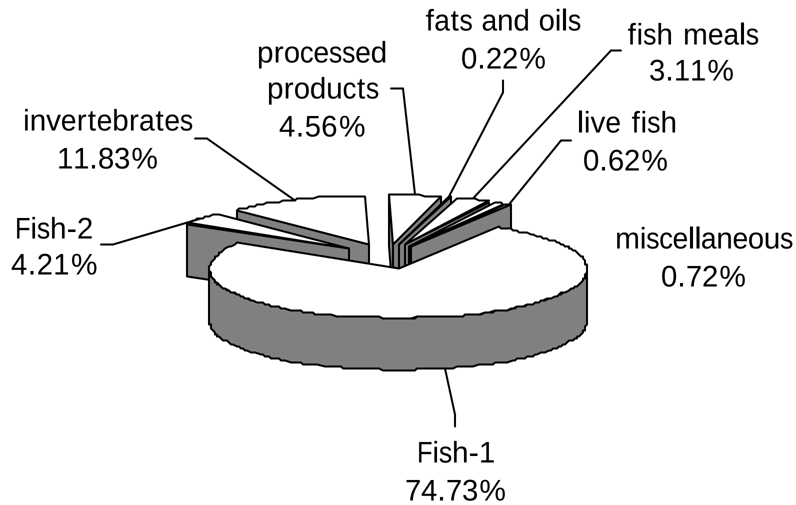


Figure 30. Breakdown of fisheries export value in 1998, Malaysia (RM908.38 million)

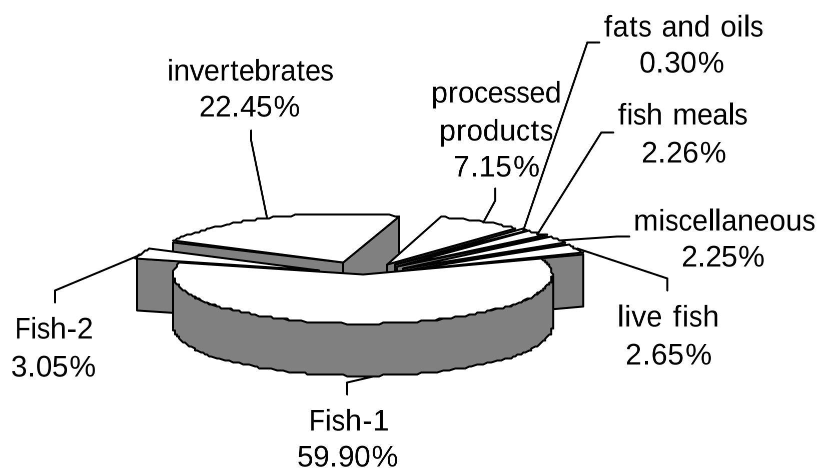


Figure 31. Breakdown of annual fisheries export volume during the 1995-1998 period, Malaysia ('000 metric tons) - refer to Table 26

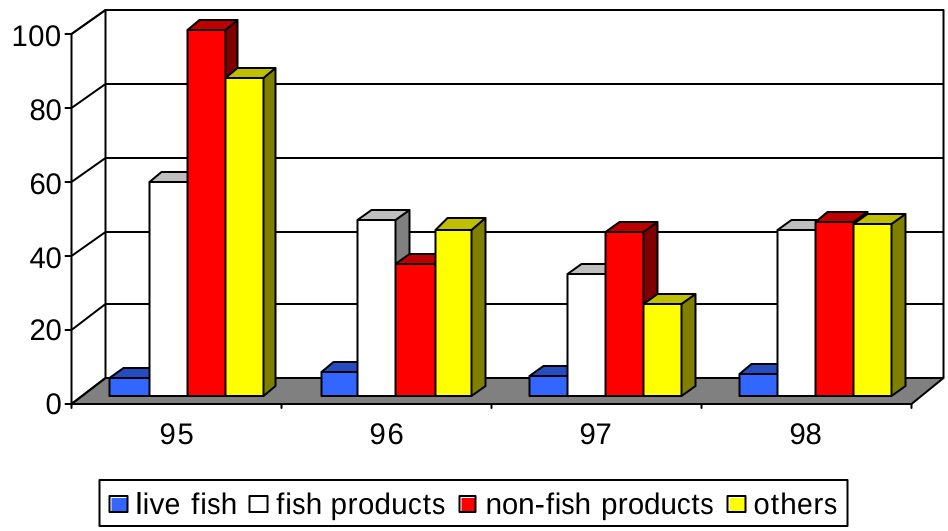


Figure 32. Breakdown of annual fisheries import volume during the 1995-1998 period, Malaysia ('000 metric tons) - refer to Table 26

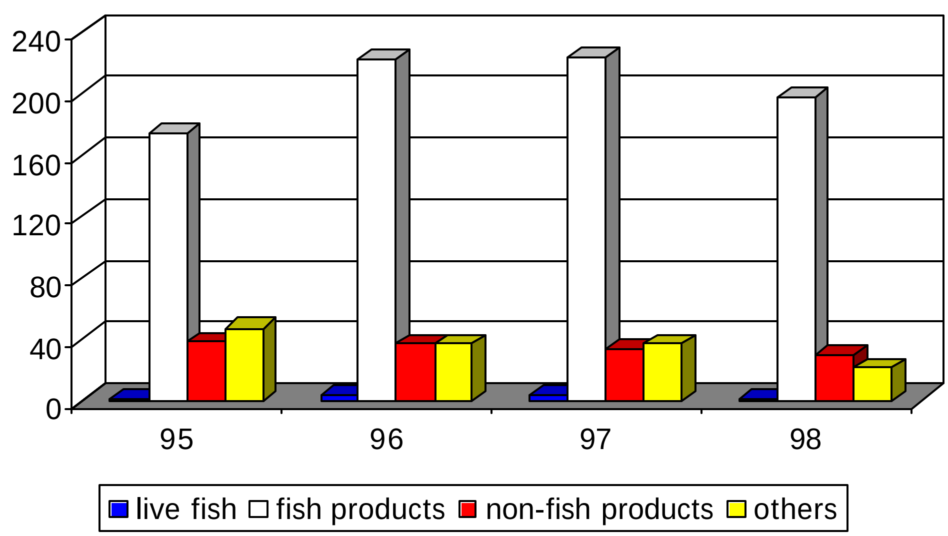


Figure 33. Breakdown of annual fisheries export value during the 1995-1998 period, Malaysia (RM million) - refer to Table 26

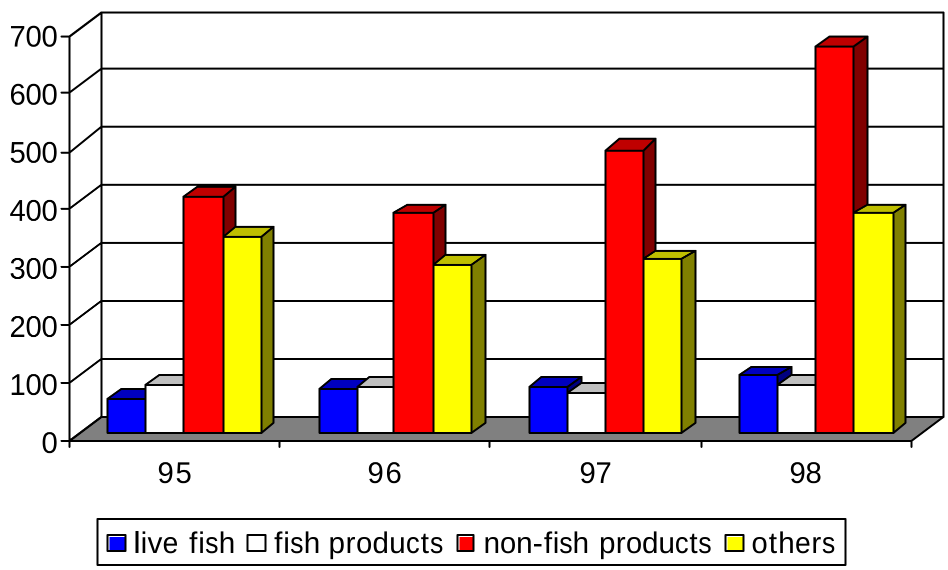
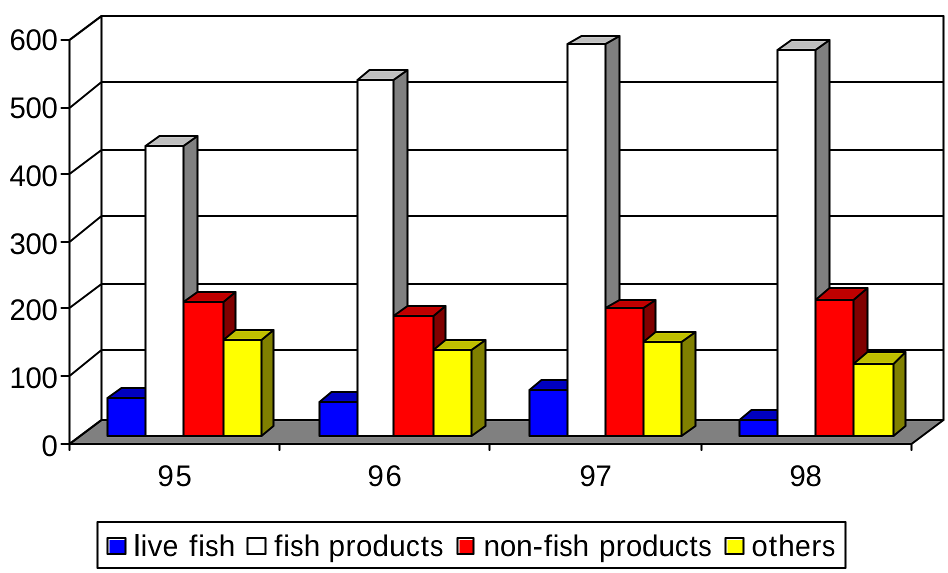


Figure 34. Breakdown of annual fisheries import value during the 1995-1998 period, Malaysia (RM million) - refer to Table 26



III. OVERVIEW OF THE STATE OF SABAH, MALAYSIA

History

The State of Sabah (formerly known as British North Borneo under the British colonial period[33]) joined Malaysia on 16th September 1963. Sabah is also called "Land below the Wind" because of its strategic position below the typhoon belt. Although there is evidence of trade with China from the 7th century, it is generally believed that since time immemorial, much of the trade including fisheries is much confined within the SSME area.

Some Significant Historic Dates

1665	The first Englishman, Captain Cowley, visited Borneo.
1877	Baron Von Overbeck and Alfred Dent signed four leases with the Sultan of Brunei. Some 28,000 square miles of territory and some 900 miles of North Borneon coastline were leased out to them. Another treaty with the Sultan of Sulu was also concluded ceding large portions of territory to Overbeck and Dent.
1881	Kudat became the first official capital of North Borneo until 1883.
1882	The British North Borneo Chartered Company was formed.
1884	Sandakan became the capital of British North Borneo.
1888	North Borneo became a British protectorate.
1942	Japanese forces landed in Labuan, Sabah on January 1st and occupied Sabah until she was liberated by the Australian Ninth Division in 1945.
1946	Sabah became a British Crown colony. Kota Kinabalu became the capital.
1963	Sabah gained independence from Britain on 31st August.
1963	Sabah joined Sarawak and Malaya to form Malaysia on 16th September.

State Government Machinery

Under the State Constitution, the *Yang di-Pertua Negeri* or State Governor acts as the Head of State but only holds certain executive powers. The state administration in Sabah[34] carried out by the State Cabinet headed by a Chief Minister, State Legislative Assembly and State Public Services Department.

There are a total of 10 Ministries and 1 department that oversee several government agencies and statutory bodies in Sabah.

- Chief Minister Department
- Ministry of Finance
- Ministry of Industrial Development
- Ministry of Resource Development and Information Technology
- Ministry of Infrastructure Development
- Ministry of Local Government and Housing
- Ministry of Youth, Culture and Sports Development
- Ministry of Rural and Entrepreneurial Development
- Ministry of Community Development and Consumer Affairs
- Ministry of Tourism Development, Environment, Science and Technology
- Ministry of Agriculture and Food Industry

[33] URL source: http://www.ssl.sabah.gov.my/clh/english/history/main_history.htm

[34] URL source: http://www.sabah.gov.my

The management of fisheries in Sabah comes under the purview of the Department of Fisheries Sabah (DOF Sabah), a department under the Ministry of Agriculture and Food Industry of the State Government of Sabah. DOF Sabah has a long history that dates back to the pre-war days, which came to an end when it merged with the Department of Agriculture in the mid-1950s. In 1968, the Fisheries Branch was separated as a full department under the Ministry of Agriculture Development and Fisheries of Sabah[35].

Geography

The state of Sabah located on the northern part of Borneo Island (4^o10' - 7^o40'N and 115^o10' - 119^o20'E), is bordered by Brunei on the southwest and Indonesia on the south. With a total land area of 74,236 km^2 – with 60% covered with forests, Sabah has the second largest area (after Sarawak) among the 13 states in Malaysia. Considering all coasts with direct marine exposure (lagoons, mainland and islands), the total length of Sabah coastline becomes around 4,315 km including islands and lagoons, making it being the longest coastline[36] in Malaysia. Sabah borders the South China Sea on its west coast, the Sulu Sea on the northeast and the Sulawesi Sea on its southeast coast. The state territorial waters extend to 12 nautical miles. Malaysia maintains an Economic Exclusive Zone (EEZ) of 200 nautical miles or until the 200-meter isobath whichever is the furthest distance. The territorial waters of Sabah cover around 51,360 km^2 or about 32% of the Malaysian EEZ (170,773 km^2).

One of the most prominent mountain ranges in Sabah is the Crocker Range with an average height between 457 to 914 meters, which separates the narrow lowland of the northwest coast from the interior. The Crocker Range culminates in Gunung Kinabalu (4,095 meters), the highest mountain in Malaysia and in Southeast Asia. In general, Sabah can be divided into four principal geomorphologic regions[37], comprising of the following:

- Eastern Lowlands: include the *Northern Islands (Banggi Group of Islands and Malawali Island), Lokan Peneplain between the Labuk and Kinabatangan rivers, Kinabatangan lowlands, Segama Valley, Sandakan Peninsula, Semporna peninsula, and the Dent Hills.*

- Deltas: include the *wetlands at the mouth of rivers flowing out into the Sulawesi and Sulu Seas, comprising of the Eastern Delta formed through the merging of the Segama and Kinabatangan rivers; Cowie Delta in Tawau; and the Sugut and Labuk Deta in the northeast.*

- Central Uplands: include the *Segama and Tawau Highlands.*

- Western Lowlands: include the *Crocker Foothills, Crocker Plains, Klias Hills, and Western Islands (Labuan, Tiga, Gaya, Mangalum, Mantanani and a number of smaller islands on the continental shelf off the west coast of Sabah).*

[35] Ministry name changed to Ministry of Agriculture and Food Industry in 2000

[36] The length of the Sabah coastline in the past is generally (and officially?) referred to as exceeding 1600 km. However, from the recent GIS studies of the Sabah ICZM project, the mainland coastline for Sabah was calculated around 1,285 km, island coastline (1,854 km) and lagoons (1,189 km) – excluding FT Labuan.

[37] Information extracted from the Sabah Integrated Coastal Zone Management website Source: http://www.iczm.sabah.gov.my/

Climate

Sabah has an equatorial climate characterized by constant temperature, considerable amount of rain and high humidity throughout the year. The seasonal weather changes in Sabah and the SSME area are determined by two great apposing monsoons, which converge along the Inter-Tropical Convergence Zone (ITCZ). The ITCZ migrates north and south with the sun, heralding the change from one monsoon to another (Tomascik *et al*., 1997).

The state of Sabah including the SSME region has two seasons, wet and dry, which are separated by transition periods that respectively runs through the months of April to May and October to November each year. The dry season, which runs through the months of June to September during the Southwest Monsoon, is influenced by the Australian continental air masses. The Southwest Monsoon develops during the months of June and July when there is high pressure over Australia and low pressure over Asia. The Pacific Oceans and Asian continent air masses influence the wet season, which occurs between the months of December to March during the Northeast Monsoon. The Northeast Monsoon develops during the months of December to January when there is high pressure over Asia and low pressure over Australia. The transition from the Northeast Monsoon begins during March when the ITCZ is on the equator and moving northward. The transition period from the Southwest Monsoon begins in September, with the weakening of the Australian high pressure when the ITCZ is on the equator and is moving southwards. The northeast monsoon normally brings a considerable heavy amount of rain in most parts of Sabah. Much drier periods in most parts of Sabah were normally coincided with the Southwest monsoon.

The average of the monthly air temperature values in most parts of the coastal zone of Sabah range between 26^{o}C and 28^{o}C with normal monthly fluctuations less than 1^{o}C. Relatively, the months between March and July were recorded as the period in which temperatures were the highest which coincided with the drier SW Monsoon.

The tides in Sabah are much influenced by the tidal wave propagation from the Pacific Ocean with co-oscillation results, which is greatly complicated by the complex bathymetry and coastal geometry. Diurnal (once a day), semidiurnal (twice a day) and mixed tides are found in Sabah waters. On the west coast of Sabah, the western part of Balambangan Island down to the Brunei Bay, the tide type is mixed tide – prevailing diurnal. On the east coast of Sabah, the tidal type is mixed tide – prevailing semidiurnal except for Semporna waters including the Darvel Bay, which is of mixed tide – prevailing diurnal (Wyrtki, 1961).

District Boundaries and Demography

Administratively, Sabah is divided into 24 districts[38], including the state capital – the City of Kota Kinabalu and 2 municipalities (Sandakan and Tawau) (**Table A30**). Out of these, two districts are within the coastal zone (Sandakan and Kuala Penyu), 16 districts with land transected by the inland boundary and 6 remaining districts in the interior without land in the coastal zone (Ranau, Tenom, Pensiangan, Keningau, Tambunan and Tongod). In this report, the fisheries profile as well as other related social economic characteristics are described along on these administrative boundaries.

[38] Including the newly established administrative district of Tongod, which was formerly part of the non-coastal portion of Kinabatangan. In this report, Tongod is still considered part of the Kinabatangan district. The fishery sector of the Kinabatangan district in SSME-2 is basically freshwater riverine-based – with fishes caught in the marine waters within its administrative boundary generally landed in Sandakan. The marine fish contribution is unknown but generally believed to be substantial being part of the most productive fishing grounds in Sabah.

The total land area of Sabah[39] is around 74,236 km^2, of which 37% is in the coastal zone, 61% non-coastal and 2% on islands. Coastal districts make up 78% of the administrative total land area – with only 22% in the interior. The coastal zone has a coastline of 4,316 km[40] covering an area of 29,074 km^2, with 95% on the mainland and 5% on the islands.

The coastal zone is unevenly distributed with 15% on the west coast and 85% on the east coast. The mainland of the coastal zone is unevenly distributed with only 15% on the West Coast end 85% on the East Coast. The limited extent of the coastal zone on the West Coast is due to the Crocker Range extending close to the shoreline along most of its length. On the East Coast, the inland boundary extends far into the inland parts of the state due to the extensive and gradually sloping 15,385 km^2 Kinabatangan flood plains – which make up 35% of the total mainland area or 70% of the mainland coastal zone on the east coast.

The coastline in the SSME area is heavily indented with lagoons, estuaries, bays and mangrove swamps compared to the non-SSME portion. About 76% of the coastline on the mainland (including lagoons) lies in the SSME area. Most of the islands are also in the SSME area, with 97% and 91% of the state island area and coastline respectively in the SSME area.

Sabah has a total population of 2.45 million[41] (population density: 33.0 persons.km^{-2}) making up 11% of the country total (**Table A4**), with 75% of them live and work in the coastal zone. Out of the total, about 52% of them lives in the SSME area, 34% in the coastal non-SSME and 14% in the interior. The most populated areas in Sabah are distributed in major economic growth areas in the coastal zone, i.e. Kota Kinabalu, Sandakan, Tawau, Lahad Datu and Semporna.

Sabah is endowed with a heterogeneous population. The indigenous population alone is made up of some 30 ethnic groups conversing in more than 50 indigenous languages and not less than 80 dialects. The main indigenous groups in Sabah include the Kadazan-Dusun-Murut (including the Rungus and Lotud), Bajau (Darat and Laut), Brunei Malay, Orang Sungei, Kadayan, Bisaya, Suluk and many other subgroups including Bonggi, Iranun and Ida'an. The Chinese form the largest non-indigenous group. Other groups include illegal immigrants of various ethnic groups from the Philippines and Indonesia.

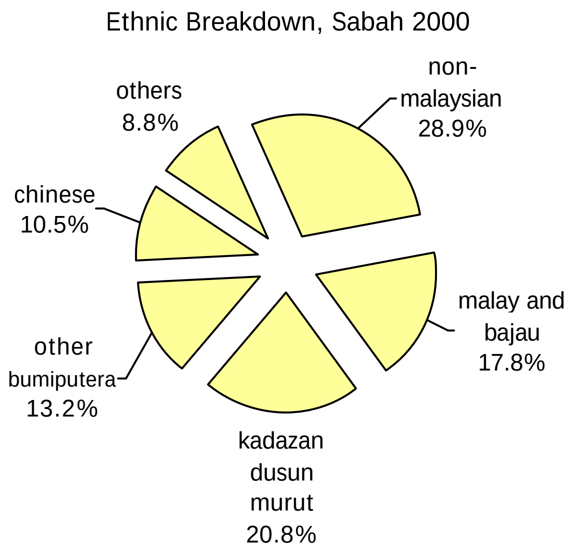
A large portion of these illegal immigrants live and work in the SSME area – with the majority of them in Sandakan, Tawau, Lahad Datu, Semporna and Kunak as well as on the west coast including the interior. Most of them are working in agricultural plantations (mainly concentrated in the SSME area), construction, services and timber sectors as well as in fisheries. According to the Monthly Statistical Bulletin Sabah (July 2000 edition)[42], non-Malaysians including illegal immigrants make 29% of the total population.

[39] Maps in this report were obtained from the Sabah ICZM Project web site. Areas marked in green and light blue respectively denote the land area and marine waters under the administrative jurisdiction of each district. Source: http://www.iczm.sabah.gov.my/

[40] In most cases – it was generally reported that the coastline of Sabah including medium sized to large islands is about 1,743 km – making it the state having the longest coastline in the country (4,809 km). However, the 4,316 km figure in this report includes the total coastline on the mainland, lagoons and islands. This figure is quoted from the final report of the Sabah ICZM project.

[41] The number of illegal immigrants in Sabah is available at this moment of time, but it is generally believed that illegal immigrants from Indonesia and the Philippines are in the region of a few hundred thousands (see Box 1).

[42] http://www.ids.org.my/stats/Population/index.htm



Economic Setting

About 60% of the land in Sabah is under forest cover while agriculture occupies about 30%. Forest resources and agriculture produce have always been the main sources of income for the State. Mineral and non-mineral deposits such as oil, copper, gold, limestone and quarry are also found in the State. Sabah's economy is dependent on exports of its major primary commodities such as palm oil, cocoa, rubber, crude petroleum, sawn timber and plywood – that represents 70% of the total exports. At present, Sabah is the major producer of palm oil and cocoa in the whole of Malaysia. Apart from timber and the agriculture sectors, the manufacturing and the tourism sectors in the State are fast developing and gaining increasing importance to the State's economy.

The agriculture sector, including forestry, livestock and fishing, contributes the largest component to the state GDP, making up 41% of the 1999 GDP of RM9.1 billion (**Table A28** & **Figure 35**). Fisheries account for a small but important contribution to the State economy, making up 7% of the agriculture GDP or 2% of the state's annual GDP (**Figure 36**). In terms of employment, the agriculture sector has the largest work force with 32% of the state's total in 1999 (**Table A29**).

The economy of Sabah can be described as developing, with a dominant primary commodity export base. Sabah is endowed with abundant natural resources and its main exports consist of primary commodities such as timber, palm oil, rubber, copra, petroleum and cocoa (*Table 32*).

Table 32: *Export by Commodity Type, Sabah (in RM'000)*

COMMODITY	Jan-Oct 1999	% Total	Jan-Oct 2000	% Total
Processed timber and paper	1,927,298	17.4	2,009,588	18.5
Crude Petroleum	1,594,110	14.4	2,909,808	26.8
Palm Oil	3,204,540	29.0	2,553,036	23.5
Cocoa Beans	182,700	1.7	73,365	0.7
Rubber	55,601	0.5	54,055	0.5
Others	4,082,157	37.0	3,265,205	30.1
TOTAL EXPORT VALUE	11,046,406	100%	10,865,057	100%

Source: Monthly Statistical Bulletin Sabah, December 2000

Figure 35. Percentage sectoral contribution to real GDP (Gross Domestic Product), Sabah (1993-1999 period)

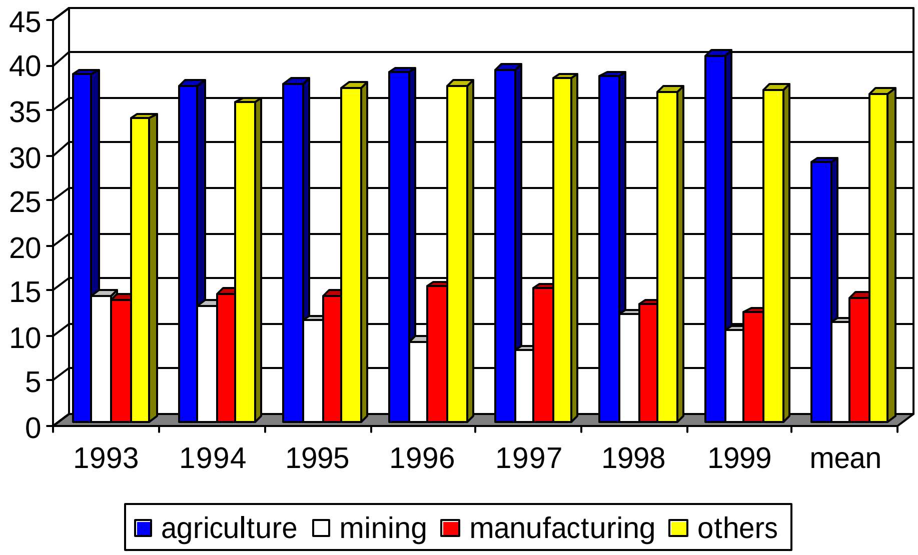
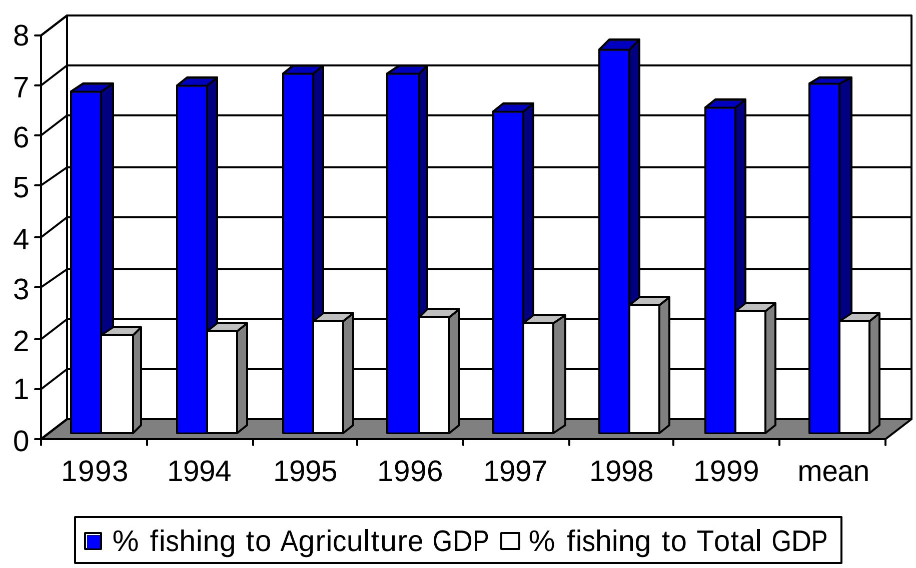


Figure 36. Fisheries contribution to real GDP (Gross Domestic Product) in Sabah (1993-1999 period)



Most of the agriculture plantations in Sabah are located in the SSME area – SSME-1 (palm oil and copra), SSME-2 (palm oil) and SSME (palm oil and cocoa). Sabah is the third most important producer of petroleum and natural gas in Malaysia. The natural gas generates electricity, which fuels a hot briquette iron plant and a methanol plant on the island of Labuan.

Development Setting

The development setting in Sabah encompasses both national and state policies. In the national context, the development of Sabah is closely tied to the objectives of the 8th Malaysian Plan[43] (2001-2005), the National Development Policy during the period of the 3rd Outline Perspective Plan OPP3 (2001-2010)[44], Vision 2020[45] and the 3rd National Agriculture Policy (1999-2010).

BOX 7: 3rd National Agriculture Policy on Fisheries

"......Marine fisheries, in particular, deep sea fishing, inshore fishing and aquaculture will be encouraged and supported with adequate incentives, infrastructure and programme. The development of the industry will focus on the further expansion of fresh and processed products including in support of the development of an integrated and viable fishery resource-based manufacturing activity. These products will cater for the expanding local and foreign markets. The exploitation of fisheries resources will be undertaken on a sustainable basis........."

These national policies guide the broad development thrusts of Malaysia and development strategies for Sabah as follows:

- Restructuring the State economy through industrial development in three areas: downstream processing of the States' natural resources, commercialising agriculture through opening up of more land for large scale industrial crops, and modernisation of small holdings and the fishery sector;

- Ensuring a balanced development of the major sectors of the economy so as to increase mutual complementarities to optimise growth;

- Improving the productivity and income of the people;

- Promoting and strengthening integration by reducing the wide disparities in economic development between regions and between urban and rural areas;

- Promoting human resource development, including the creation of a productive and disciplined workforce with the necessary skills to meet challenges in industrial development;

- Ensuring adequate provision of basic social and physical infrastructure for building an internationally competitive economy; and

- Ensuring that adequate attention is given to protect the environment and ecology so as to maintain the long-term sustainability of development in the State.

[43] http://www.epu.jpm.my/RM8/front_RM8.html

[44] http://www.epu.jpm.my/OPP3/front_opp3.html

[45] http://www.epu.jpm.my/epu-mservis-v2020.html

Based on these development objectives, it is predicted that Sabah's economy will grow at 7-8% per annum during the next decade; at the same time it is expected that the economy will be transformed from a commodity dependent to an industrial-based economy.

In the state context, the agriculture development in Sabah (including fisheries) is closely tied with the Outline Perspective Plan Sabah (OPPS: 1995-2010) and the second State Agriculture Policy (1999-2010). (**Appendix 1**)

Management of the Coastal Zone in Sabah

The recently completed Sabah Integrated Coastal Zone Management (ICZM) study recommended several strategies pertaining to the management of the coastal zone in Sabah[46].

There are a number of legal instruments relevant to coastal zone management including fisheries in Sabah. Among the important legislations includes the following:

- Fisheries Act 1985 (amended 1993, Act 317)
- Fisheries Ordinance of Sabah (2 subsidiaries – pertaining to fish bombing and destruction of marine resources)
- Pearl Oyster Fisheries Ordinance 1965
- Environmental Quality Act 1974 (containing 20 subsidiaries and regulations on the environment)
- Exclusive Economic Zone Act 1984
- Environmental Conservation Enactment 1996 (prescribed activities order – to protect and conserve natural resources and safeguard the environment)
- Environmental Conservation Enactment 1997 (6 subsidiaries pertaining to turtle conservation)
- Merchant Shipping Ordinance 1960

Other relevant acts and ordinances also include the following:

- Explosive Act 1957 (can be used to deal with illegal fish bombing)
- Geological Act 1974
- Merchant Shipping Act 1974 (Act 129)
- Merchant Shipping Act 1994 (Act 515)
- Merchant Shipping Ordinance 1952 (control of pollution and maritime casualties)
- Mining Ordinance 1960
- Petroleum (safety measures) Act 1984
- Petroleum Development Act 1974
- Petroleum Mining Act 1966 (control of maritime pollution, cutting of timber, fishing and navigation)
- National Forestry Act 1974
- Town and Country Planning Ordinance (Cap 141 of 1969)
- Water Resources Enactment 1998
- Parks Enactment 1984

Besides the above laws and regulations, another state enactment applicable to the management and conservation of fisheries in Sabah is the Conservation of Environmental Enactment 1996 (section 5: fisheries and activities)[47], which has provision for fisheries and activities which may endanger marine and aquatic life.

[46] For more details, please refer to the ICZM webite at http://www.iczm.sabah.gov.my/
[47] http://www.sabah.gov.my/jkas/laws/default.htm

Biodiversity

The ecology of the coastal zone of Sabah contains a wide range of different natural habitats, ranging from coral reefs, mangrove swamps, sea grass beds and coastal wetlands including estuaries, which are reflective of the great biodiversity in the Sulu Sulawesi Marine Ecoregion. Some of these habitats are still near pristine state with very little change due to natural and human factors; whilst in other areas the natural habitats have been displaced by development. Mangrove forests, sea grass beds and coral reefs are important ecosystems along the coastline of Sabah. These ecosystems provide habitats and feeding grounds of many species, some of which are exploited for food. Sabah also have an enormous swampy forest covered flood plain along its longest river, the Kinabatangan River, which is dotted with at least 11 ox-bow lakes and contains the richest natural freshwater fisheries in Malaysia.

The Island of Borneo – that includes the state of Sabah – Malaysia harbors about 10,000–12,000 species of flowering plants van Steenis, 1950; Kiew, 1984; Mat Salleh et al., 1992), 220 species of terrestrial mammals (Payne et al., 1985) and 900 species of butterflies (Otsuka, 1988). Sabah alone is reported to be home to 449 species of birds (Rajaratnan, 1997), 140 species of frogs (Inger and Stuebing, 1997), 145 species of snakes (Inger and Tan, 1996), 103 species of termites (Thapa, 1981), 155 species of freshwater fishes (Inger and Chin, 1990), and a few hundred species of commercial value marine fishes (Chua and Mathias, 1978; Chin, 1998; Vidthayanon, 1998; Mohsin *et al.*, 1996).

Malaysia is signatory to the international Convention on Biological Diversity and, in 1998, launched its own National Policy on Biodiversity. This policy contains guiding principles for the conservation of natural ecosystems and the sustainable utilization of biological diversity for the benefits of all sectors of society. In Sabah, there are three enactments pertaining to biodiversity:

- Cultural Heritage (*Conservation*) Enactment, 1997.
- Wildlife Conservation Enactment, 1997
- Conservation of Environment Enactment, 1996

Malaysia is a signatory of CITES, where among the protected faunal species include the dugong (*Dugong dugon*) and Hawksbill turtle (*Eretochelys imbriacata*). There are currently 18 species of marine mammals confirmed or reported in Sabah waters (Dollar et al., 1997; Jaaman *et al.*, 1997; Jaaman, 1999, 2000), comprising of the following:

- 1 species dugong (*Dugong dugon*)
- 2 species of baleen whales (*Balaenoptera edeni, Balaenoptera acutorostrata*)
- 7 species of toothed whales *(Orcinus orca, Globicephala macrorhynchus, Pseudorca crassidens, Ziphius cavirostris, Kogia breviceps, Physeter catodon, Peponocephala electra*)
- 7 species of dolphins (*Stenella attenuata, Stenella longirostris, Tursiops truncatus, Grampus griseus, Lagenodelphis hosei, Sousa chinensis, Orcaella brevirostris*)
- 1 species of porpoise (*Neophocoena phocoenoides*)

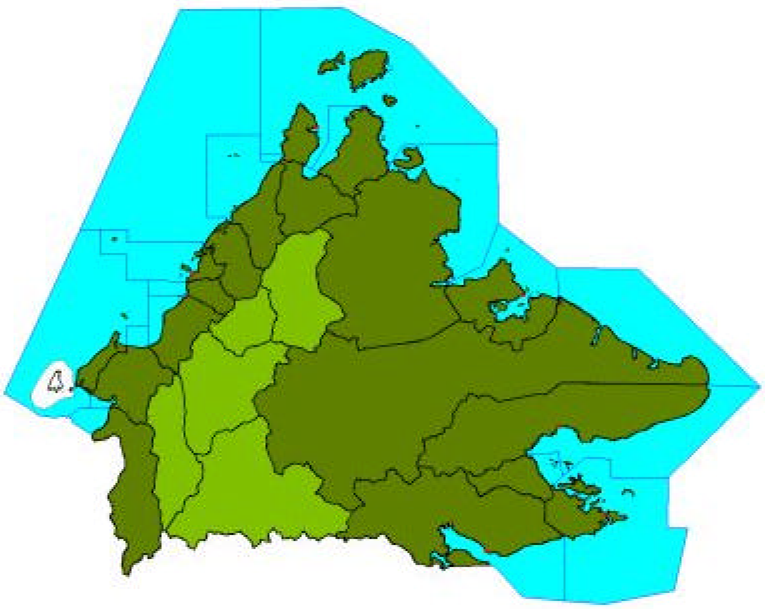
All species of marine mammals and whale shark in Malaysia are totally protected. There are four government departments responsible in managing and protecting marine mammals in Malaysia.

- Department of Wildlife & National Parks Malaysia (*Wildlife Protection Act 1972*)
- Dept. of Fisheries Malaysia [*Fisheries Act 1985, Part VI - aquatic mammals in Malaysian EEZ & Fisheries Regulations 1999 (Control of Endangered Species of Fish)*]
- Department of Wildlife Sabah (*Wildlife Conservation Enactment 1997*)
- Department of Forestry Sarawak (*Wildlife Protection Ordinance 1998*)

IV. PROFILE OF THE FISHING DISTRICTS IN SABAH

There are 18 administrative districts in the coastal zone – including two municipalities and the City of Kota Kinabalu that play an important role in the development of the fisheries industry in Sabah. For the purpose of this report – these districts are divided into the following 2 zones:

- SSME zone: Kudat, Kota Marudu, Pitas, Beluran, Sandakan Municipality, Kinabatangan, Tawau Municipality, Kunak, Lahad Datu and Semporna.
- Non-SSME zone: Kota Belud, Tuaran, City of Kota Kinabalu, Penampang, Papar, Beaufort, Kuala Penyu and Sipitang.



*** colours in blue – fishing grounds, dark green – coastal districts, light green – interior districts

The geographical and demographical of the two zones are summarized in the following:

Table 33: *Geographical and demographic features of Sabah*

GEOGRAPHICAL ZONE	Land Area (km^2)	Sea Area (km^2)	Coastline (km)	Population	Population Density Person.km^{-2}
Non-SSME area	9,621	22,394	759	833,680	86.65
SSME area	48,393	28,966	3,557	1,280,708	26.51
Interior	16,222	-	-	335,001	21.34
TOTAL	74,236	51,360	4,316	2,449,389	33.27

Table 34: *Fishing profile of Sabah*

COASTAL ZONE	Fulltime Fishermen	Fishing Villages	Total Fishing Vessels	Fishing Vessel Type	
				Non-motorized	Motorized
Non-SSME area	5,725	201	2,964	746	2,218
SSME area	15,120	389	7,492	1,778	5,714
TOTAL	20,845	590	10,456	2,524	7,932

SSME AREA

Ten coastal districts make up the Malaysian portion of the SSME area, comprising of three sub zones[48]: SSME-1 (Kudat, Kota Marudu, Pitas) on the northern part of Sabah; SSME-2 (Sandakan, Kinabatangan, Beluran) on the northeast; and SSME-3 (Tawau, Lahad Datu, Semporna, Kunak) on the southeast (*Tables 35*).

Table 35: *Breakdown of population and land area by SSME sub-zones*

LAND AREA	% SSME SHARE					TOTAL
	SSME1 area	SSME2 area	SSME3 area	Total SSME	Non-SSME	
% Population '000	6.4	20.6	25.2	52.3	47.7	100%
% TOTAL Sea Area	14.6	18.7	23.1	56.4	43.6	100%
% TOTAL Land Area	6.2	38.8	20.2	65.2	34.8	100%
% Coastal Mainland	8.7	55.9	23.9	88.4	11.6	100%
% Non-Coastal Area	3.6	29.0	17.3	49.9	50.1	100%
% Island Area	40.9	19.8	36.7	97.4	2.6	100%
% TOTAL Coastline	21.5	27.1	33.8	82.4	17.6	100%
% Mainland Coastline	10.0	30.0	33.6	73.7	26.3	100%
% Lagoon Coastline	20.8	31.1	26.2	78.1	21.9	100%
% Island Coastline	30.0	22.5	38.8	91.3	8.7	100%
TOTAL Population '000	157.9	505.0	617.8	1,280.7	1,168.7	2,449,389
TOTAL Sea Area	7,523	9,599	11,844	28,966	22,394	51,360 km^2
TOTAL Land Area	4,625	28,803	14,965	48,393	25,843	74,236 km^2
Coastal Mainland Area	2,388	15,392	6,579	24,359	3,190	27,549 km^2
Non-Coastal Area	1,613	13,109	7,827	22,549	22,613	45,162 km^2
Island Area	624	302	559	1,485	40	1,525 km^2
TOTAL Coastline	930	1,169	1,458	3,557	759	4,316 km
Mainland Coastline	129	386	432	947	338	1,285 km
Lagoon Coastline	247	368	310	925	260	1,185 km
Island Coastline	554	415	716	1,685	161	1,846 km

The SSME area covers an area of 48,393 km^2 or 65% of the state total land area (74,236 km^2), which comprised of 3% (1,485 km^2) on islands, 50% (24,359 km^2) on the coastal mainland and 47% (22,549 km^2) in the non-coastal area. About 60% or 28,803 km^2 of the SSME total land area falls within the SSME-2, followed by 31% (14,965 km^2) in SSME-3 and 9% (4,625 km^2) in SSME-1.

The coastal zone of the SSME covers an area of 25,844 km^2 or 53% of the SSME total land area, which comprised of 94% of land on the mainland and 6% on the islands. The coastal zone in the SSME area represents 89% of the state total zone (29,074 km^2). The coastal waters of the SSME area cover a total sea area of 28,966 km^2, with 41% (11,844 km^2) in SSME-3, 33% (9,599 km^2) in SSME-2 and 26% (7,523 km^2) in SSME-1. The coastal waters of the SSME area represent about 53% of the state total coastal waters (51,360 km^2).

The SSME area has a total coastline of 3,557 km or 82% of the state total coastline (4,316 km), with 27% (947 km) distributed along the mainland proper – 74% state total (1,285 km), 26% (925 km) along lagoons – 78% state total (1,185 km) and 47% (1,685 km) around the islands – 91% state total (1,846 km).

[48] Discrimination of these 3 zones is based on their location, ecological features and administrative boundaries. SSME-1 being adjacent to the Super Corridor (Balabac Straits) with oceanographical features influenced by the South China Sea and Sulu Sea; SSME-2 influenced entirely by the Sulu Sea; and SSME-3 in the Sulawesi Sea.

Administrative districts in the SSME area that are predominantly non-coastal with land transected by the inland boundary include Kunak (23% coastal), Kota Marudu (26% coastal), Tawau (34% coastal), Kinabatangan[49] (45% coastal) and Beluran[50] (38% coastal). While districts that are predominantly coastal include Sandakan (100% coastal), Kudat (97% coastal – with most of the 3% non-coastal area in the Matunggong sub district), Semporna (85% coastal), Pitas (83% coastal) and Lahad Datu (58% coastal).

In the SSME area, SSME-3 has the highest population density (41.3), followed by SSME-1 (34.2) and SSME-2 (17.5). The overall population density in the SSME area is much lower (26.5) than the state average (33.0) and non-SSME area (45.2). This is due to low population densities of Beluran (7.9) and Kinabatangan (4.9) of SSME-2.

The largest coastal districts in Sabah are falls within the SSME area comprising of three districts: Kinabatangan (17,516 km^2), Beluran (9,018 km^2) and Tawau (6,119 km^2), making up 44% of the state total area or more than 67% of the SSME total.

There are a total of 200-odd islands along the entire SSME coastline ranging in size from less than 1 ha to several square kilometers, with many of them comprising of unsheltered rocky islands and muddy islands in sheltered bays and estuaries. These islands have a total land area around 1,485 km^2 or 97% of the state total island area. Most of these islands are found in the Banggi group of islands including Malawali Island in the north of Kudat in SSME-1 (664 km^2), muddy islets in the estuarine areas off Tawau (294 km^2), off Sandakan and Beluran (206 km^2), and numerous rocky to sandy islands of the Darvel Bay in Semporna (234 km^2). Among the islands of prime importance in the Malaysian Portion of the SSME area includes the Selingan Turtle Islands[51] and Langkayan Island off Sandakan, proposed Semporna Island Park[52] and Sipadan Island[53] off Semporna, and Banggi Group of Islands[54] off Kudat. Concerned authorities are now looking into the possibility of establishing part or whole of the Langkayan Island as a MMA (Managed Marine Area) together with key stakeholders in the area.

[49] A large portion of the non-coastal area of Kinabatangan is now under the newly established district of Tongod.

[50] Beluran has two sub districts under its local government administrative jurisdiction: Telupid – 100% non-coastal and Paitan – predominantly coastal.

[51] This group of 5 islands is regionally important as nesting grounds for green turtle (*Chelonia mydas*) and hawksbill turtle (*Eretochelys imbriacata*). They are being conserved under the Turtle Islands Heritage Park Agreement between Malaysia and the Philippines. The Malaysian part includes the islands of Selingan, Bakkungan Kecil and Gulisan, covering an area of 1,749 ha including the surrounding coral reefs and sea, was established as a National Park in 1977.

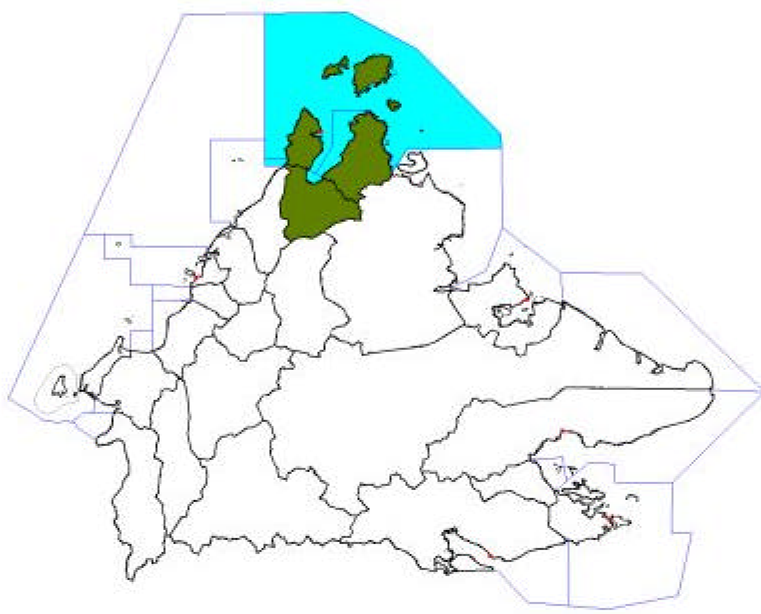
[52] A group of islands in the Darvel Bay just west of the Wallace Line – being proposed by Sabah Parks for a managed multi-use area for conservation of coral reef and mangrove ecosystems.

[53] The Late Jacques Cousteau had this to say of Sipadan Island: "……I have seen other places like Sipadan 45 years ago, but now, no more. Now we have found again an untouched piece of art,,,…a jewel……."

[54] This area is one of the important feeding areas and migratory routes of dugong, whale shark and manta ray in the SSME area. The endangered giant clam (*Tridacna gigas*) was reported found in this area. The coral reefs in this area are under serious threat from destructive (blast and cyanide) fishing practices. This area is now being considered as a MPA (North Borneo Marine Park - Sabah).

SSME-1

SSME-1 comprising of 3 districts (Kudat, Kota Marudu and Pitas) on the northern part of Sabah has a total area of 4,625 km^2, which represents 10% (4,625 km^2) of the SSME or 6% of the state total area (*Table 36-38*). The SSME-1 coastal zone covers an area of 3,012 km^2 or 65% of the SSME-1 total land area, which comprised of 79% of land on the coastal mainland and 21% on the islands. The coastal zone of the SSME-1 area represents 12% of the coastal zone in the state. Within SSME-1, only Kota Marudu is not a coastal district – where only 26% of the land area lies within the coastal zone. Kudat and Pitas are coastal districts – with more than 80% of the land area within the coastal zone. Overall, out of the 2,388 km^2 of the coastal zone on the mainland, 54% is in the Pitas district, 26% in Kudat and 20% in Kota Marudu.



SSME-1 has a total coastline of 930 km or 26% of the SSME total coastline (3,557 km), with 14% (129 km) distributed along the mainland proper – 14% SSME total (947 km), 27% (247 km) along lagoons – 27% SSME total (925 km) and 60% (554 km) around the islands – 33% SSME total (1,685 km).

SSME-1 has a total human population around 157,900 that represents 12% of the SSME total or slightly more than 6% of the state population. The population density in SSME-1 is about 34.2 persons.km^{-2}, which is 29% higher than the SSME average (26.5 persons.km^{-2}).

SSME-1 has a total of 20-odd small muddy islets distributed in sheltered estuaries and estuaries of the Marudu Bay and some 70 islands in the Banggi Group of Islands, that make up 42% of the state total island area. More than 99% of the island area in SSME-1 falls under Kudat district. The Banggi Group of Islands covers 270 square miles of which 33 are inhabited. Muddy islets mainly near river estuaries and sheltered lagoons in the eastern and southern portions of the Marudu Bay that falls under the administrative boundaries of Kota Marudu and Pitas only have a combined total area of 4 km^2 or 0.6% of the SSME-1 total.

The fishing grounds of SSME-1 cover a total area of 7,523 km^2, representing 26% of the SSME total or 15% of the state total. Within SSME-1, over 90% of the fishing ground lies under the administrative boundary of Kudat. A large portion of it lies in the Sulu Sea, with the northern part located below the Balabac Strait[55].

Table 36: *Breakdown of district by land area in SSME-1*

LAND AREA	% DISTRICT SHARE			Total (km^2)
	Coastal Mainland	Non-Coastal	Island	
Kudat	49.0	2.7	48.2	1,285
Kota Marudu	26.1	73.7	0.1	1,786
Pitas	83.1	16.8	0.1	1,554
TOTAL	51.6	34.9	13.5	4,625

Table 37: *Breakdown of districts by coastline length in SSME-1*

LAND AREA	% DISTRICT SHARE			Total (km)
	Islands	Lagoons	Mainland	
Kudat	75.8	16.9	7.4	664
Kota Marudu	47.1	47.1	5.7	70
Pitas	9.2	52.0	38.8	196
TOTAL	59.6	26.6	13.9	930

Table 38: *Breakdown of fishing ground, population and land area by district in SSME-1*

AREA AND POPULATION CHARACTERISTICS	% SSME-1 SHARE			SSME-1 TOTAL	SSME TOTAL	% SSME
	Kudat	Kota Marudu	Pitas			
% Fishing Ground Area	90.4	1.7	7.9	7,523		
% TOTAL Land Area	27.8	38.6	33.6	4,625		
% Coastal Mainland	26.4	19.5	54.1	2,388		
% Non-Coastal Area	2.2	81.6	16.2	1,613		
% Island Area	99.4	0.3	0.3	624		
% TOTAL Coastline	71.4	7.5	21.1	930		
% Mainland Coastline	38.0	3.1	58.9	129		
% Lagoon Coastline	45.3	13.4	41.3	247		
% Island Coastline	71.4	7.5	21.1	554		
% Human Population	43.2	37.3	19.5	157,937		
Fishing Ground Area (km^2)	6,803	129	591	7,523	28,966	26.0
TOTAL Land Area (km^2)	1,285	1,786	1,554	4,625	48,393	9.6
Coastal Mainland Area	630	467	1,291	2,388	24,359	9.8
Non-Coastal Area	35	1,317	261	1,613	22,549	7.2
Island Area	620	2	2	624	1,485	42.0
TOTAL Coastline (km)	664	70	196	930	3,557	26.1
Mainland Coastline	49	4	76	129	947	13.6
Lagoon Coastline	112	33	102	247	925	26.7
Island Coastline	503	33	18	554	1,685	32.9
TOTAL human population	68,242	58,841	30,854	157,937	1,280,708	12.3
Population density per km^2	53.11	32.95	19.85	34.15	26.46	

[55] An important Super Corridor (SS) for the transportation of genetic materials and migration of marine mammals and pelagic fishes from the South China Sea and sorrounding seas into the Sulu Sulawesi Marine Ecoregion.

The fishing ground on the west side of the Kudat Peninsula lies in the South China Sea, and falls under the administrative boundaries of Tuaran and Kota Belud that have a total area of 13,743 km^2. Trawlers based in Kota Kinabalu and Kudat also operate in the area[56]. On the other hand, some of the fishing fleet based in Sandakan carries out fishing operations on the eastern portion of SSME-1 fishing ground[57].

The fishing grounds of Pitas – restricted to the eastern portion of the Marudu Bay make up 8% of the SSME-1 total. While Kota Marudu with fishing ground covering the shallow areas on the southern portion of the Marudu Bay – only make up less than 2% of the SSME-1 total. Most of the fishing activities in Kota Marudu and Pitas are traditional in nature, confined to the operation of trammel nets, hook & lines, traps and shellfish collection.

SSME-1 plays an important role in the development of coastal fisheries of Sabah. In 1999, the marine fish landings in SSME-1 totaled 35,000 metric tons, with 81% of it landed by commercial gears. It represents about 25% of the SSME and 17% of the state total marine fish landings. Landings by commercial gears contributed 29% and 18% respectively to the SSME and total commercial landing total. While traditional gear landings contributed 17% and 14% respectively to the SSME and state traditional landing total. The total marine fish production has a combined retail value of RM254 million, which represents 36% of the SSME and 26% of the state total. The SSME-1 contribution of the total SSME and state total marine fish landings by resource group in 1999 is summarized in Table 39-40 below.

Table 39: *SSME-1 marine fish landings, 1999*

District	Landings ('000 mt)	% Total	Landings (RM million)	% Total
Kudat	34.19	97.63	248.36	97.90
Pitas	0.47	1.34	2.31	0.91
Kota Marudu	0.36	1.03	3.03	1.19
TOTAL	35.02	100	253.70	100

Table 40: *SSME-1 marine fish contribution*

Resource	% SSME-1 breakdown	% contribution	
		SSME	STATE
Demersal finfish	64.4%	42.3%	27.5%
Pelagic Fish	23.9%	12.8%	8.9%
Shrimp	6.2%	26.0%	20.0%
Others	5.5%	20.7%	12.1%
TOTAL	100%	25.7%	17.2%

About 30% of the marine fish landings in 1999 comprised of trash fish and unsold fish were used as raw materials for fishmeal plants. A total of 2,300 metric tons of fishmeal was produced using 10,700 metric tons of fish – or 47% of the demersal finfish total landings.

Marine aquaculture is an important fishery activity in SSME-1. In 1999, the total production was around 117 metric tons, with cage culture contributing 99.7% to the total marine aquaculture production in SSME-1. It represents 45% of the marine cage culture production in the SSME

[56] Trawlers usually spend 4-5 days fishing before returning to Kota Kinabalu. While trawlers based in Kudat usually return after spending an average of 2-3 days fishing.

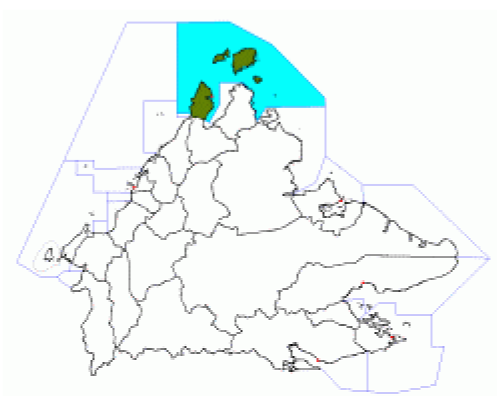
[57] Mainly trawling, purse seining, hook & line and gillnetting operations.

area or 25% of the state total. Most of the cage culture activities[58] are based in Banggi. Fishes cultured comprised mainly of high value reef fishes including coral groupers and Napoleon wrasses sourced from local waters, Indonesia and the Philippines. The total fish production has a total wholesale value of RM5.1 million – or average farm gate price of RM44/kg, making it a very lucrative business – with production targeted mainly for the live fish trade in Hong Kong.

Mollusk culture is another important marine aquaculture activity in SSME-1. It is based in Kota Marudu, where fish farmers operate an integrated fish cage cum mollusk culture farm using materials and technical assistance provided by DOF Sabah. Fries are obtained from the wild using traps in estuarine areas. In 1999, the marine aquaculture production in Kota Marudu totaled 2.13 metric tons, comprising 1.8 metric tons of finfish – mainly estuarine groupers, mangrove snapper and barramundi (RM27,000), 0.23 metric tons of green mussels (RM460) and 0.10 metric ton (RM250) of oysters.

Kudat District

Kudat located on the Kudat Peninsular, with an area of 4,625 km^2, is the smallest administrative district of SSME-1, i.e. representing 28% of the SSME-1 area or less than 3% of the SSME total area. Kudat consists of Kudat proper on mainland (57.3% total area), and two sub districts – Banggi (31.1%) in the north and Mattungong (11.6%) on the southwest.



The town of Kudat on the eastern side of the Kudat Peninsular, which was the former capital of British North Borneo from 1881-1884, is the major growth centre for the district and in the SSME-1 area. It is also the major port in the SSME-1 area. Kudat Town is located about 192 km from the state Capital, Kota Kinabalu. It is easily accessible via the Kota Kinabalu - Kota Belud – Kudat highway. There is a small airport in Kudat Town with regular flights[59] linking Kudat with Kota Kinabalu and Sandakan.

Most of the Kudat Peninsula is mountainous – with extensive tidal swamps and sandy beaches being prominent features on the eastern and western side of the peninsular respectively. The non-coastal areas in the central part of the district are hilly areas. The coastline on the mainland is only about 161 km (including 112 km of lagoons) and has small floodplains and meander belts of short rivers flowing through it. Kudat has many islands ranging from less than 1 ha to several square kilometers in size, comprising of the Banggi Group of Islands and Malawali Island in the

[58] Marine cage culture production from Banggi and surrounding areas in 1999 totaled 115 metric tons (98% SSME-1 production) comprising of high value reef fishes – with a significant portion that were suspected to be collected by cyanide fishing.

[59] Malaysian Airline System (MAS) 18-passenger Piper Cherokee plane

north. More than 99% of the islands in SSME-1 are much confined within the Kudat district. These islands make up 48% of the total land area in Kudat district or 42% of the SSME total island area. Kudat is a predominantly coastal district, with more than 97% of the total land area (including islands) in the coastal zone.

BOX 8: Seaweed cultivation raises hopes of islanders

"……….With the recent introduction of seaweed cultivation on the island, Rabiau and some 700 fellow islanders can now earn an alternative income. Being subsistence fishermen, islanders who live in three villages on Balambangan have no other source of income, and life can become difficult when winds are strong causing the South China Sea to become rough.

"We are excited about seaweed cultivation here in Balambangan because there are times when we cannot go out to sea. "And even when the sea is not rough, we earn between RM200 and RM300 a month selling fish in Kudat. Some, however, earn less than RM150 per month," said Rabiau who is Kampung Batu Sirih headman. The other two villages on the island are Kampung Selamat and Kampung Kuok Simpuh.

Recently, the New Sunday Times was invited by Universiti Malaysia Sabah (UMS) to witness the initial stages of seaweed cultivation at Lung Bay on Balambangan Island. UMS, through its Borneo Marine Research Unit (BMRU), is carrying out research and development on seaweed cultivation at Lung Bay on the island, which is located next to Banggi island.

BMRU head Associate Professor Dr Ridzwan Abdul Rahman said the project was aimed at eradicating poverty among the islanders. Compared to the present income of villagers, seaweed cultivation promises higher returns. It takes between 45 and 60 days for seedlings to mature into seaweed, and harvest on 0.4 hectare can bring a minimum of RM3,000, according to Ridzwan.

He said the project was approved and funded by the Federal Rural Development Ministry and the State Government, with UMS acting as the R&D institute. Other agencies involved in project are the State Fisheries Department and the Malaysian Fisheries Development Authority. The latter will purchase the seaweed from villagers, dry it and market it. "We hope the project will reduce the number of hardcore poor in the State," he said when met on the island. Some 50 families who are in the hardcore poor category will benefit from the project. "But eventually, every-one on the island will benefit from seaweed cultivation," said Ridzwan. Some 40ha and four ha, respectively, have been gazetted at sea and on land for the development of seaweed on the island.

SOURCE: http://agrolink.moa.my/moa1/newspaper/perikanan/sf990808.html

Agriculture, capture fisheries and marine cage culture are the main economic activities of the district. Ecotourism[60] is a potential economic activity in the near future. Seaweed (*Eucheuma cottonii*) farming has been identified to be suitable for development in the Banggi Group of Island - in the Balabac Straits off Kudat. The island is covered with dense tropical forest and surrounded by numerous reefs. At present, the British-based NGO – Greenforce[61] team of volunteers are involved with UNIMAS[62] in the survey of reefs and working with local people on community based

[60] A number of local companies are now looking into the possibility of opening up diving resorts in the Banggi Group of Islands.

[61] http://www.btinternet.com/~greenforce/borneo.htm

[62] http://www.unimas.my/ibec/

resource management initiatives. Greenforce is also proving assistance to Universiti Malaysia Sabah[63] (UMS) in the development of seaweed farming under the PPRT[64] (*Projek Pembasmian Rakyat Termiskin*) program. The target group includes coastal communities involved in destructive fishing practices in Banggi. Blast and cyanide fishing ranked second in importance after hook & line fishing in many villages in these islands.

The Banggi group of islands is one of the poorest in Sabah with average household income typically below RM300, which is well below the poverty line. According to Fisher (2000), about 40% of the population comprised of subsistence farmers, with the remaining 60% using fishing as their primary source of income. Blast fishing and cyanide fishing can be considered as the main sources of food and income besides hook & line fishing. The fishermen comprised of both locals and illegal immigrants – the majority of them very poor living in wooden houses or huts built on stilts over the sea or on the beach, where there is no other alternative sources of income – besides fishing for sustenance and economic purposes. In recent years, both blast and cyanide fishing activities are on the increase mainly due to the development of marine cage culture in the area. Cyanide fishing is carried out in reef areas targeting for high value reef fishes (mainly coral groupers and Napoleon wrasse) to meet the increasing demand from marine cage culture farms in the Banggi group of islands and surrounding areas[65]. Fishes caught by blast fishing[66] are the main sources of feed for marine cage culture farms in the Banggi group of islands – mainly due to the high cost involved in transporting trash fish from mainland Kudat.

Kudat contribute more than 97% of the annual marine fish landings in SSME-1, with 70-80% of it landed by commercial vessels (trawlers and purse seiners). The fishery in Banggi is traditional-based with hook & line fishing, gill netting and destructive fishing practices being the main fishing activities. It is the major contributor of traditional landings in SSME-1. Marine fisheries involving some 130-odd fishermen in Mattunggong in the south is artisanal in nature, with average annual fish landings around 250-odd metric tons – with a large portion of it for their own consumption. Other sources of fish come from aquaculture (1.7 metric ton in 1999), with marine aquaculture and freshwater earthen pond culture contributing 58% (56% mollusks) and 42% respectively.

Kudat has a total of 234 villages or human settlements, with most of them in Mattungong (120), Kudat proper (75) and Banggi Group of Islands (41). Kudat has an estimated total population about 68,200, representing 43% of SSME-1 or 5% of the SSME total. Out of the total, 15% are in the urban area and 85% in the rural area including the Banggi Group of Islands. It is has a moderately high population density of 53.1 persons.km^{-2}, making it the most density populated district in SSME-1 and ranked third in the SSME area after Semporna (91.5 persons.km^{-2}) and Sandakan (153.1 persons.km^{-2}). Most of the people in Kudat proper live and work in Kudat Town – the main growth center of SSME-1. In the Banggi Group of Islands – which have a combined area of 700-odd km^2, the population is around 18,000 (26% of Kudat total), out of which about 3,000 or 17% total are illegal immigrants mainly from the Philippines (Fisher, 2000). According to the latest estimates, there is a total of 4,600 illegal immigrants in Kudat, comprising of 3,700

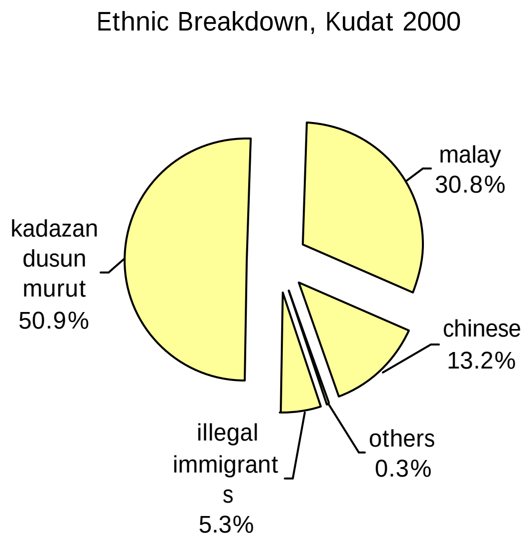
[63] http://www.ums.edu.my/ipmb/

[64] Poverty Eradication for the Hardcore Poor Project under the Federal Ministry of Rural Development

[65] Supply from Kudat is now on the decline - some operators are now sending out carrier boats to collect fish from Indonesia. According to some sources – the average collection from Indonesia is around 2 metric tons comprising mainly of coral groupers and Napoleon wrasse.

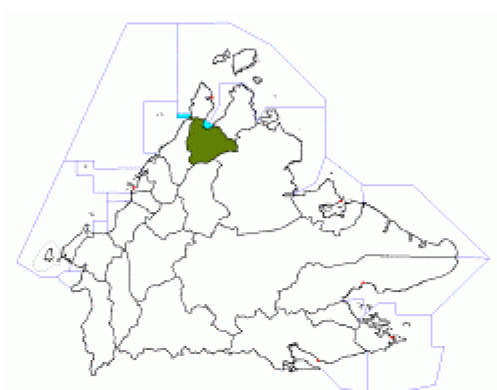
[66] Besides reef areas, blast fishing is also carried out in open waters targeting for schooling fish aggregated using traditional FADs.

from the Philippines and 900 from Indonesia. The breakdown of the population by ethnic group in Sabah is summarized bellows:



Kota Marudu District

Kota Marudu covers a total land area of 1,786 km^2 and is the largest administrative district in SSME-1. It represents 34% of SSME-1 or 4% of the SSME total area. However, the coastal zone of Kota Marudu is only 469 km^2 (including 2 km^2 of islands) or 26% of the total land area, and this represents less than 20% of the SSME-1 coastal zone or less than 2% of the SSME total.



Kota Marudu has a total population about 59,000, representing 37% of the total population of SSME-1 or less than 5% of the SSME total. It is has a relatively high population density of 32.9 persons.km^{-2}, that make it the second most densely populated district in SSME-1.

The coastline is very short (70 km) compared to other districts in SSME-1, with only 6% (4 km) along the mainland, 33 km along lagoons and 33 km along islands. It is surrounded by hills from the west right down to the south and to the east. Generally Kota Marudu is located on low-lying areas and is subjected to flooding by the three major rivers flowing northwards from the hills.

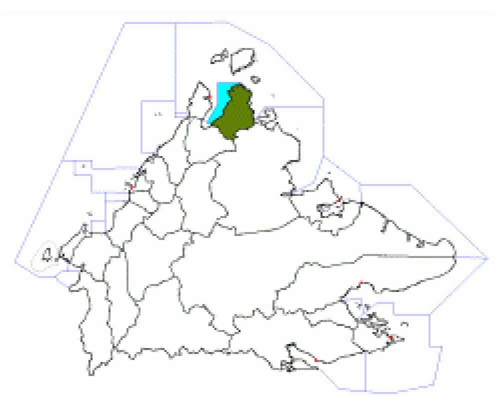
Kota Marudu is an agricultural based district, with commercial oil palm cultivation being the main economic activity. Rice cultivation and livestock husbandry are also important activities in Kota Marudu. Extensive alluvial floodplains and tidal swamps are the main features of the coastal zone. All of the mangrove swamps north of Kota Marudu has been gazetted as a mangrove protection forest where no development is allowed including aquaculture.

Most of the fishing activities carried out in this district is traditional in nature and much confined to the inner part of the Marudu Bay using 10-30 footer boats powered with outboard engines. Among major fishing activities include catching of shrimps using trammel nets, mangrove crab trapping and shellfish collection.

In general, the annual fish landing is around 500 metric tons, contributing only 1% to the total fish landings in SSME-1. There is also a jellyfish fishery[67] occurring seasonally between the months of February to June that contribute a significant portion to the total landings. Present landing are inadequate to meet the local demand, where fish supply are sourced from Kudat. Aquaculture is an important contributor to the annual fish production in Kota Marudu. Freshwater aquaculture involving traditional earthen pond systems is carried out on a subsistence basis in the non-coastal areas and do not contribute much to the overall fish production. Water supply during prolonged droughts and suitable land is the main contraint to the development of this sub sector. On the other hand, marine aquaculture, comprising of floating cage systems and mollusk culture (green mussel and oyster) contributed almost 50% to the total fish production, with yield up to 490 metric tons in 1999. A significant portion comes from a DOF Sabah initiated pilot community-based integrated marine cage culture project involving 20 fish farmers in the Teritipan Village about 20 km from Kota Marudu Town. This project was initially started as a demonstration farm with 2 fish farmers in 1996 with the primary objective to encourage coastal communities in the Kota Marudu District to get involved in marine aquaculture as a main source of income. At present 20 fish farmers are involved in the project and is the largest community farm in SSME-1. Plans are in the pipeline to include a live seafood restaurant and other facilities at the farm to boost up aqua-tourism activities in the district.

Pitas District

The Pitas District, covering a total land area of 1,554 km^2, is the second largest administrative district in SSME-1 after Kota Marudu, i.e. 39% of the SSME-1 total land area or slightly more than 3% of the SSME total. It is the most remote district in Sabah only accessible by sea and a trunk road from Kota Marudu – about 3 hours drive from Kota Kinabalu. Pitas is a coastal district, with 83% of its total land area in the coastal zone. It also has the longest coastline (178 km including 102 km of lagoons) among the districts in SSME-1.



[67] At present, there is only one jellyfish processing plant left in Kota Marudu – reasons for the closure of other plants during the last few years are still unknown but might have been due to economics factors as well as consistently dwindling landings by fishermen.

Pitas District has a total population about 30,900, i.e. 19% of the total population of SSME-1 or less than 3% of the SSME total. The topography of Pitas ranges from high hills and terraces in the north to mountains in the south and extensive tidal swamps all along the coast. The main population comprised of Kadazan Dusun Murut (*Rungus, Kimaragang, Tambanua, Sonsogon*) and muslim-bumiputers (*Orang Sungai, Bajau, Suluk, Ubian*). The former represents 50% of the population – mainly involved in subsistence agriculture, and their settlements are mainly found in the hinterland. While the latter represents 40% of the population, with most of them working as fishermen – and live in settlements near the sea. Chinese who are involved in commerce only make up a small portion of the population. Most of the settlements are along the unsurfaced trunk road linking Kota Marudu with Pitas and in the Pitas Town area. Considerable but unknown numbers of illegal immigrants in Pitas are mainly employed in the agriculture and wood processing sectors. Pitas have a low population density of 19.5 persons.km^{-2}, making it the third most sparsely populated district in the SSME or the state, after Beluran (7.9 persons.km^{-2}) and Kinabatangan (5.0 persons.km^{-2}). Pitas is one of the most deprived districts in Sabah in terms of infrastructure. Basic public amenities are at minimum, with Pitas Town being the main growth center having only two rows of wooden shops. This district is also reputedly classified as the second poorest district in the whole of Malaysia. The main economy is primarily based upon oil palm cultivation, fishing and wood processing[68].

The main fisheries activities in Pitas are traditional-based in nature, with *bagang* fishing being the major source of fish supply as well as hook & line and gill netting. The operation of *bagang* with anchoives as the target species[69] is concentrated in the eastern portion of the Marudu Bay on the west side of the Pitas Peninsula. At early July 2001, there are some 100-odd *bagangs* operating in Pitas, contributing an average monthly landing between 25-130 metric tons[70].

Besides being the main producer of dried anchovies in the region, Pitas is also well known for its salted fish products, with Kg. Kanibongan, the main production center in the district, contributing around 1-3 metric tons of salted and dried fish products each year. There are no ice plants in Pitas – where the unsold portion of the landings are usually dried or salted and sometimes during peak seasons transported to nearby Kota Marudu for disposal. Other fishing activies using hook & line, gill netting (including trammel nets) and traps are carried out near Malawali Island or around estuarine areas confined to the eastern portion of the Marudu Bay. Pitas is well known in SSME-1 for its giant freshwater prawn (*Macrobranchium rosenbergi*) resources, that are mainly caught using traps and other gears at the mouths of the 9 major rivers flowing out into the Marudu Bay. The extensive relatively untouched areas of sea, tidal swamps, estuaries as well as coral reefs in Pitas have great potential development for marine aquaculture including sea ranching, seaweed farming and cage culture. At present, aquaculture is still in its infancy with only a few fish farmers involved. Freshwater aquaculture is mainly practiced on a subsistence

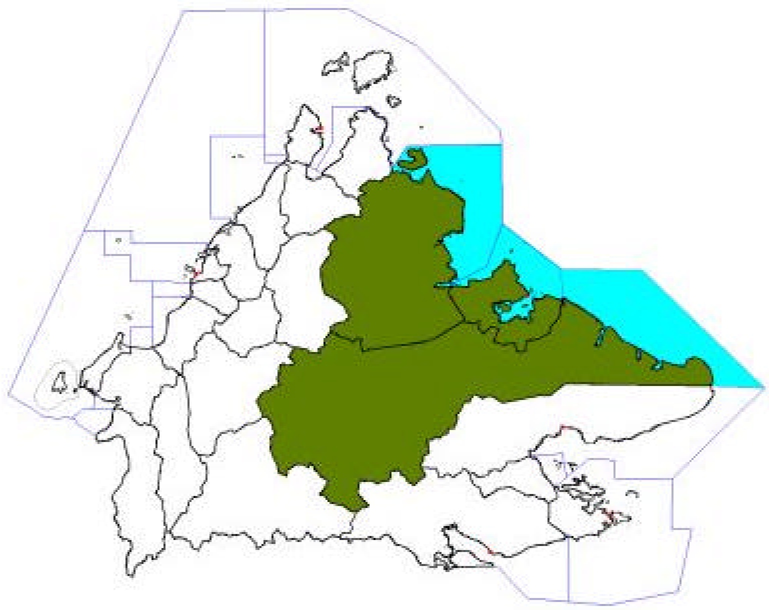
[68] During a visit to Pitas in mid June 2001 – a number of particleboard factories are on the verge of closing down due to dwindling supply of raw materials – with approved forest concession almost being fully logged.

[69] Pitas district is the major source of dried anchovies in the SSME-1 area, with average production between 10-15 metric tons per month. Most of the dried anchovies are transported by road to Kota Kinabalu prior to redistribution to other districts as well as for export.

[70] *Bagangs* contributed 40% of the total fish landings (1,900 metric tons) in 2000. This is a very lucrative business, where each bagang unit can give a nett return between RM1,000 to RM3,000 per month. According to the DOF officer-in-charge of Pitas District, the total fish landings in 2000 had increased by 400% from 470 metric tons in 1999, due to the 10-fold increase in *bagang* landings. There was a 100% increase in the number of bagangs operating in the Pitas District for that particular period.

basis among human settlements in the interior – with limited freshwater supplies and marketing problems being the main constraints to further development.

SSME-2



SSME-2 comprised of 3 districts (Beluran, Sandakan and Kinabatangan) on the northeast coast of Sabah. It has a total area of 28,803 km^2, which represents 60% of the SSME and 39% of the state total area (*Table 41-43*). The SSME-2 coastal zone covers an area of 13,109 km^2 or 55% of the SSME-2 total land area, which comprised of 98% of land on the coastal mainland and 2% on the islands. The coastal zone of the SSME-2 area represents 61% of the coastal zone in the state. SSME-2 has a total coastline of 1,169 km or 33% of the SSME total coastline (3,557 km), with 33% (386 km) distributed along the mainland proper – 41% SSME total (947 km), 32% (368 km) along lagoons – 40% SSME total (925 km) and 36% (415 km) around the islands – 25% SSME total (1,685 km).

Kinabatangan, covering an area of 17,516 km^2, is the largest district in SSME-2, making up 61% of SSME-2 and 36% of the SSME total land area. Beluran is the second largest district in SSME-2, covering an area of 9,018 km^2, which represents 31% of SSME-1 and 19% of the SSME total land area. The municipality of Sandakan, covering an area of 2,269 km^2 is the smallest district in SSME-2, which represents 5% of SSME-2 and 8% of the SSME total area.

SSME-2 has a total human population around 505,000 that represents more than 39% of the SSME total or slightly more than 21% of the state population. The population density in SSME-2 is about 17.5 persons.km^{-2}, which is 34% lower than the SSME average (26.5 persons.km^{-2}).

Table 41: *Breakdown of district by land area in SSME-2*

LAND AREA	% DISTRICT SHARE			Total (km^2)
	Coastal Mainland	Non-Coastal	Island	
Beluran	59.7	38.0	2.3	9,018
Sandakan	96.6	0.0	3.4	2,269
Kinabatangan	44.6	55.3	0.1	17,516
TOTAL	53.4	45.5	1.0	28,803

Table 42: *Breakdown of districts by coastline length in SSME-2*

LAND AREA	% DISTRICT SHARE			Total
	Islands	Lagoons	Mainland	(km)
Beluran	49.3	17.9	32.8	469
Sandakan	35.4	41.5	23.1	424
Kinabatangan	12.3	39.1	48.6	276
TOTAL	35.5	31.5	33.0	1,169

Table 43: *Breakdown of population and land area by district in SSME-2*

AREA AND POPULATION	% SSME-2 SHARE			SSME-2	SSME	%
CHARACTERISTICS	Sandakan	Beluran	Kinabatangan	TOTAL	TOTAL	SSME
% Fishing Ground Area	17.7	35.2	47.0	9,599		
% TOTAL Land Area	7.9	31.1	60.8	28,803		
% Coastal Mainland	14.2	35.0	50.8	15,392		
% Non-Coastal Area	0.0	26.2	73.8	13,109		
% Island Area	25.8	68.2	6.0	302		
% TOTAL Coastline	36.3	40.1	23.6	1,169		
% Mainland Coastline	25.4	39.9	34.7	386		
% Lagoon Coastline	47.8	22.8	29.3	368		
% Island Coastline	36.1	55.7	8.2	415		
% Human Population	68.8	14.0	17.2	505,017		
Fishing Ground Area (km^2)	1,703	3,381	4,515	9,599	28,966	33.1
TOTAL Land Area (km^2)	2,269	9,018	17,516	28,803	48,393	59.5
Coastal Mainland Area	2,191	5,381	7,820	15,392	24,359	63.2
Non-Coastal Area	0	3,431	9,678	13,109	22,549	58.1
Island Area	78	206	18	302	1,485	20.3
TOTAL Coastline (km)	424	469	276	1,169	3,557	32.9
Mainland Coastline	98	154	134	386	947	40.8
Lagoon Coastline	176	84	108	368	925	39.8
Island Coastline	150	231	34	415	1,685	24.6
TOTAL human population	347,334	70,900	86,783	505,017	1,280,708	39.4
Population density per km^2	153.08	7.86	4.95	17.53	26.46	

SSME-2 is predominantly a coastal area, with 54% of the total land area (including islands) within the coastal zone. The distinctive features of SSME-2 are the presence of extensive mangroves[71] and swamps and estuaries along the coast, rich fishing grounds, protected habitats that include the Selingan Turtle Islands and Kinabatangan Wetland Santuary, presence of many species of wildlife and aquatic animals not commonly found elsewhere. Among the unique species found in this region include proboscis monkeys, Orang Hutans, freshwater crocodiles, dugongs, dolphins, whale sharks, and the elusive rare freshwater shark[72] – *Glyphis* sp. SSME-2 also has the most productive shrimp fishing grounds in the state. The Kinabatangan district is described as one of the most fertile in the state and even in the whole of Malaysia.

The fishing grounds of SSME-2 cover a total area of 9,599 km^2 in the Sulu Sea, representing 33% of the SSME total or 19% of the state total. Within SSME-2, about 47% of the fishing ground falls under the Kinabatangan District, 35% in Beluran District and 18% in Sandakan Municipality. There is no marine fisheries activities based in Kinabatangan – where fishing is traditional riverine-based fisheries in the middle portion of the Kinabatangan River. Some of the fishing fleet based in Sandakan, the principal fishing port of SSME-2, exploit these waters using various types of gears by trawling, purse seining, long lining, hook & line, trapping and gillnetting. This area is the most important hook & line fishing ground in SSME-2.

[71] More than 60% of the 306,000-odd ha of mangrove areas in Sabah are found in the SSME-2 area

[72] Source: http://www.flmnh.ufl.edu/fish/Sharks/InNews/glyphis.htm

The coastal fisheries in SSME-2 contribute a significant portion of the total fisheries production in the SSME area and in Sabah as a whole. In 1999, the marine fish landings in SSME-2 totaled some 33,700 metric tons, with 72% of it landed by commercial gears. It represents about 24% of the SSME and 16% of the state total marine fish landings. Landings by commercial gears contributed 24% and 15% respectively to the SSME and total commercial landing total. While landings by traditional gears contributed 24% and 20% respectively to the SSME and total traditional landing total. The total marine fish production has a combined retail value of RM198 million, which represents 28% of the SSME and 20% of the state total. The SSME-2 contribution of the total SSME and state total marine fish landings by resource group in 1999 is summarized in Table 44-45 below.

Table 44: *SSME-2 marine fish landings, 1999*

District	Landings ('000 mt)	% Total	Landings (RM million)	% Total
Sandakan	29.42	87.27	178.56	90.27
Beluran	4.29	12.73	19.24	9.73
Kinabatangan	NA		NA	
TOTAL	33.71	100	197.80	100

Table 45: *SSME-2 marine fish contribution*

Resource	% SSME-2 breakdown	% contribution	
		SSME	STATE
Demersal finfish	45.5%	28.3%	18.4%
Pelagic Fish	33.0%	16.7%	11.5%
Shrimp	8.5%	33.9%	26.0%
Others	13.0%	46.0%	26.9%
TOTAL	100%	24.3%	16.3%

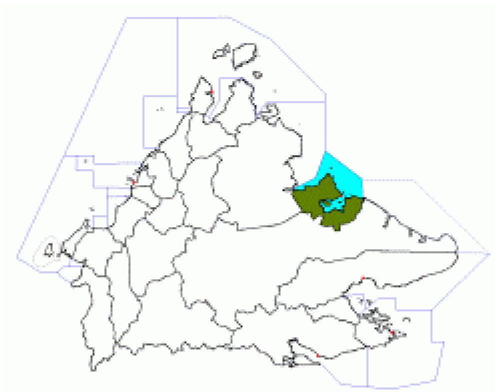
About 30% of the marine fish landings in 1999 comprised of trash fish and unsold fish were used as raw materials for fishmeal plants. A total of 2,300 metric tons of fishmeal was produced using 10,700 metric tons of fish – or 47% of the demersal finfish total landings.

Marine aquaculture, involving cage culture and tiger shrimp culture in brackish water ponds, is an important fishery activity in SSME-2. In 1999, the total production was around 126 metric tons (RM2.13 million), with cage culture contributing 70% by volume and 50% by value to the total marine aquaculture production in SSME-2. Cage culture contributed 34% and 19% by volume to the SSME and state production total cage culture production respectively. Cultured tiger shrimp contributed 30% by volume and 50% by value to the total SSME-2 production. Cultured tiger shrimp contributed both 2% by volume to the SSME and state total production respectively.

Mollusk culture is another important marine aquaculture activity in SSME-1. It is based in Kota Marudu, where fish farmers operate an integrated fish cage cum mollusk culture farm using materials and technical assistance provided by DOF Sabah. Fries are obtained from the wild using traps in estuarine areas. In 1999, the marine aquaculture production in Kota Marudu totaled 2.13 metric tons, comprising 1.8 metric tons of finfish – mainly estuarine groupers, mangrove snapper and barramundi (RM27,000), 0.23 metric tons of green mussels (RM460) and 0.10 metric ton (RM250) of oysters.

Sandakan Municipality

The Sandakan municipality is main growth center in SSME-2. It was the former capital of British North Borneo between 1884-1946[73]. It has the smallest land area (2,269 km^2) in SSME-2, i.e. 8% of the SSME-2 or about 6% of the SSME total land area. It is 100% coastal, with 97% of the land area on the mainland and 3% on the islands including the Selingan Turtle Islands. The topography of the district varies widely from tidal swamps to sandy beaches along the northern coast, floodplains on the south, hills on the central areas and high rocky steep hills along the Sandakan town coast. The coastline on the mainland including along lagoons is about 274 km long. Most of the land in Sandakan is fertile and favourable for high value crops cultivation. The major economies of this district are wood processing[74], agriculture[75] and fisheries. In recent years, ecotourism and wildlife conservation[76] has become an important economic activity[77] in Sandakan.



Due to its geographical proximity with the Southern Philippines, Sandakan is considered the main gateway for barter trade with the Southern Philippines[78]. Sandakan is the major port in the SSME-2 area – with regular ferry services to the Southern Philippines. The airport in Sandakan is the second largest in Sabah with average weekly load of 5,300 passengers.

Besides marine capture fisheries, fishing boat building[79] and aquaculture also plays an important role in the development of the fisheries industry in Sandakan. The main aquaculture activities

[73] Kota Kinabalu (formerly Jesselton) became the capital when Sabah (formerly North Borneo) became a British Colony in 1946.

[74] Annual round log production is in the region of 4 million cubic meters.

[75] Main crops are oil palm (250,000 ha plantation producing 350,000 metric tons annually) and cocoa (50,000 ha plantation producing 25,000 metric tons of cocoa beans annually).

[76] Attractions include Sepilok Orangutan Santuary and Selingan Turtle Islands.

[77] Foreign visitors are from Japan, USA, France, the Philippines, Thailand and other European countries.

[78] Exports to the Southern Philippines, comprising mainly of consumer goods including food products, averaged RM2 million each month. While monthly imports from the Southern Philippines averaged RM35,000 comprising mainly of consumer goods including Filipino cigarettes, liquor and other products meant for the Filipino populace in Sandakan and other parts of Sabah as well.

[79] Sandakan is the major fishing boat-building center in Sabah. There are 8 fishing boat building factories in Sabah – with the capacity to contruct 5-10 fishing boats per factory per year.

include freshwater fish culture in earthen ponds, marine cage culture and tiger shrimp farming[80]. At present, there are at least 300 fish farmers in the municipality.

Sandakan has an estimated total population about 347,300, representing about 69% of the total population of SSME-2 or 27% of the SSME total. It has the largest population in SSME-2, and ranked second in Sabah after Kota Kinabalu. It is has a very high population density of 153.1 persons.km^{-2}, making it most densely populated district in SSME-1, and ranked third in the state after Penampang (264.8 persons.km^{-2}) and Kota Kinabalu (1,161.2 persons.km^{-2}). The high population size is mainly due to the large numbers of illegal immigrants, from Indonesia and the Philippines. The high population is also attributed by in-migrant workers from other districts because of the employment opportunities offered by major light industries[81] including fisheries processing plants[82] and agriculture sector[83] including fisheries. The major export products are palm oil, sawn timber, cocoa beans, plywood and veneer sheets, frozen shrimps and other fisheries products[84].

One of the major environmental concerns in Sandakan is the widespread use of destructive fishing practices. Cyanide fishing to stun and collect high value reef fishes is not widely practiced in Sandakan waters, where most of the supply comes from the Philippines[85]. However, blast fishing is a major issue for many years, where the devasting toll on coral reef habitats in the area had affected the quality and quantity of fish caught from reef areas. The main culprits are illegal immigrants, either by individual fishermen for subsistence purposes or commercial blast fishing by groups of fishermen who are being sponsored by certain syndicates in the fishing industry. Previously, the catches are sold at the Sandakan fish market, and lately due to enforcement being beefed up, most of the catches being sold to immigrant workers in oil palm estates in the interior (including in the Kinabatangan district) or illegal immigrants in coastal squatter settlements.

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[80] Marine aquaculture production in 1999 totaled 109 metric tons comprising of 38 metric tons of cultured tiger shrimp (2 farms) and 71 metric tons from cage culture (125 farmers). The production from freshwater aquaculture involving 150 fish farmers, 400 ponds and pond area of 50 hectares is roughly estimated about 100 metric tons (assuming average yield of 2 metric ton/ha/annum).

[81] There are 183 factories employing 25,500 workers in the Sandakan district. There are 17 palm oil mills in the region.

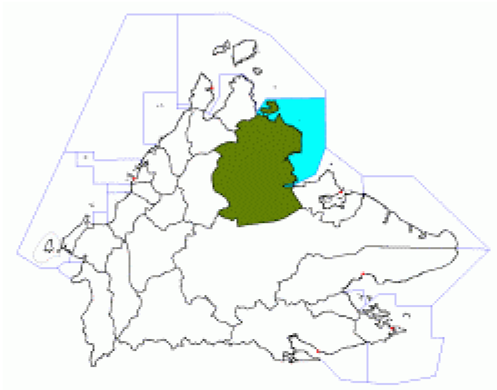
[82] There are 11 shrimp processing plants including 2 fishmeal plants in Sandakan.

[83] Recent studies had shown that foreign labour contributes 70% of the total 96,000-odd blue-collar jobs in the agriculture sector

[84] The annual exports of processed fisheries products from Sandakan is around 5,000 metric tons, with 70% comprising of frozen shrimps, 15% frozen fish, 12% crab and crab meat and 3% others. Live mantis shrimp is also an important export commodity, with exports between 8-9 metric tons annually. Exports of both dried shark fins and sea cucumbers averaged 2-3 metric tons annually. A large portion of these dried fish products are imports from the Philippines by barter trade. Exports of live lobsters peaked at 10 metric tons in 1995, but during the last few years, the export volume has drastically declined for some unknown reasons. Interviews with some major players in the live fish trade revealed that a major portion of live fish including mantis shrimp and lobsters are sourced from the Philippines.

[85] The author was informed by discrete sources in the industry that a number of carrier boats based in Sandakan make regular port-to-port visits to the Philippines to collect high value live reef fish from local fishermen or fish agents. The fishes are either brought direct to Sandakan or redivert to Banggi – where there are a number of so-called "cage culture farms" in operation.

Beluran District



Beluran is the second largest district in SSME-2, representing 31% of SSME-2 or more than 18% of the SSME total land area. About 62% of its total land area lies in the coastal zone – ranging from the undulating hills on the east to the flat plains along coastline. Islands make up 2% of the total land area – comprised of Pulau Jambongan as the largest island and a number of tiny muddy islets in sheltered bays, mangrove swamps and estuaries. Beluran has two sub districts, Telupid in the east that is 100% non-coastal and Paitan in the north (predominantly coastal). Agriculture (cocoa and oil palm), logging and fisheries are the major economies of Beluran.

Beluran has a population about 70,900, i.e. 14% of SSME-2 or 5.5% of the SSME population total. It is has a very low population density of 7.9 persons.km^{-2}, making it the second more sparsely populated district in Sabah after Kinabatangan (5.0 persons.km^{-2}).

In general, Beluran is divided into two areas: Sugut in the north and Labuk in the southern part. The Sugut and Labuk rivers are the main rivers flowing eastwards from the Crocker range towards the sea. The Paitan Sub District covers the Sugut area while the Labuk Area fall within the Beluran Proper district administration.

The Sugut Area that falls under the sub district of Paitan lies north of Beluran – its topography ranges from the mountainous Crocker range and hills on the west to the extensive tidal and mangrove swamps on the east. The Sugut Area contains the poorest people known in Sabah or even in the whole country. This is mainly due to its remoteness coupled with the unfavourable topography and many riverine systems cutting across the area. Accessibility to the Paitan Sub District is only possible by sea[86] (5-8 hours from Beluran depending on boat engine and sea conditions). A road connecting Pitas and Paitan is now under construction and expected to be completed in a couple of years. Mangrove swamps and numerous river estuaries are the prominient features of the coastal zone. Most of the mangrove swamps in this area is untouched and in pristine condition. Among the major economic activities in Paitan include logging and fishing. Traditional fishing is an important activity, with demand limited to local markets and occasional visiting fish traders. Fishing is mainly carried out using various types of traditional gears within the riverine systems and in inshore waters[87]. Aquaculture is almost not in existent in the Sugut Area – and has high potential for development in view of its untouched and pristine natural habitats and underexploited fisheries resources.

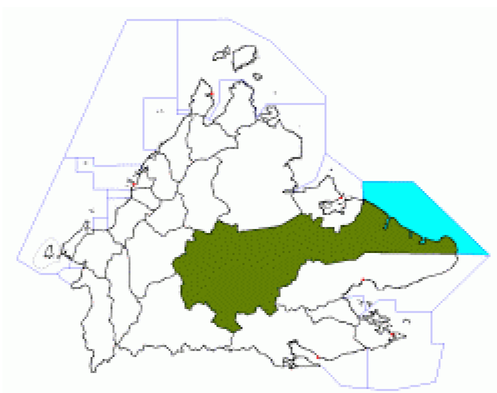
[86] Some parts of Sugut are accessible from Beluran by road through logging tracks and wooden bridges across rivers. However, direct access to Paitan is virtually impossible because many of these logging tracks and bridges are damaged and not maintained by the concerned logging companies.

[87] Fishermen in Paitan are reluctant to fish far out into the sea because of piracy problems.

The Labuk Area in lowlands in the south is being extensively cultivated with oil palm. There has been a growing concern among environmental groups of excessive pollution of plantation of oil palm that is said to be polluting the rivers. Fisheries are also an important economic activity, with marine fish being the main source of fish protein in the district. This district is famous for its dried or salted seafood in the region, where among important marine proucts are shrimp, finfish, elasmobranchs, and mollusks including cockles[88]. Aquaculture is limited much to freshwater fish culture in traditional earthen pond systems. Marine aquaculture is not well developed in Beluran proper and do not have much potential for development (except for Paitan) because of pollution risks from agriculture runoffs.

The main fishing ground of Beluran is the Labuk Bay and surrounding areas. Most of the marine fish landings are landed in Beluran Town. The Labuk estuary is deep and can allow bigger fishing vessels to reach Beluran Town and land its fresh catches. One of the major constraints to further development of the marine capture fisheries in Beluran is the limited extent of the fishing ground coupled with limited excess to offshore waters because of piracy attacks.

Kinabatangan District



Kinabatangan, covering an area of 17,516 km^2, is the largest district in SSME-2, making up 61% of SSME-2 and 36% of the SSME total land area. Kinabatangan is predominantly coastal, with 54% of its area within the coastal zone. Most of the non-coastal zone in the interior, covering an area of 9,678 km^2 (46% total area), is now part of the new established administrative district of Tongod. Originating in southwestern Sabah, the Kinabatangan River flows 560 km through the east coast of Sabah into the Sulu Sea. The Kinabatangan River Basin, covering an area of 15,400 km^2, is the largest riverine system in Sabah. The lower reaches of the Kinabatangan River had been reported by WWF Malaysia to contain some of the few remaining freshwater lakes and swamp rainforests in all of Southeast Asia.

The rural areas of Kinabatangan, especially in the interior and upstream areas, are undeveloped with most of them only accessible by rivers. The newly established District of Tongod is only accessible from the Kota Kinabalu – Sandakan highway via Telupid – one of the 2 sub districts of Beluran. A large portion of the coastal mainland comprised of the Kinabatangan floodplains – which is among the most productive type of wetland in Sabah.

[88] There used to be an important cockle (*Anadara granosa*) fishery in Beluran, the largest in mollusk fishery in Sabah before the mid 90s, that is now on the verge of collapsing probably due to overfishing as well as pollution from agricultural runoffs. Prior to 1996, there used to be extensive natural cockle beds associated with mudflats and mangrove swamps stretching from Kanawi Island in the inner portion of the Labauk Bay in the north down to Gum-Gum in the south. Present annual landings fluctuated around 50 metric tons or less compared to peak landings up to 3,000 metric tons in the early 90s.

Kinabatangan has a total coastline of 276 km – with 49% (154 km) on the mainland proper, 39% (108 km) along lagoons and 12% around islands. The main features of the coastline are the presence of extensive mangroves and tidal swamps outlining the mainland and lagoons. Most of these mangroves areas had been gazetted as protected mangrove forest reserves. Most of the islands that are found near sheltered estuaries and lagoons, and consists mainly of small muddy islands of a few hectares in size.

Kinabatangan has an estimated total population about 86,800, representing about 14% of the total population of SSME-2 or 5.5% of the SSME total. It is has a very low population density of 7.9 persons.km^{-2}, making it the second more sparsely populated district in Sabah after Kinabatangan (5.0 persons.km^{-2}).

The low undulating hills and the alluvial plains spreading eastwards along the Kinabatangan floodplains form the largest area of the coastal zone. The floodplains along the Kinabatangan River had been planted with oil palm, which is the main economic activity of the district. The Kinabatangan floodplains, which have the largest area of oil palm plantations in the state, had been dubbed by some people as the “oil palm bowl” of Sabah.

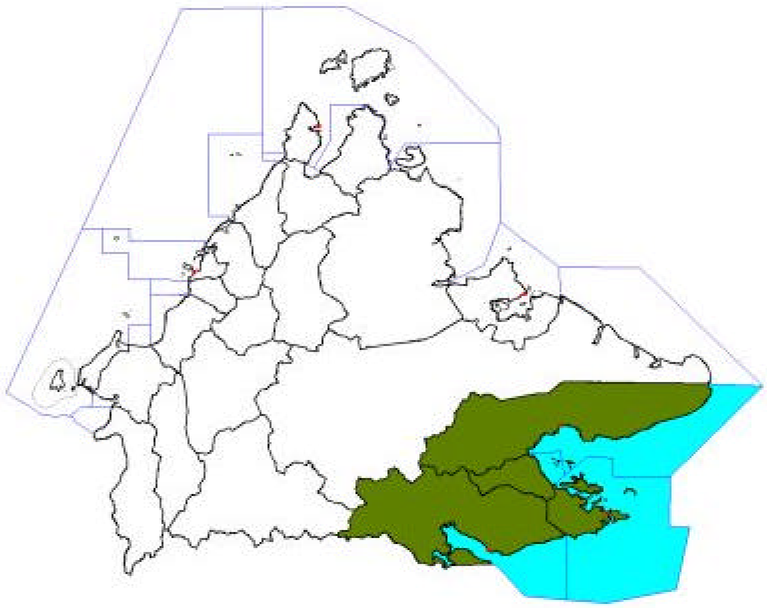
Another growing economic industry in Kinabatangan is ecotourism. Kinabatangan is home to Sukau – the “Gateway to Borneo’s wildlife” with proboscis monkeys on the lower Kinabatangan River is the major attraction besides other wildlife found in the area. Another unique feature of Kinabatangan that has now increasingly becoming a tourism attraction is the Gomantong caves which are famous for birds’ nests in Sabah.

There are insignificant marine fisheries activities in Kinabatangan, where freshwater aquaculture and riverine fisheries practiced on a subsistence basis, are the main source of fish in the district, besides supplementary fish supplies brought in by fish traders from Sandakan and Lahad Datu. There is some potential for commercial aquaculture development in ox-bow lakes upstream or along the coast. However, possible pollution impacts originating from agriculture plantations and oil palm refineries upstream might affect the economic viability of any future marine aquaculture operations. Development of marine aquaculture will also depend on degazetting the present protected mangrove forest reserves – which is a last option considering that Kinabatangan has one of the last pristine and untouched mangrove areas in the state. Freshwater aquaculture in earthen pond and cages culture systems is another feasible option – focusing on local freshwater species including giant freshwater prawn (*Macrobranchium rosenbergii*) and ikan patin.

<u>SSME-3</u>

SSME-3 comprised of 4 districts (Tawau, Lahad Datu, Kunak and Semporna) facing the Sulawesi Sea in the east. It has a total land area of 14,965 km^2, which represents 31% of the SSME or 20% of the state total area (*Table 46-48*). By area breakdown, Lahad Datu is the largest district (6,672 km^2), followed by Tawau (6,119 km^2), Semporna (1,183 km^2) and Kunak (991 km^2).

The SSME-3 coastal zone covers an area of 7,138 km^2 or 48% of the SSME-2 total land area, which comprised of 92% on the mainland and 8% on the islands. The coastal zone of SSME-3 represents almost 25% of the coastal zone in the state.



The fishing grounds of SSME-3 cover a total area of 11,844 km^2 in the Sulawesi Sea, i.e. 41% of the SSME or 23% of the state total fishing grounds. Within SSME-2, about 50% of the fishing ground falls under the Semporna District, 31% under the Lahad Datu District, 17% in Tawau Municipality and 3% under the Kunak District.

Table 46: *Breakdown of population and land area by district in SSME-3*

AREA AND POPULATION CHARACTERISTICS	% SSME-3 SHARE				SSME-3 TOTAL	SSME TOTAL	% SSME
	Tawau	Kunak	Lahad Datu	Semporna			
% Fishing Ground Area	16.6	2.7	31.0	49.8			
% TOTAL Land Area	40.9	6.6	44.6	7.9			
% Coastal Mainland	26.9	3.4	58.0	11.7			
% Non-Coastal Area	51.8	9.8	36.1	2.3			
% Island Area	52.2	0.7	5.2	41.9			
% TOTAL Coastline	32.8	5.3	24.6	37.4			
% Mainland Coastline	19.0	8.6	49.1	23.4			
% Lagoon Coastline	60.0	4.8	10.3	24.8			
% Island Coastline	29.3	3.5	15.9	51.3			
% Human Population	49.4	7.9	25.3	17.5			
Fishing Ground Area (km^2)	1,967	317	3,666	5,894	11,844	28,966	40.9
TOTAL Land Area (km^2)	6,119	991	6,672	1,183	14,965	48,393	30.9
Coastal Mainland Area	1,771	223	3,815	770	6,579	24,359	27.0
Non-Coastal Area	4,056	764	2,828	179	7,827	22,549	34.7
Island Area	292	4	29	234	559	1,485	37.6
TOTAL Coastline (km)	478	77	358	545	1,458	3,557	41.0
Mainland Coastline	82	37	212	101	432	947	45.6
Lagoon Coastline	186	15	32	77	310	925	33.5
Island Coastline	210	25	114	367	716	1,685	42.5
TOTAL human population	304,888	48,571	156,059	108,236	617,754	1,280,708	
Population density per km^2	49.83	49.01	23.39	91.49	41.28	26.46	

Table 47: *Breakdown of district by land area in SSME-3*

LAND AREA	% DISTRICT SHARE			Total (km²)
	Coastal Mainland	Non-Coastal	Island	
Tawau	28.9	66.3	4.8	6,119
Kunak	22.5	77.1	0.4	991
Lahad Datu	57.2	42.4	15.1	6,672
Semporna	65.1	15.1	19.8	1,183
TOTAL	44.0	52.3	3.7	14,965

Table 48: *Breakdown of districts by coastline length in SSME-3*

LAND AREA	% DISTRICT SHARE			Total (km)
	Islands	Lagoons	Mainland	
Tawau	43.9	38.9	17.2	478
Kunak	32.5	19.5	48.1	77
Lahad Datu	31.8	8.9	59.2	358
Semporna	67.3	14.1	18.5	545
TOTAL	49.1	21.3	29.6	1,458

The SSME-3 coastal zone covers an area of 7,827 km^2 or 48% of the SSME-3 total land area, which comprised of 92% of land on the coastal mainland and 8% on the islands. The coastal zone of the SSME-2 area represents 28% of the coastal zone in the state.

SSME-3 has a total coastline of 1,458 km or 41% of the SSME total coastline (3,557 km), with 30% (432 km) distributed along the mainland proper – 46% SSME total (947 km), 21% (310 km) along lagoons – 34% SSME total (925 km) and 49% (716 km) around the islands – 42% SSME total (1,685 km).

SSME-3 has a total human population around 617,800 that represents more than 48% of the SSME total or slightly more than 25% of the state population. SSME-3 is the highest populated zone in the SSME area. The population density in SSME-2 is about 41.3 persons.km^{-2}, which is 56% higher than the SSME average (26.5 persons.km^{-2}). In terms of population size, Tawau has the highest population (304,888), followed by Lahad Datu (156,059), Semporna (108,236) and Kunak (48,571). In terms of population density, Semporna is the most densely populated (91.5 persons.km^{-2}), followed by Tawau (49.8 persons.km^{-2}), Kunak (49.0 persons.km^{-2}) and Lahad Datu (23.4 persons.km^{-2}). A significant portion of the population comprised of illegal immigrants, mainly from Indonesia (Tawau) and the Philippines (Lahad Datu and Semporna). Both Tawau and Semporna had been described respectively by some as the "Jakarta of Sabah" and "2nd Metro Manila after Sandakan". In Semporna, the regular migration flow of the *Bajau Laut* from the Philippines and their culture had been decribed in detail by Sather (1968, 1997).

Among the distinctive features of SSME-3 include the coral reef habitats of Darvel Bay, mangrove and estuarine habitats of Cowie Bay, the world famous oceanic island of Sipadan, presence of the endangered chambered nautilus (*Nautilus pompilius suluensis*) in Semporna and *bagang* fisheries[89] of Tawau, Kunak and Lahad Datu – the main source of dried anchovies in Sabah. The unique and diverse habitats make SSME-3 the most productive fishing grounds in the state. It has also been named as the "Gateway to Borneo's Eco Diving" with Pulau Sipadan and nearby islands in Semporna as the main attraction for underwater diving adventures. Among the serious threats to these unique and invaluable habitats is the usage of destructive fishing practices.

[89] Most of dried anchovy production is targeted for overseas markets, with the Philippines being one of the major importing countries.

Blast fishing in both reef and non-reef areas ares widely being practiced by illegal immigrants in the coastal areas. In the SSME-3, blast fishing is carried out for two main reasons. Firstly, it is for subsistence purposes. Secondly, blast fishing as a business with syndicates or middlemen involved, where illegal immigrants are employed to catch high value fish species in reef areas. The catches are sold to some segments of the small-scale fish processing business[90] as well as certain “niche markets”.

Due to the increasing demand from the Live Reef Fish Trade based in Hong Kong and dwindling fish supplies from traditional sources in the region, the use of cyanides and other types of poisons to stun and collect high value reef fishes are on the increase. Discrete interviews with some of the key players in the so-called “fish cage culture” business, which is in fact, *temporary storage of fish in transit cages prior to marketing*, revealed that fish supplies are also coming in from Indonesia, with Nunukan as the main transit point.

SSME-3 is the main barter trade gateway with Indonesia since time immemorial. It is the main entry point for the flow of fisheries products from Nunukan – Indonesia to sustain the viable operations of existing fish processing plants in Tawau. A large portion of fisheries products “imported” from Indonesia is destined for overseas markets including Peninsular Malaysia. SSME-3 is also a minor barter trade gateway with the Philippines through Semporna, which is only a couple of hours boat ride from the Sulu Archipelago Group of Islands.

Besides being a major player in palm oil, SSME-3 is the main producer of cocoa beans in the state[91], and has been dubbed by some as the “cocoa bowl” of Malaysia. The cocoa processing plant based in Tawau is one of the biggest in the country.

The coastal fisheries in SSME-3 contribute the bulk of the total fisheries production in the SSME area and in Sabah as a whole. In 1999, the marine fish landings in SSME-3 totaled some 69,500 metric tons, with 67% of it landed by commercial gears. It represents about 50% of the SSME and 34% of the state total marine fish landings. Landings by commercial gears contributed 47% and 30% respectively to the SSME and total commercial landing total. Landings from traditional gears contributed 58% and 47% respectively to the SSME and state traditional landing total. The total marine fish production has a combined retail value of RM249 million; which represents 36% of the SSME and 25% of the state total. The SSME-3 contribution of the total SSME and state total marine fish landings by resource group in 1999 is summarized in *Table 49-50*.

Table 49: *SSME-3 marine fish landings, 1999*

District	Landings (‘000 mt)	% Total	Landings (RM million)	% Total
Tawau	19.47	28.01	83.78	33.65
Semporna	12.01	17.28	42.47	17.06
Lahad Datu	14.86	21.38	56.50	22.70
Kunak	23.17	33.33	66.20	26.59
TOTAL	69.51	100	248.95	100

[90] Among the popular raw materials for making fish balls is the yellow-tail fulsier (*Caesio* spp.) or *ikan sulit* which is normally caught by blast fishing. Most fish ball processors preferred this species because of its taste and meat texture.

[91] Cocoa bean exports between Jan-Oct 1999 was about RM183 million (1.7% total export value)

BOX 9: SIMPLE FARMING METHOD

FLOATING plastic bottle dot the seascape where the *Eucheuma kapayachus alverazii* seaweed is cultivated. These bottles keep the seaweed afloat. Called the long-line semi-raft method, it is the most popular method employed by farmers in Sabah, the only state in Malaysia, which farms the seaweed.

Strands of seaweed seedlings are tide to old plastic bottles held in place in the sea by wooden poles. Suitable for shallow water, this method uses fewer wooden poles to hold more strands of seaweed then the initial method introduced in the state called staking or bottom culture.

Besides these methods, the Raft Mark II (also known used, usually in deeper waters of between 3.5m and 20m. With this method, ropes anchored on the sea bottom with rocks are tied perpendicularly to the ends of two long horizontal pieces of belian wood. Strands of seedlings are tied to strings running parallel to the ropes.

The Raft MKII method uses long lines between 90m and 180m that can hold 9,000 plants. However, being labor intensive, it takes 45 to 60 days to harvest an acre (0.4ha) of seaweed.

A one-acre area can produce two tonnes of seaweed. The seaweed is harvested when the seedlings grow to about 2kg. Harvesting is carried out four to five times a year. The seaweed is ten dried on wooden platforms.

The farming are should have good water movement to allow free flow of nutrients. The waves should not be too strong. In fact, there should be protected from currents and strong winds.

The farm should also be protected from herbivorous fish, starfish and turtles, which love to feed on seaweed. Seaweed cultivation was initiated by the Sabah Fisheries Department in 1978, when the department looked into the types of seaweed suitable for cultivation in Semporna.

Towards the later part of 1979 and in 1980, a small number of local fishermen began to take up Eucheuma farming. The Fisheries Department took over the full operation of the seaweed project in 1980 and six years later introduced another cultivation technique - Raft MKII - in lagoons where the water is 3m to 5m deep.

Seaweed cultivation slowed down towards the end of 1982, party due to attacks by the Siganids (a type of fish), which graze the growing tips and outer surface of the seaweed, and damage caused by sea turtles.

The mariculture of seaweed was given a boost in 1989 when Marine Colloid, a US-based company, introduced a sponsored planting programme to commercialize production.

By the end of 1990, a small but steady production was under way and, by 1991, export had reached 20 tonnes per month. This was a turning point for the industry, which has seen a steady increase in yields since then.

- By Loh Foon Fong

SOURCE: http://agrolink.moa.my/moa1/newspaper/perikanan/rf20010130b.html

Table 50: *SSME-3 marine fish contribution*

Resource	% SSME-3 breakdown	% contribution	
		SSME	STATE
Demersal finfish	23.0%	29.4%	19.1%
Pelagic Fish	67.6%	70.5%	48.7%
Shrimp	4.9%	40.1%	30.8%
Others	4.5%	33.2%	19.4%
TOTAL	100%	50.0%	33.5%

Besides agriculture, ecotourism, barter trading and capture fisheries, marine aquaculture is an important activity in SSME-3. In 1999, the total production was 4,881 metric tons (RM60.86 million) – which represent 95% of the SSME and 90% of the state total production volume or 89% of the SSME and 84% of the state total production value. State marine aquaculture production in 1999 was around 5,453 metric tons (RM72.6 million).

Seaweed production in 1999 represents 62% (3,008 metric tons) by volume and 11% (RM6.62 million) by value of SSME-3 total aquaculture production. Seaweed is cultured in Semporna[92] and Kunak[93], with some production expected from Banggi and Kota Belud in a couple of years time.

Tiger shrimp (*Penaeus monodon*) contributed 37% by volume and 86% by value to the SSME-3 total aquaculture production. SSME-3 is the "tiger shrimp bowl" of Sabah, with the commercial tiger shrimp farms based in Tanjung Batu – Tawau being one of the largest in the country. In 1999, SSME-3 tiger shrimp production totaled 1,798 metric tons (RM52.15 million)[94], contributing 97.9% to the SSME and 97.6% to the state total production volume.

Cage culture contributed 1% (54 metric tons) by volume and more than 3% (RM2.08 million) by value to the SSME-3 total aquaculture production. However, it represents 21% and 11% of the SSME and state total production volume respectively. The main cage culture activities are in Semporna[95], Tawau[96] and Lahad Datu.

[92] In 2001, there are more than 600 household families invoved in seaweed farming in Semporna, with some earning nett income of RM1500/month. In 1999, dried seaweed production from Semporna was about 2,962 metric tons (98.5% total) generated some 290 ha of seaweed farms. Average farm yields of partially dried seaweed stands at 6-8 metric ton/ha/year.

[93] In 1999, dried seaweed output was 47 metric tons (2.5% total) generated from some 6.7 ha of seaweed farms. It is believed that some of the dried seaweed was sold direct to buyers in nearby Semporna. At present, there are about 60-odd household families involved in seaweed farming.

[94] Annual cultured tiger shrimp production averaged 2,000-3,500 metric tons. The 1999 production is low output because of white spot disease outbreaks that virtually affected more than 50% of the farms.

[95] It was believed that the present production values are underestimates and could run to more than 500 metric tons including "live fish" imports from Indonesia. Reports had been received on the increasing use of cyanide and tuba (*Derris* spp.) to collect high value fishes from reef areas. Traders based in Tawau and Kudat have very good contacts in Indonesia – where highly value live reef fish including Napoleon Wrass from Sulawesi and elsewhere in the region can easily be obtained provided that the prices are right.

[96] Present production values are underestimates. A high percentage of actual production comes from Indonesia comprising of high value species including humphead wrass and coral groupers. Information on total "live fish" exports out of Tawau by two companies in 1999 totaled 358 metric tons comprising of: coral groupers – 98 metric tons, humphead wrass – 44 metric tons, crabs – 203 metric tons, lobsters – 6 metric tons and barramundi – 7 metric tons.

Green mussel (*Perna viridis*) culture contributed 0.4% (20 metric tons) by volume and 0.03% (RM 20,000) by value to the SSME-3 total aquaculture production. However, this production represents 99% and 61% of the SSME and 61% of the state total green mussel production. The bulk comes from the community-based integrated marine aquaculture project initiated by DOF Sabah in Indrasabah[97]. It is expected the production to increase to more than 100 metric tons by end of 2001[98].

Most of the marine aquaculture production from SSME-3 is destined for local and overseas niche markets; in particular, include: tiger shrimp fries (9.2 million tails in 1999), tiger shrimps[99], seaweeds in dried form[100] or semi-refined carrageen products[101] and live fish from cage culture[102]. Other processed fisheries products exported include frozen shrimp, fish (chilled, fresh and frozen) and fishmeal[103].

Tawau Municipality

Tawau covers a total land area of 6,119 km^2 and is second largest administrative district after Lahad Datu in SSME-3, representing 41% of SSME-3 or 13% of the SSME total area. Tawau is predominantly non-coastal, where 30% or 1,771 km^2 of the mainland total area lies within the coastal zone. Islands including Pulau Sebatik make up almost 5% of the total land area. It has a total coastline of 478 km, of which only 17% is on the mainland proper, 39% around estuaries and lagoons, and 44% around islands – mainly muddy islets in the Cowie Bay and Pulau Sebatik.

Tawau has a coastal zone area of 1,771 km^2 on the mainland, with most of it concentrated along the narrow coastal areas at the southern part of the district. Some 70% of Tawau are hilly areas. Most of the coastal topography on the west comprised of tidal swamps and river estuaries of the Kalabakan, Brantian and Merotai rivers flowing to the Cowie Bay. On the east, the coast is covered with tidal swamps, floodplains, hills and sandy beaches.

Agriculture (oil palm and cocoa plantation), barter trading, aquaculture and logging are the major economic activities of Tawau. Tawau is the major economic growth centre in SSME-3. Tawau is also the focal point for barter trading, which has been a traditional economic activity since many decades ago between Tawau and Nunukan in Indonesia.

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[97] It has been envisaged by DOF Sabah that Indrasabah will become the future "green mussel bowl" of Sabah besides other sister projects established in Sungai Umpul – Kota Belud and Sungai Mengkabong - Tuaran, which are having problems with marketing because of annual "red tide blooms" occurring regularly along the west coast of Sabah.

[98] Plans are in the pipeline to include government sponsored downstream processing facilities to encourage production as well as to address present marketing contraints.

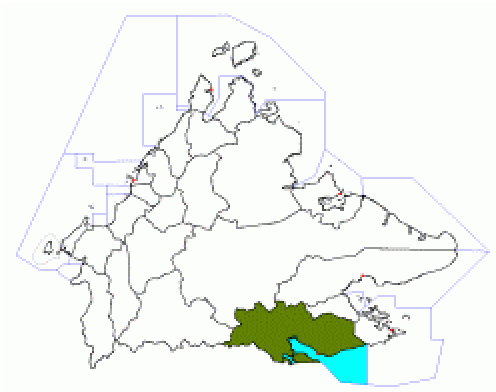
[99] High value farmed tiger shrimps are targeted mainly for the niche markets in Japan, USA and Europe. Frozen shrimps exports in 1999 totaled 6,700-odd metric tons (RM184 million – 58% total export value)

[100] In 1999, 2,671 metric tons of dried seaweed was exported mainly to Hong Kong (57%), Korea (31%), Denmark (8%) and the Philippines (1%). Prior to 1997, almost 100% are exported to Denmark.

[101] There are two plants involved in the extraction of semi-refined carageneen from seaweeds in Tawau and Semporna. However, local supplies are still inadequate to meet the demand. These plants are depending on imported dried seaweed from Indonesia and the Philippines to sustain viable operations.

[102] Targeted for the Live Reef Fish Trade based in Hong Kong

[103] 1999 exports: frozen shrimp (1,300 metric tons) and fish – fresh, chilled and frozen (1,635 metric tons)



Fisheries including marine aquaculture and downstream processing of fisheries products[104] play an important part of Tawau's economy. The commercial tiger shrimp culture farms in Batu Payung are the biggest in Sabah and among the top five in the country[105], where most of the production are targeted for overseas markets. Tawau has the highest number of fish or shrimp processing plants in the state – with raw materials sourced from the surrounding districts or imported from Indonesia.

Tawau has a total population around 304,900 people, i.e. 49% of the SSME-3 and 24% of the SSME population total. It is the most populated district in SSME-3. It has a high population density of 49.83 persons.km^{-2}, making it the second most densely populated district in SSME-3 after Semporna (91.5 persons.km^{-2}) and ranked fourth in the SSME area after Kudat, Semporna and Sandakan. The high population size is mainly due to the presence of migrant workers and illegal immigrants that make up a significant portion of the total population. Most of them are employed as employed as workers in the agriculture, construction and processing sectors as well as in fisheries. The majority of these migrant workers as well as illegal immigrants are from Indonesia – with most of them of the *bugis* stock originating from Sulawesi.
The fishing grounds of Tawau cover a total area of 1,967 km^2, i.e. 17% of SSME-3 or 7% of the SSME total. The fishing grounds are much confined to the Cowie Bay and northwest portion of the Sulawesi Sea, stretching out from the Indonesian waters in the south up to the Semporna waters in the north. Tawau has the richest shrimp fishing ground in the whole of SSME-3 and is one of the major contributor of shrimp landings in the state. However, trawlers also operate in or near Indonesian waters as well – and this might have attributed to the increasing trend in shrimp landings in Tawau during the last number of years[106].

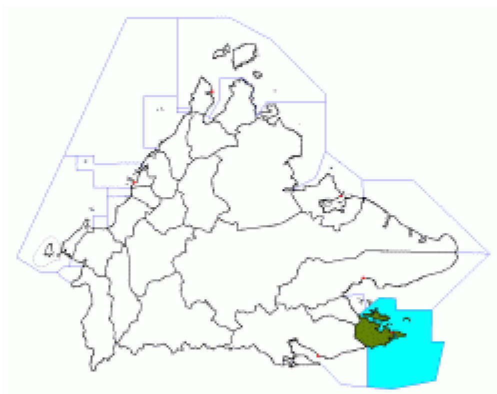
[104] This will be discussed in greater detail in the next chapter

[105] Please refer to Tables A22-A23 in this report

[106] Previous studies carried out (Chin and Goh, 1978 & Biusing, 1985) shown that the MSY of shrimp stocks in Tawau might be around 500-600 metric tons annually. However, annual shrimp landings for the last number of years has far surpassed 2,000 metric tons. However, more in-depth studies are necessary to verify the actual MSY levels of shrimp stocks in Tawau.

Semporna District

Semporna covers a total land area of 1,183 km^2 and is third largest after Lahad Datu and Tawau in SSME-3, representing 8% of SSME-3 or 2% of the SSME total area. Semporna is coastal district, where 81% or 949 km^2 of the mainland total area lies within the coastal zone. Islands including Pulau Sipadan and the Semporna Group of Islands make up 20% of the total land area. It has a total coastline of 545 km, of which only 19% is on the mainland proper, 21% along bays and lagoons, and a high 49% around islands.



Semporna has a coastal zone area of 770 km^2 on the mainland, with most of it comprising of flat undulating areas except for the mountainous area on the central western part of the district. The northern coastal area is bounded by tidal swamps, low hilly areas and floodplains in the interior. The southern portion consists of sandy beaches and low-lying hills. Semporna proper is actually an island extension from the mainland featuring low hills, tidal swamps and corals surrounding it.

One of the outstanding features of Semporna is the highly diverse biodiversity and habitats of the Semporna Group of Islands, among them - Pulau Bumbum, Pulau Timbun Mata and Pulau Bohey Dulang. Off Semporna are the islands of Pulau Sipadan and Pulau Mabul, which are the famed diving spots in the region. Tourism activities are now developing rapidly where there are at least 15 tour operators in Semporna. Besides tourism, agriculture (oil palm and cocoa) and fishing are among the main economic activities of Semporna. Marine capture fisheries in Semporna play an important role in the development of the fisheries industry in Sabah, being a major contributor of pelagic landings including oceanic tunas in the state. Marine aquaculture also plays an important role in the socio-economic development of coastal communities in Semporna. At present, there are some 600-odd households involved in seaweed farming. To date, some of these household are earning as much as RM1,500 a month from seaweed farming alone. This is due to the high and attractive prices offered for partially dried seaweed that can go as high as RM2.50/kg.

Semporna has a total population around 108,240 people, i.e. almost 18% of the SSME-3 and 8% of the SSME population total. It is the most densely populated district (91.5 persons.km^{-2}) in the SSME-3, ranking second in the SSME area after Sandakan. About 30% of the population stays in the islands whose main livelihood depends on fishing, with most of them (some 20,000) in Pulau Bumbum. The high population size in Semporna is mainly due to its huge numbers of illegal immigrants, where most of them are employed as employed as plantation workers and as well as in fisheries. The majority of these migrant workers as well as illegal immigrants are from the Philippines – mainly of the *bajau laut* stock.

The fishing grounds of Semporna cover a total area of 5,894 km^2, i.e. 50% of SSME-3 or 20% of the SSME total. The fishing grounds lies partly in the outer portion of the Darvel Bay and the open seas of the Sulu Sea including around the presently disputed islands of Sipadan and

Ligitan[107]. At present, fishing is mainly carried out in the Darvel Bay, around the Semporna Group of Islands and some parts of the Malaysian portion of the Suluwesi Sea.

BOX 10: BLAST FISHING IN SEMPORNA

"………Economically, after drift-netting and spear-fishing, the next most important method of fishing is with the use of explosives (*timbak daing*). For a short time, from the early to mid-1970s, such fishing was practiced on a wide scale in Semporna, not only by the Bajau Laut, but also by other fishermen in response to a greatly increased market demand for fish created by the opening of a trunk road to the larger urban market and timber town of Tawau to the south. It was heavily promoted by commercial traders who supplied local fishermen with fuses and other materials for making explosives……"

"……In 1979, the most compeling deterent, so far as the villagers are concerned, was the danger of injury involved in the handling of explosives. A number of village fishermen have suffered injuries, including one near fatality. One village boat was split open and sunk as a result of a boming accident, when explosives detonated prematurely in the water immediately beneath the vessel…………."

"…………….Explosives are made by the villagers of a mixture of powdered dammar, sodium chlorate, and sulphur, and are usually packed inside a glass bottle, which is sealed with a waterproof stopper through which a locally made fuse is inserted. Stoppers are usually made of rubber slipper soles. The fuse is ignited by matches inserted in the stopper. The length of the fuse may be varied depending on the depth at which the bomb is meant to explode. Fish may be sighted from the surface or by diving, and at night schools of fish are usually detected by the phosphorescent flashes they produce……………"

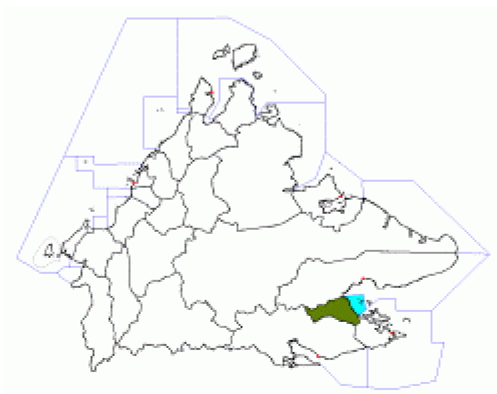
"………As soon as a sighting is made, the bomb is lit and thrown into the water, its fuse adjusted for depth. After it explodes, the fishing party begins collecting fthe catch. Since fish killed by concussion do not float to the surface, but sink, the catch must be recovered by diving. At night, a floating buoy is usually set out to mark the location, so that the crew can return at sunrise when there is enough light to begin diving. There is some variation in methods of collecting fish depending on the depth of the water in which they are taken. In deep water (6 fathoms or deeper), a diver is usually lowered by rope with lead or stone weights. A second weighted rope is used as a signal line. The diver carries a container around his waist to hod the fish which he collects from the sea floor. When he ca no longer hold his breath, he jerks on the signal line, and is pulled to the surface by the rest of the crew. Using this method, fish can be taken from as deep as 15-16 fathoms. However, most bombing is done in shallower water. A variety of fish are taken by bombing, but fulsiers (*Caesio* spp.), large schools of which regularly appear in shallower waters, appears to be a major target………………"

Quoted from: Sather, C. 1997. *The Bajau Laut: Adaptation, history and fate in a maritime fishing society of south-eastern Sabah*. Oxford University Press.

[107] Including the disputed areas claimed by Indonesia to be part of their EEZ waters. A large portion of the fishing grounds is presently not exploited by the fishing fleet in Semporna because of frequent presence of the Indonesian Navy. Matters pertaining to these overlapping territorial claims had been brought to the International Court of Justice for settlement.
URL: http://www.icj-cij.org/icjwww/idocket/iinma/iinmaframe.htm

Kunak District

Kunak covers a total land area of 991 km^2 and is the smallest district in the SSME area, i.e. less than 7% of SSME-3 or 2% of the SSME total area. Kunak is predominantly non-coastal, where 23% or 223 km^2 of the mainland total area lies within the coastal zone. Numerous small rocky islets along the coast make up only 0.4% (4 km^2) of the total land area. The other islands in the Darvel Bay mainly fall within the administrative boundary of Lahad Datu. It has a very short total coastline of only 77 km, of which 48% is on the mainland proper, 20% along bays and lagoons, and almost 33% around islands.



The fishing grounds under the Kunak District administrative boundary cover a total area of only 317 km^2, i.e. less than 3% of SSME-3 or 1% of the SSME total. It lies in the inner portion of the Darvel Bay. However, fisheries licenses allow the commercial fishing fleet based in Kunak to operate far out into the bay and open waters as well. However, the traditional fishery sector activities are much confined within the Darvel Bay.

Kunak has a total population around 48,600 people, i.e. almost 8% of the SSME-3 and 4% of the SSME population total. The district is moderately populated (49.0 persons.km^{-2}) slightly lower than the SSME-3 average (41.3 persons.km^{-2}). Most of the human settlements are concentrated around Kunak Town and along the coast southwards up to Pangi and in the northern portion of the district. A considerable portion of the population comprised of migrants workers employed in the agriculture sector – mainly in oil palm plantations in the area. Oil palm cultivation is the main economic generating activity in Kunak – where there are 5 palm oil refineries to cater the needs of the district.

The population of Kunak is confined within the coastal zone covering an area of 223 km^2 on the eastern portion of the district – which comprise of low hills and flood plains dominated by tidal swamps. Most of the land is suitable for agricultural purposes – where most of the suitable lands in the area are planted by oil palm and cocoa.

The unpopulated area on the western portion of the district is undeveloped comprising of high hills and mountains. The major rivers of Tingkayu and Sabahan flow eastwards through these mountains into the Darvel Bay. The Madai Caves – famous for its bird nests and the Madai Waterfalls are the main tourism attractions of the district. Kunak Town is the main economic center of Kunak District, which lies on a plateau surrounded by high hills and mountains.

Besides agriculture and tourism, fisheries play an important role in the economic development of Kunak. The fishing industry in Kunak can be broadly categorized into three groups: traditional type using traps and nets, *bagang* fishery and commercial fishing. Traditional fishing is much confined to reef areas, mangrove areas and estuaries within the inner portion of the Darvel Bay.

Traditional gear landings do not contribute much to the total fish production but plays an important role in sustaining the livelihood of coastal communities that depend on the sea for their daily sustenance.

The *bagang* fishery[108] in Kunak is the one of the major source of dried anchovies in SSME-3, which is mainly exported overseas including to the Philippines. A number of large fish processing plants in Kunak operate their own commercial fishing vessels to source for raw materials. Landings are carried out at jetties adjacent to these processing plants, and the commercial portion of the catch is immediately processed for export overseas including to Peninsular Malaysia. Some of the catch is also brought by road for disposal at the municipal central fish market in Tawau, which is about an hour drive from Kunak. The unused portion of the catch including trash fish[109] is processed into fishmeal[110] and exported overseas as well.

Besides capture fisheries, marine aquaculture also plays an important role in the development of the fisheries industry in Kunak. Many areas in the Darvel Bay including Kunak waters had been identified to be suitable for marine aquaculture. At present, only seaweed farming had been developed on a small-scale involving some 60-odd households. Farm yields in 1999 covering an area of 7-8 ha was around 50-odd metric tons of partially dried seaweed. Most of these dried seaweeds were sold to a company based in Semporna.

Unlike other districts in the SSME area, the issue of destructive fishing practices is not so serious in Kunak. This is probably due to the non-presence of cage culture operations in the area coupled with the fact that there are better economic opportunities in *bagang* fishing and minimum presence of illegal immigrants. However, blast fishing is very common in nearby Lahad Datu.

Lahad Datu District

Lahad Datu covers a total land area of 6,672 km^2 and is the largest district in SSME-3, i.e. more than 44% of SSME-3 or about 14% of the SSME total area. Lahad Datu is predominantly non-coastal, where 57% or 3,815 km^2 of the mainland total area lies within the coastal zone. The numerous small rocky islets along the coast make up only 0.4% (29 km^2) of the total land area despite making up 32% of the total coastline. It has a long coastline of 358 km, of which 59% is on the mainland proper, 9% along bays and lagoons, and 32% around islands.

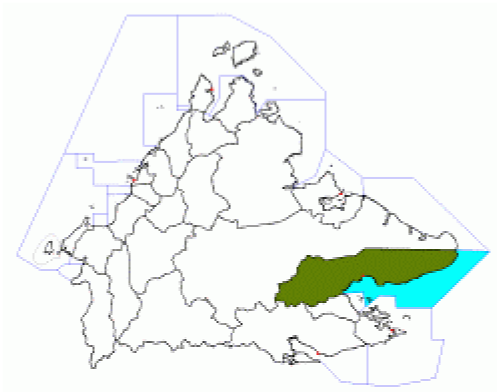
The fishing grounds of Lahad Datu cover a total area of 3,666 km^2, i.e. 31% of SSME-3 or almost 13% of the SSME total. The fishing grounds lies mainly in the northern portion of the Darvel Bay and partly in the open seas of the Sulu Sea. These fishing grounds are also being exploited by fishing vessels based in Kunak.

Lahad Datu has a total population around 156,100 people, i.e. about 25% of the SSME-3 and 12% of the SSME population total. Despite being the second most populated district in SSME-3, it is the most sparsely populated district (23.4 persons.km^{-2}) – about half the SSME-3 average (49.0 persons.km^{-2}). In the SSME area, it is the second most sparsely populated district after Pitas (19.9 persons.km^{-2}).

[108] The *bagang* fishery of Tawau, Lahad Datu and Kunak is discussed in-depth in another part of this report

[109] A large portion of unsold commercial value fish including sardines and round scads is also processed into fishmeal.

[110] The average fishmeal production from these plants is about 2,500 metric tons per annum – 99% of the SSME-3 fishmeal production. The raw materials used for fishmeal production in SSME-3 is estimated around 11,500 metric tons per annum or about 28% of the average annual marine fish landings



The coastal zone of Lahad Datu covers an area of 3815 km^2, which lies on the Tungku-Sahabat alluvial plains on the east and Silam on the southern part of the district. Most of the coastal zone comprised of undulating hills, alluvial plains and tidal swamps. The Segama is the main river that flows through the district into the Darvel Bay. Lahad Datu, which lies near the coast, is the main administrative center of the district. Lahad Datu is also home to the world famous Danum Valley Research Centre and Tabin Wildlife Reserve – which are the main tourism attraction sites of the district.

Agriculture including palm oil and cocoa cultivation is the main economic activity of Lahad Datu. The 250,000 ha FELDA palm oil plantation scheme at Tungku-Sahabat is among the largest plantation in Sabah. Wood processing is the second most important economic activity in Lahad Datu, where there is a large port near Silam to ship out timber products. Fishing is an important economic activity, where Lahad Datu is famous in the region for its dried shrimps and salted fish. The major source of fish comes from commercial trawling, bagang operations and blast fishing. Blast fishing is very rampant in Lahad Datu due to the presence of a large population of illegal immigrants in the coastal areas. Unlike other districts, some local fishermen are also involved in blast fishing especially those staying in remote areas where there is a lack of other economic opportunities.

NON-SSME AREA[111]

The non-SSME area of Sabah is on the west coast facing the South China Sea, stretching from the southwestern end of the Kudat Peninsular down to the Sipitang District bordering with Brunei and state of Sarawak. The non-SSME area comprising of eight districts along the west coast, including the state capital, the City of Kota Kinabalu, cover a land area of 9,621 km^2, which represents about 13% of the state total area. The non-SSME area is predominantly a non-coastal zone, with 33% of the total land area within the coastal zone. Islands along the west coast have a total area of 40 km^2, making up 0.4% of the total land area – or 1.2% of the land area within the coastal zone. It has a total coastline of 759 km in length (17.6% state total), with 79% on the mainland including lagoons and 21% around the islands.

Marine waters that fall within the jurisdiction of administrative districts in the non-SSME area covers an area of 22,394 km^2 (44% state total) within the 200-meter continental shelf area, stretching in the south from the Malaysian border of the Brunei Bay up to the international waters bordering with the Philippines in the north. A large portion of the waters in the north is also being exploited by some of the commercial fishing vessels based in Kudat.

[111] Please refer to the Sabah ICZM web site for information on coastal districts in the non-SSME area

Islands found in the non-SSME area represents less than 3% (40 km^2) of the total island area in the state, comprising mainly of small islands which have considerable presence of coral reefs. More than 80% of the islands are in Kota Kinabalu (53% area) and Kuala Penyu (40% area) including with two MPA (Marine Protected Areas) managed by Sabah Parks[112].

The non-SSME area has a total human population around 834,000 people (34% state total), with 42% (354,000) of them in the City of Kota Kinabalu. The population density is estimated about 86.7 persons.km^{-2}, which is 163% higher than the state average (33.0 persons.km^{-2}). The high population density is due to the presence of highly populated areas in major economic growth centers covering the City of Kota Kinabalu (1,162.2 persons.km^{-2}) and surrounding areas of Penampang (264.8 persons.km^{-2}), Papar (69.3 persons.km^{-2}) and Tuaran (65.9 persons.km^{-2}).

For the purpose of this report, the non-SSME zone is divided into 2 sub-zones: West Coast – north and West Coast South. The fisheres contribution from the non-SSME area in 1999 is summarized in *Table 51-54*. Information on the geaographical features and and population of the non-SSME area is given in *Tables 55-57*.

Table 51: *Non-SSME marine fish landings, 1999*

District	Landings ('000 mt)	% Total	Landings (RM million)	% Total
Kota Belud	5.53	8.0	35.80	12.2
Tuaran	0.92	1.3	5.55	1.9
Kota Kinabalu	54.37	78.8	205.68	70.2
Papar	0.81	1.2	4.24	1.4
Beaufort	3.09	4.5	24.05	8.2
Kuala Penyu	2.97	4.3	12.13	4.1
Sipitang	1.30	1.9	5.73	2.0
TOTAL non-SSME	68.99	100%	293.18	100%
TOTAL Sabah	207.21		993.64	
% non-SSME	33.3%		29.5%	

Table 52: *Non-SSME fish volume contribution*

Resource Landings (in '000 metric ton)	Sub Total Landings	% contribution		TOTAL
		non-SSME	SSME	
Finfish	179.21	32.9	67.1	100%
Crustaceans	17.10	24.9	75.1	100%
Others	10.22	56.4	43.6	100%
TOTAL	207.21	33.3	66.7	100%

Table 53: *Non-SSME fish value contribution*

Resource Landings (in RM million)	Sub Total Landings	% contribution		TOTAL
		non-SSME	SSME	
Finfish	776.77	28.7	71.3	100%
Crustaceans	168.92	22.7	77.3	100%
Others	47.95	66.4	33.6	100%
TOTAL	993.64	29.5	70.5	100%

[112] Tunku Abdul Rahman Park (4,929 ha) established in 1974, and Pulau Tiga Marine Park *15,864 ha) established in 1978

Table 54: *Non-SSME fish value contribution*

Gear Landings (in '000 metric ton)	Sub Total Landings	% contribution		TOTAL
		non-SSME	SSME	
Trawl Net	91.29	49.9	50.1	100%
Seine Net	44.16	19.9	80.1	100%
Gill Net	22.98	21.5	78.5	100%
Lift Net	10.16	21.6	78.4	100%
Hook & Line	28.26	13.6	86.4	100%
Others	10.37	35.4	64.6	100%
TOTAL	207.21	33.3	66.7	100%

Table 55: *Breakdown of population and land area in the non-SSME area*

AREA AND POPULATION CHARACTERISTICS	% non-SSME		Total SSME	Total Sabah	% Sabah
	West Coast North	West Coast South			
% Fishing Ground Area	71.6	28.4	100%		
% TOTAL Land Area	48.8	51.2	100%		
% Coastal Mainland	47.3	52.7	100%		
% Non-Coastal Area	50.2	49.8	100%		
% Island Area	65.0	35.0	100%		
% TOTAL Coastline	63.0	37.0	100%		
% Mainland Coastline	55.3	44.7	100%		
% Lagoon Coastline	71.5	28.5	100%		
% Island Coastline	65.2	34.8	100%		
% Human Population	87.1	12.9	100%		
Fishing Ground Area (km^2)	16,025	6,369	22,394	51,360	43.6
TOTAL Land Area (km^2)	4,692	4,929	9,621	74,236	13.0
Coastal Mainland Area	1,509	1,681	3,190	27,549	11.6
Non-Coastal Area	3,257	3,234	6,491	45,162	14.4
Island Area	26	14	40	1,525	2.6
TOTAL Coastline (km)	478	281	759	4,316	17.6
Mainland Coastline	187	151	338	1,285	26.3
Lagoon Coastline	186	74	260	1,185	21.9
Island Coastline	105	56	161	1,846	8.7
TOTAL human population	726,160	107,520	833,680	2,449,389	34.0
Population density per km^2	154.8	21.8	86.7	33.0	

Table 56: *Breakdown of district by land area in non-SSME*

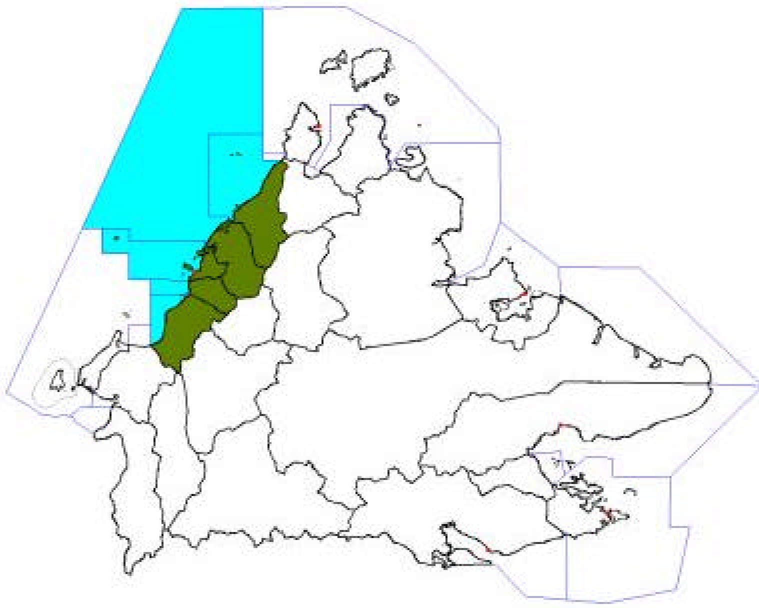
LAND AREA	% DISTRICT SHARE			Total (km^2)
	Coastal Mainland	Non-Coastal	Island	
West Coast - North	32.2	67.3	0.6	4,692
West Coast - South	34.1	65.6	0.3	4,929
TOTAL	33.3	66.4	0.4	9,621

Table 57: *Breakdown of districts by coastline length in non-SSM*

LAND AREA	% DISTRICT SHARE			Total (km)
	Islands	Lagoons	Mainland	
West Coast - North	22.0	38.9	39.1	478
West Coast - South	19.9	26.3	53.7	281
TOTAL	21.2	34.3	44.5	759

West Coast North

The West Coast – North zone comprised of five administrative districts (Kota Belud, Tuaran, City of Kota Kinabalu, Penampang and Papar), covering a total land area of 4,692 km^2 (51% non-SSME area) and represents 6.3% of the state total area. It is a predominantly non-coastal zone, with less than 31% of the land area including islands within the coastal zone.



Islands along the coast have a total area of 26 km^2, making up 0.6% of the total land area – or 1.6% of the land area within the coastal zone. It has a coastline of 478 km in length, with 78% on the mainland including lagoons and 22% around the islands. Kota Kinabalu is the only predominantly coastal (61% area in the coastal zone) in the West Coast – North Zone, while other districts are more non-coastal with most of the land in the hinterland: Penampang (85% non-coastal), Tuaran (77% non-coastal), Kota Belud (63% non-coastal) and Papar (62% non-coastal). The profile of these districts is given in *Table 58-60*.

Table 58: *Breakdown of district by land area in West Coast North*

LAND AREA	% District Share			Total (km^2)
	Coastal Mainland	Non-Coastal	Island	
Kota Belud	37.2	62.5	0.3	1,396
Tuaran	22.9	77.1	0.1	1,247
Kota Kinabalu	54.1	39.0	6.9	305
Penampang	14.0	86.0	0.0	494
Papar	37.7	62.3	0.0	1,250
TOTAL	32.2	67.3	0.6	4,692

Table 59: *Breakdown of districts by coastline in West Coast North*

COASTLINE	% Sub Zone Share			Total (km)
	Island	Lagoon	Mainland	
Kota Belud	16.4	35.3	48.3	116
Tuaran	14.9	63.5	21.6	148
Kota Kinabalu	44.3	30.5	25.2	131
Penampang	14.3	28.6	57.1	21
Papar	4.8	8.1	87.1	62
TOTAL	21.2	34.3	44.5	478

Table 60: *Breakdown of population and land area by district in West Coast - North*

AREA AND POPULATION CHARACTERISTICS	% West Coast North					Sub Total	Non-SSME	% non-SSME
	Kota Belud	Tuaran	Kota K'balu	P'pang	Papar			
% Fishing Ground Area	12.3	73.5	9.9	1.7	2.7	100%		
% TOTAL Land Area	29.8	26.6	6.5	10.5	26.6	100%		
% Coastal Mainland	34.4	18.9	10.9	4.6	31.2	100%		
% Non-Coastal Area	26.8	29.5	3.7	16.1	23.9	100%		
% Island Area	15.4	3.8	80.8	0.0	0.0	100%		
% TOTAL Coastline	24.3	31.0	27.4	4.4	13.0	100%		
% Mainland Coastline	29.9	17.1	17.6	6.4	28.9	100%		
% Lagoon Coastline	22.0	50.5	21.5	3.2	2.7	100%		
% Island Coastline	18.1	21.0	55.2	2.9	2.9	100%		
% Human Population	10.0	11.3	48.8	18.0	11.9	100%		
Fishing Ground Area (km^2)	1,969	11,774	1,581	273	428	16,025	22,394	71.6
TOTAL Land Area (km^2)	1,396	1,247	305	494	1,250	4,692	9,621	48.8
Coastal Mainland Area	519	285	165	69	471	1,509	3,190	47.3
Non-Coastal Area	873	961	119	425	779	3,257	6,391	51.0
Island Area	4	1	21	+	+	26	40	65.0
TOTAL Coastline (km)	116	148	131	21	62	478	759	63.0
Mainland Coastline	56	32	33	12	54	187	338	55.3
Lagoon Coastline	41	94	40	6	5	186	260	71.5
Island Coastline	19	22	58	3	3	105	161	65.2
TOTAL human population	72,337	82,212	354,153	130,809	86,649	726,160	833,680	87.1
Population density per km^2	51.8	65.9	1,161.2	264.8	69.3	154.8	86.7	

Note: + less than 1 km^2

West Coast South

The West Coast – South zone comprised of three districts (Beaufort, Kuala Penyu and Sipitang) that has a land area of 4,929 km^2, which represents 51% of the non-SSME area or 6.6% of the state total area. It is a predominantly non-coastal zone, with less than 35% of the land area including islands within the coastal zone.

Islands along the coast have a total area of 14 km^2, making up 0.3% of the total land area – or 0.8% of the land area within the coastal zone. It has a coastline of 281 km in length, with 80% on the mainland including lagoons and 20% around the islands. The profile of these districts is given in *Table 61-63*

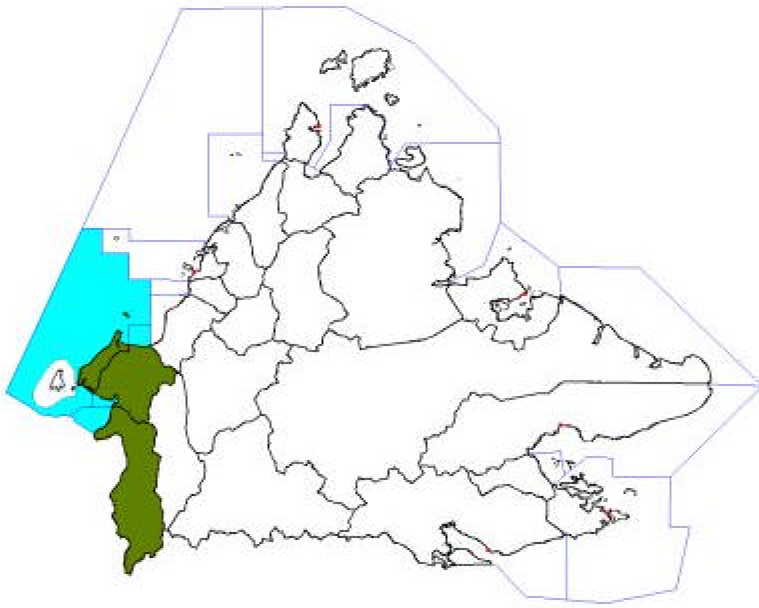


Table 61: *Breakdown of population and land area by district in West Coast - South*

AREA AND POPULATION CHARACTERISTICS	% West Coast South			Sub Total	Non-SSME	% non-SSME
	Beaufort	Kuala Penyu	Sipitang			
% Fishing Ground Area	5.0	89.6	5.4	100%		
% TOTAL Land Area	34.7	9.3	56.0	100%		
% Coastal Mainland	63.8	26.7	9.6	100%		
% Non-Coastal Area	19.6	0.0	80.4	100%		
% Island Area	14.3	85.7	0.0	100%		
% TOTAL Coastline	34.5	54.1	11.4	100%		
% Mainland Coastline	25.8	53.6	20.5	100%		
% Lagoon Coastline	48.6	50.0	1.4	100%		
% Island Coastline	39.3	60.7	0.0	100%		
% Human Population	57.4	15.4	27.3	100%		
Fishing Ground Area (km^2)	320	5,704	345	6,369	22,394	28.4
TOTAL Land Area (km^2)	1,709	460	2,760	4,929	9,621	51.2
Coastal Mainland Area	1,072	448	161	1,681	3,190	52.7
Non-Coastal Area	635	0	2,599	3,234	6,391	50.6
Island Area	2	12	0	14	40	35.0
TOTAL Coastline (km)	97	152	32	281	759	37.0
Mainland Coastline	39	81	31	151	338	44.7
Lagoon Coastline	36	37	1	74	260	28.5
Island Coastline	22	34	0	56	161	34.8
TOTAL human population	61,698	16,511	29,311	107,520	833,680	12.9
Population density per km^2	36.1	35.9	10.6	21.8	86.7	

Table 62: *Breakdown of district by land area in West Coast South*

COASTLINE	% Sub Zone Share			Total (km^2)
	Coastal Mainland	Non-Coastal	Island	
Beaufort	62.7	37.2	0.1	1,709
Kuala Penyu	97.4	0.0	2.6	460
Sipitang	5.8	94.2	0.0	2,760
TOTAL	34.1	65.6	0.3	4,929

Table 63: *Breakdown of districts by coastline in West Coast South*

COASTLINE	% Sub Zone Share			Total
	Island	Lagoon	Mainland	(km)
Beaufort	22.7	37.1	40.2	97
Kuala Penyu	22.4	24.3	53.3	152
Sipitang	0.0	3.1	96.9	32
TOTAL	19.9	26.3	53.7	281

Figure 37. Sectoral breakdown of fish production, Sabah 1995-1998 (in '000 metric ton)

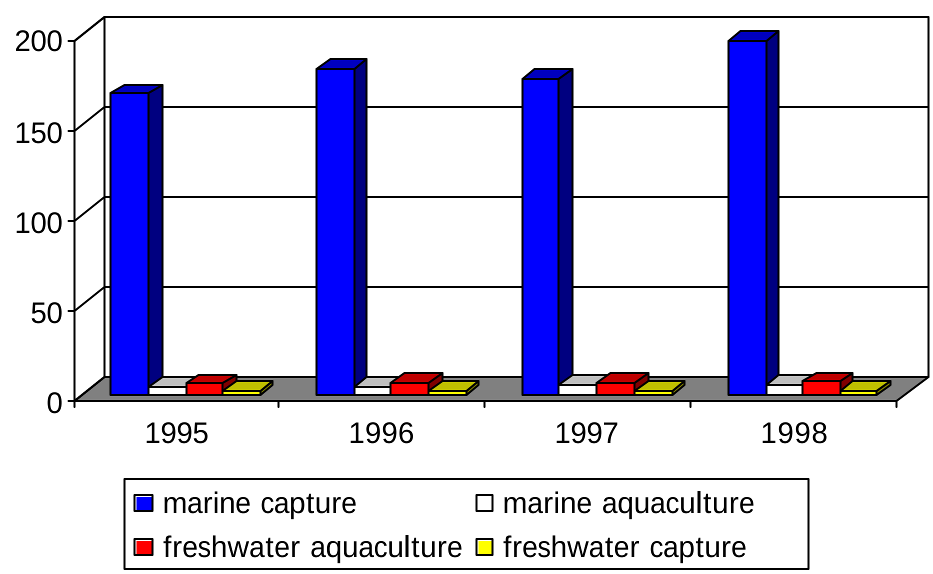
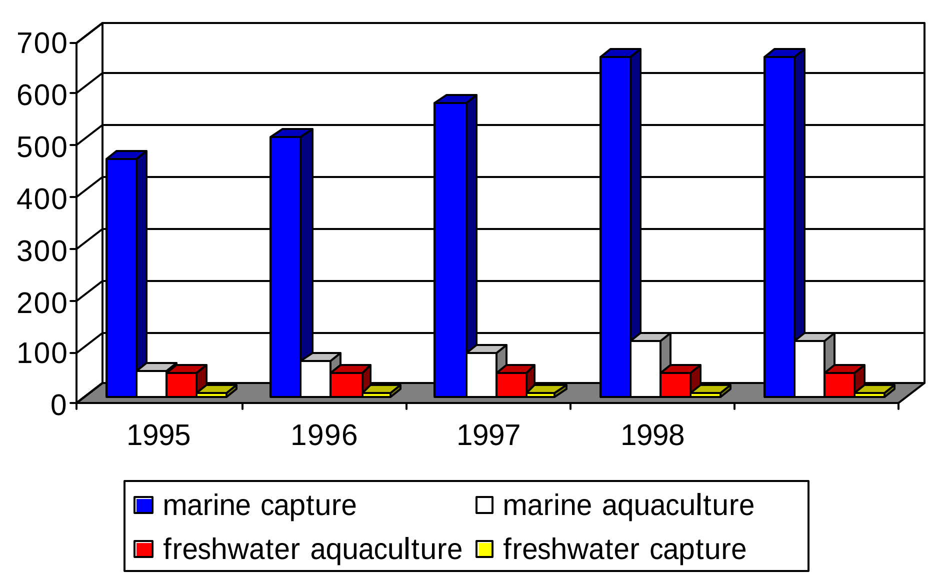


Figure 38. Sectoral breakdown of fish production, Sabah 1995-1998 (in RM million)



V. OVERVIEW OF THE FISHERIES INDUSTRY IN SABAH

Fisheries GDP Contribution

Fisheries contributed 7% of the agriculture GDP or 2% of the state's annual GDP (**Figure 36**). The GDP breakdown of fish production for 1995-1999 is given in **Table A31** and **Figures 37-38**. In 1998, fish production[113] had increased 18% by volume and 46% by value from 178,116 metric tons (RM576 million) in 1995 to 209,666 metric tons (RM843 million) in 1998. Marine fisheries contributed the bulk (93%) of the annual production volume, followed by freshwater aquaculture (3%), marine aquaculture (2%) and freshwater fisheries (1%) during the 1995-1998 period. In terms of value, marine fisheries contributed 80%, followed by marine aquaculture (11%), freshwater aquaculture (7%) and freshwater capture fisheries (1%) to the annual total.

For marine fisheries, annual production had increased 24.5% by volume and 51.5% by value from 166,462 metric tons (RM461 million) in 1995 to 207,213 metric tons (RM698 million) in 1999. Finfish contributed the bulk (86.2%) of the annual production volume, followed by shrimp (5.4%), mollusks (5.1%), crabs (2.9%) and other invertebrates (0.3%). In terms of wholesale value, finfish contributed 73.2%, followed by shrimp (17.5%), mollusks (6.7%), crabs (2.4%) and other invertebrates (0.2%) to the annual production. Finfish share to the annual production increased by 2.0% from 85.1% in 1995, reaching its peak (87.1%), and stabilized at 86.8% in 1999. The stable increment in finfish landings throughout the years is primarily due to increase in trawl landings including trash fish targeted for fishmeal plants and marine cage culture farms. However, shrimp share decreased by 63.5% from a high 7.4% (12,398 metric tons) in 1995 to a minimum 2.7% (5,609 metric tons) in 1999. The sharp decline in shrimp landings is mainly due to over fishing and probably also caused by the reduction of fishing effort[114]. On the other hand, both crab and mollusks landings are quite stable throughout the years; with crab share peaking at 5.5% in 1999 (211% increase from 3,695 metric tons in 1995 to 11,481 metric tons in 1999); and mollusk landings increasing from 7,413 metric tons in 1995 to a high 10,451 metric tons in 1998 and then stabilizing at 10,045 metric tons in 1999. Miscellaneous invertebrate landings had declined by 86.8%, from 1,348 metric tons in 1995 to 178 metric tons in 1999. Reasons for this sharp decline, including over fishing, however, still remains inconclusive due to incomplete data.

For freshwater aquaculture, the annual production had increased 13.2% by volume and 3.5% by value from 6,123 metric tons (RM47 million) in 1995 to 6,929 metric tons (RM49 million) in 1998. About 95% of the annual production volume is contributed by earthen pond culture, while the remaining les than 5% comes from cage and concrete tank culture systems.

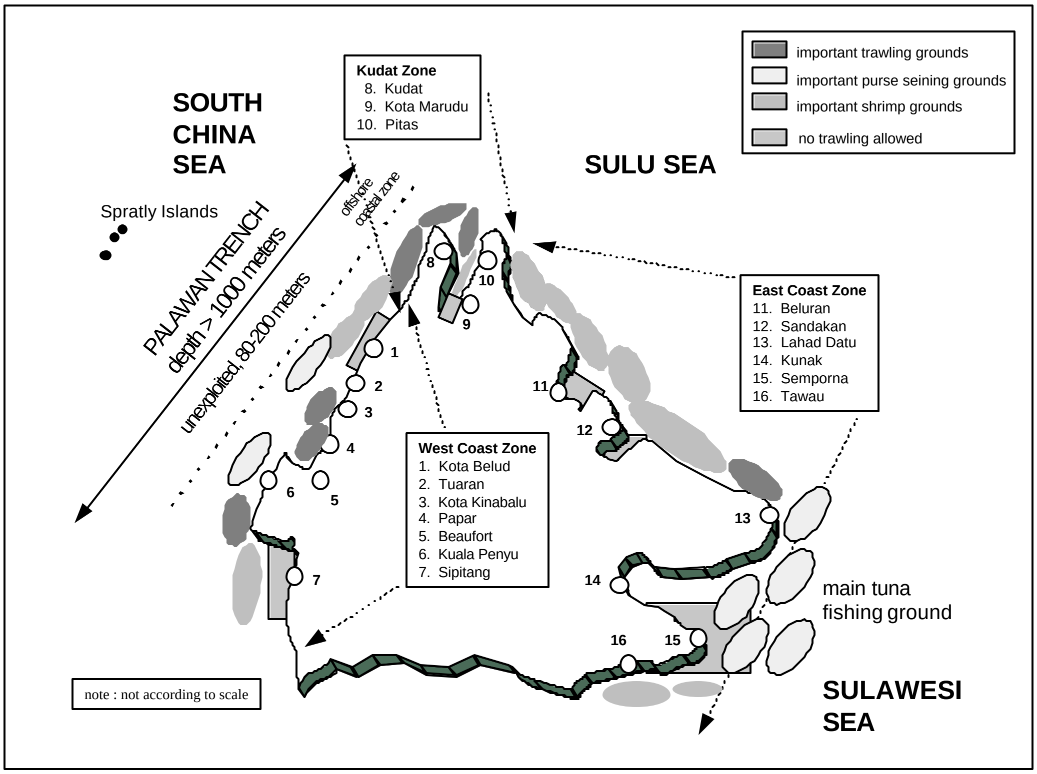
For marine aquaculture, production had increased 41.4% by volume and 40.0% by value from 3,381 metric tons (RM52 million) in 1995 to 5,454 metric tons (RM73 million) in 1999. However, the value had decreased by -33.4% from RM109 million in 1998 because sharp decline in shrimp production (–32.2%) in 1999 because of white spot disease outbreaks in Tawau and Lahad Datu. Consequently, its production share decreased from 56.5% in 1998 to 33.8% in 1999. Shrimp culture contributed 48.3% to the total production volume, followed by seaweed culture (40.3%), cage culture (9.7%), oyster culture (1.1%) and mussel culture (0.6%). In terms of value, shrimp culture contributed 74.6%, followed by cage culture (21.0%), seaweed culture (3.9%), oyster culture (0.3%) and mussel culture (less than 1%) to the annual production.

[113] Freshwater aquaculture production estimate for 1999 is still being finalized. Freshwater ornamentals and fry (finfish and shrimp) contributed RM6.4 million in 1995 and RM15.1 million in 1998.

[114] DOF Sabah is phasing out the number of small trawlers that are mainly used for catching shrimps in the shallow inshore waters. Assessment of the shrimp trawler fishery is discussed in another chapter.

Fishing Grounds

The major part of the fishing grounds in Sabah lies in the South China Sea that extends to the limit of the continental shelf off the west coast. The continental shelf is about 100 km in width and extends up to the 200-metres depth contour. The fishing grounds on the east coast are limited in area and in close proximity with the international boundaries between Malaysia – Philippines for SSME-1 and SSME-2 and between Malaysia – Indonesia for SSME-3. SSME-1 is bounded by the South China Sea on the western part and Sulu Sea in the north. Fishing grounds of SSME-2 and SSME-3 are respectively in the Sulu Sea and Sulawesi Sea.



The marine waters of Sabah cover an area around 51,360 km^2 (**Table A30**). Out of the total, 56% falls within the SSME area – with 26% of the sub total in SSME-1, 33% in SSME-2 and 41% in SSME-3. In the SSME area, Kudat has the largest fishing ground – 6,803 km^2 or 23.5% SSME total, followed by Semporna (5,894 km^2), Kinabatangan (4,515 km^2), Lahad Datu (3,666 km^2), Beluran (3,381 km^2), Tawau (1,967 km^2) and Sandakan (1,703 km^2). Districts in the SSME area with small fishing grounds are Kota Marudu (129 km^2 or 0.4% SSME total), Kunak (317 km^2) and Pitas (591 km^2).

In general, most of the fishing activities in Sabah are concentrated in coastal waters within the 30 nautical mile zone sustaining both traditional and commercial fisheries sectors. On the other hand, the offshore fishing waters beyond 30 nautical miles (west coast) are still not yet fully exploited fully by the local fishing fleet[115]. On the east coast, fishing is also contrainted by

[115] Most of the commercial trawlers based in Kota Kinabalu are not capable of trawling beyond the 80-meter depth. At present, only a limited number of lcommercial fish purse seiners based in Kota Kinabalu and FT Labuan are fishing beyond the 30 nautical zone limit.

security problems[116]. Most of the inshore coastal zone is trawlable, with substrates ranging from soft corals, mixture of mud-sand to muddy bottoms. Untrawlable areas including mainly in reef areas off Semporna, some parts on the west coast and northern Kudat are important fishing grounds for both commercial and traditional fishing vessels.

There are five main shrimp fishing grounds in Sabah, i.e. (i) Brunei Bay; (ii) along the upper west coast (between Tuaran and Kota Belud); (iii) Marudu Bay in Kudat - SSME-1; (iv) Labuk Bay in Sandakan - SSME-2; (v) Cowie Bay in Tawau – SSME-3 and (vi) Darvel Bay in Lahad Datu – SSME-3. These areas are located within the inshore waters and the 50-m depth tends to define the outer limit of commercially viable shrimp trawling operations (Chin and Goh, 1967). On the east coast, the important trawling areas are in Tawau, Darvel Bay, and between Tambisan Island and northern Sandakan (Marchesa Bay and Labuk Bay). Fishing grounds on the east coast are limited in area due to close proximity with international waters. On the west coast, the trawlable grounds are more extensive, stretching from the Brunei Bay in the south up to the southwestern portion of Kudat Peninsular. Mangroves are highly productive ecosystems and are reported to be critical to the life cycles of most marine life including shrimps. High shrimp catch rates were often observed in most areas adjacent to extensive mangrove swamps and river estuaries (e.g. Labuk Bay, Brunei Bay, Marudu Bay, Cowie Bay). There is a total of 316,000-odd hectares of mangrove swamps in Sabah, out of which a large portion is protected as mangrove forest reserves.

The coral reefs in Sabah are in various stages of degradation, among others, caused by pollution, sedimentation, and most of all by destructive fishing practices including blast and cyanide fishing (Chua and Mathias, 1978; Oakley et al., 1997a; 1997b, 1997c, 1999; Pilcher and Oakley, 1997; Pilcher and Cabanban, 2000).

Fisheries Potential Yield

There is a paucity of information pertaining to the distribution, biology and stock assessment of fisheries resources in Sabah, with most studies limited to the west coast (Anonymous, 1989a; Biusing, *et al*., 1994; Biusing, 1991, 1993a, 1994a, 1994b, 1995; Biusing and Rumpet, 1998; Vidthayanon, 1998). In the SSME area, only a few studies had been carried out (Simpson and Chin, 1978; Anonymous, 1983; Sapli Mulok, 1986; Biusing, 1985, 1987 & 1993b).

At present, the potential yield of marine fisheries resources in Sabah is still unknown. Using historical data and past resource survey results, Biusing (1996) reported that the MSY (maximum sustainable yield) of fisheries resources in Sabah might be in the region of 350,000 metric tons[117] (*Table 64*).

At present, fishing activities in the state are mainly concentrated within the 30 nautical mile limit and thus Sabah's fisheries may be termed as predominantly coastal. Some of the resources have have already shown signs of overfishing, particularly for shrimps resources (**Figure 39**). Fishing grounds that still have some room for further development include the Sipadan-Ligitan waters off Semporna, Malaysian EEZ waters along the Palawan Trench, and the outer portion (>100 meter depth) of the continental shelf along the west coast. Among high-value resources found along the outer west coast of Sabah include various species of invertebrates, coastal tunas and small pelagics (Biusing *et al.*, 1997). Past resource surveys and fishing operations shown that there

[116] Malaysian sovereignity of the offshore fishing grounds off Semporna is still being disputed by Indonesia and this issue had been brought to the International Court of Justice.

[117] This estimate should be treated with great caution because it did not take into account the potential yield of coral reef fishes, and pelagic resources (coastal and oceanic) off Semporna, Kudat and along the Palawan Trench (west coast)

are abundant small pelagics and oceanic tunas in these offshore waters. However, the economic viability of exploiting these fishing grounds is still unknown because of insufficient catch and effort data to carry out a thorough evaluation of available fisheries resources.

“Demersal” refer to finfish and various invertebrates that spend most of their adult life on or near the sea bottom. The demersal assemblage in Sabah is typical of bottom faunal communities in predominantly soft substrates and coral reefs of the Indo Pacific region. Catches landed by various gears particularly trawlers and traps in Sabah's coastal waters consist mainly of demersal species. There are about 400 demersal species representing 170 genera and 100 families in Sabah waters. “Pelagic” fish refers to fishes that spend all or most of their adult life living through the water column away from the seabed. The pelagic fish assemblage in Sabah waters consists of about 100 species distributed among 50 genera and 20 families.

There are about 1,635 species of fish representing 35 orders and 153 families in Southeast Asian waters (Allen, 2000). There are at least 518 species representing 24 orders and 108 families in the coastal waters of Sabah and Sarawak (Vidthayanon, 1998). Overall, 712 species representing 28 orders and 138 families are found in Malaysian waters, of which 460 species have commercial value (Mohsin *et al*., 1996).

In general, about 200-300 species of marine fishes caught by various gears are landed in the major landing sites, with an average of 50-100 species being displayed for sale daily in the fish markets. Additional seasonal 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 inhabit 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.

BOX 11: SABAH'S CORAL REEFS UNDER FIRE

UNSCRUPULOUS fishermen and their explosive techniques are proving to be the bane of Sabah's rich coral reefs. Experts say that 45% of the corals and fisheries have been lost.

Fish bombing and poisoning have damaged Sabah's coral reefs so extensively that less than 5% are in good condition, current research on its marine environment shows. As a result, the supply of top value seafood that breeds in coral reefs, such as lobsters and garoupa, is expected to collapse in about four years, marine experts say. The culprits are fishermen who bomb the kaleidoscopic reefs or squirt sodium cyanide into them to stun the fish for a quick catch. In the process, they have devastated the once beautiful and unspoilt marine paradise that extended along much of Sabah's long coastline. For years now, experts have collected evidence of the horrendous damage that is being done. Already, some 45% of Sabah's coral reefs and fisheries have been lost, according to Dr Steve Oakley, professor of environmental science at the Institute for Biodiversity and Environmental Conservation, Universiti Malaysia Sarawak.

Oakley, who has been researching the coral reefs in Sabah since 1996, says an average of three explosions per hour have been consistently recorded in Sabah seas and go up to 15 blasts per hour. Coral reefs in pristine condition are only found in two areas now, he says - at Pulau Sipadan near the Indonesian border and Pulau Layang-layang, which is part of the Spratlys.

As a result of the damage, fish are no longer breeding in the reefs, says Oakley, and the income of local fishermen has diminished. Ironically, says Oakley, they would be earning four times their current income if they had not damaged the coral ecosystems through fish bombing. The outlook for a quick solution is not good, since damaged coral reefs take 10 years to recover, says Oakley. "The situation is not hopeless although once the reefs are destroyed, there is no turning back," he says. Even reefs in protected areas, like the Pulau Tiga forest reserve, have not been spared. Using a hydrophone and tape recorder, Oakley has gathered evidence of the damage to the coral reef systems.

"A single blast can destroy an area of corals about three to five meters in diameter. All fish within a circle of 15 to 25 metres are killed," he says. Among the badly affected areas are the Ligitan reefs, the reefs north of Sandakan, those between Marudu Bay and Pulau Matanani and Pulau Mengalaum on the west coast. "Anywhere there is a reef, the fishermen have been blasting them".

"For every square kilometre of damaged reef, we have lost 90% of the resources that would have been available," he says. Most valuable products that come from the sea, including the lobsters and garoupas that land up in seafood restaurants across Asia, come from coral reefs. "The most expensive items on the menu come from coral reefs... but sadly most of the big fish are not breeding anymore," says Oakley.

According to Don Baker, a professional diver who was in the US navy, and is now working on a reef project here, the live fish trade in Sabah will collapse within the next four years. It is estimated that 90% of fish caught in this destructive manner never lands in Malaysia because they fetch better prices overseas.

The commercial value of coral reefs is computed at around US$6,000 (RM22,800) per square hectare of healthy corals. Their value is derived from photo tourism, diving, snorkeling, underwater photography and sustainable harvesting of 20% of marine life a year, according to Baker. At the World Eco-Tourism Conference in Kota Kinabalu recently, he expressed concern that over 90% of Sabah's coral reef ecosystems are being progressively destroyed.

He blamed the damage on explosives, cyanide, fish trawling close to shallow reefs, nutrients and fertilisers from agricultural development, increase in coastal development and human wastes and unregulated tourism. While Baker believes that the fish bombing is wholly the work of foreigners, Oakley has found that the fishing boats that had been captured on film were registered in towns like Kudat, Sandakan and Kota Kinabalu.

SOURCE: http://agrolink.moa.my/moa1/newspaper/perikanan/nf991114.html

Table 64: *Maximum Sustainable Yield of Marine Fisheries Resources in Sabah*

Fishing Zone	Resource Group	MSY[a] (metric tons)	Current Exploitation[b]	Exploitation Level
Coastal Waters	Pelagic fish	115,000	93,000	81%
	Demersal finfish	115,000	85,000	72%
	Crustaceans	20,000	15,000	75%
	Other invertebrates	15,000	10,000	67%
	Sub Total	265,000	203,000	77%
Offshore Waters	Pelagic fish	75,000	3,000	4%
	Demersal finfish	10,000	2,000	20%
	Sub Total	85,000	5,000	6%
	Grand Total	350,000	208,000	59%

a – modified from Biusing (1996); b – based on 1998-1999 average
Demersal fin fish include trash fish

Fishing Gears of Sabah

In general, fishing operations in Sabah can be broadly categorized into two groups: commercial and traditional sectors. The commercial fishery sector involved fishing using various types of commercial gears operated by motorized vessels in both coastal and offshore waters. On the other hand, the traditional fishery sector involved fishing using various types of traditional gears operated by non-motorized and motorized boats in both inshore and coastal waters. The former is better organized, more capital intensive and accounts for greater income as opposed to latter, which is much smaller, dispersed and often fragmented in organization, high labor intensive and low in capital investment. Information on fishing gears and methods used in Sabah are available (Chin, 1962 & 1998; Goh, 1967; Makino, 1983; Makino and Shimomoto, 1989; Tabrett, 190; DOF Sabah, 1992). While lift net (LN), hook and line (HL), and other miscellaneous gears (OT) are categorized as traditional gears.

Commercial Gears

Under the DOF Malaysia fisheries statistics, trawl net (TN), seine net (SN) and gill net (GN) are categorized as commercial gear. Long line (vertical and bottom) under the hook & line category (traditional gear) is considered a commercial gear.

<u>Trawl Net</u>

Description: A conical bag shaped net with two wings, pulled by one boat for a period of time to catch mainly fish and other aquatic animals that live directly on or near the sea bottom. Trawl net is sub-divided into 3 sub groups: otter board trawl, pair trawl and beam trawl.

Commercial trawling using the otter board trawl net in Sabah began in the early 1960s after experimental fishing using a 90 GRT trawler in the Marudu Bay (SSME-1) in 1958 showed very encouraging results. Fishing operations targeting for shrimps were much confined to inshore waters mainly adjacent to mangroves and estuaries. Most of the fishing fleet consisted of small trawlers (10-25 GRT size) powered by 30-55 HP inboard engines. These trawlers landed only shrimps and some high value fish with more than 90% of the by-catch being discarded at sea.

Shrimp trawling was a lucrative business in the mid 60s with a lot of investment made in this fishing sector. The main shrimp trawling grounds are: Kudat (Marudu Bay), Sandakan (Labuk Bay) in SSME-2, Tawau (Cowie Bay) in SSME-3, and Brunei Bay (non-SSME).

In 1967, the average shrimp CPUE from a fleet of 208 trawlers was estimated around 15 metric tons. Finfish trawling began to develop in the mid 70s when shrimp landings began to dwindle down in the inshore waters. Large trawlers were introduced targeting both shrimp and high value finfish in the deeper waters of the coastal zone. Since the mid 80s, most of the trawler by-catch consisting of trash fish and juveniles of commercial fish formerly discarded at sea are now being landed as feed supply for aquaculture farms (marine cage culture and shrimp farming) and as well as raw materials for fish meal processing plants. Until now, trawlers contribute more than 40% of the total annual fish landings. At present, the trawler fleet consisted of 1,442 trawlers of various sizes (**Table A34**) with fishing operations within the 80-meter depth of the coastal zone. Only a few trawlers are capable of trawling beyond the 80-meter depth because of technology constraints. The sizes of trawl nets used range between 20 to 60-meter head rope length and engine horsepower of vessel between 120 to 600 HP.

Figure 39a. Temporal trends of the shrimp-trawler fishery in Sabah

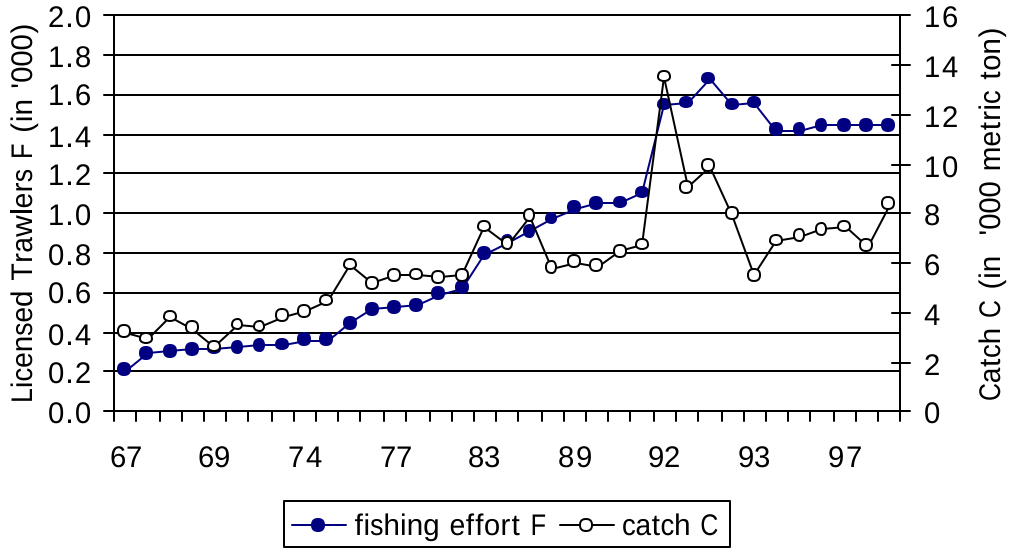


Figure 39b. Temporal trends of CPUE (catch per unit effort) of the shrimp-trawler fishery in Sabah

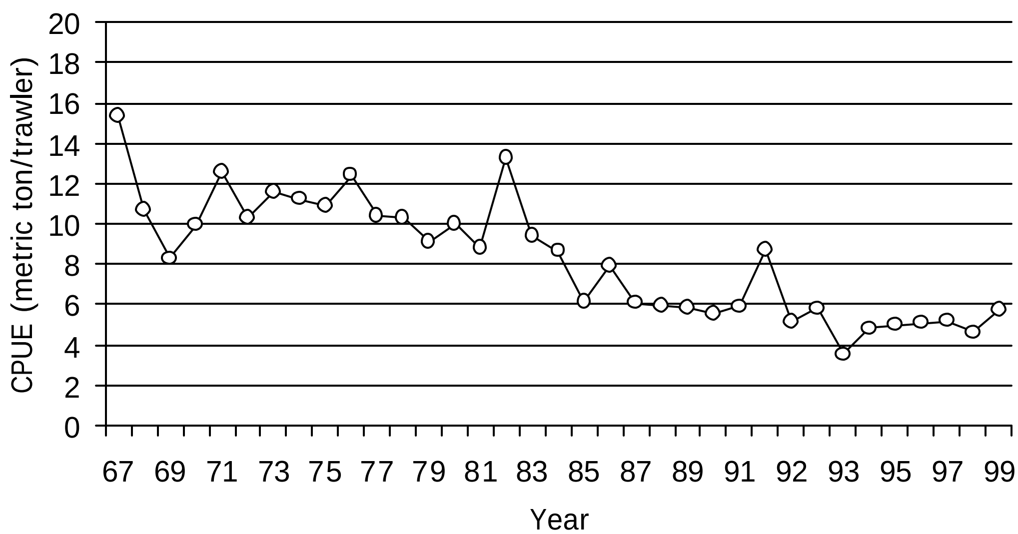


Figure 39c. Assessment of the shrimp-trawler fishery in Sabah
CPUE = 12.8254 - 0.0052 F (r = -0.8695, n = 35)

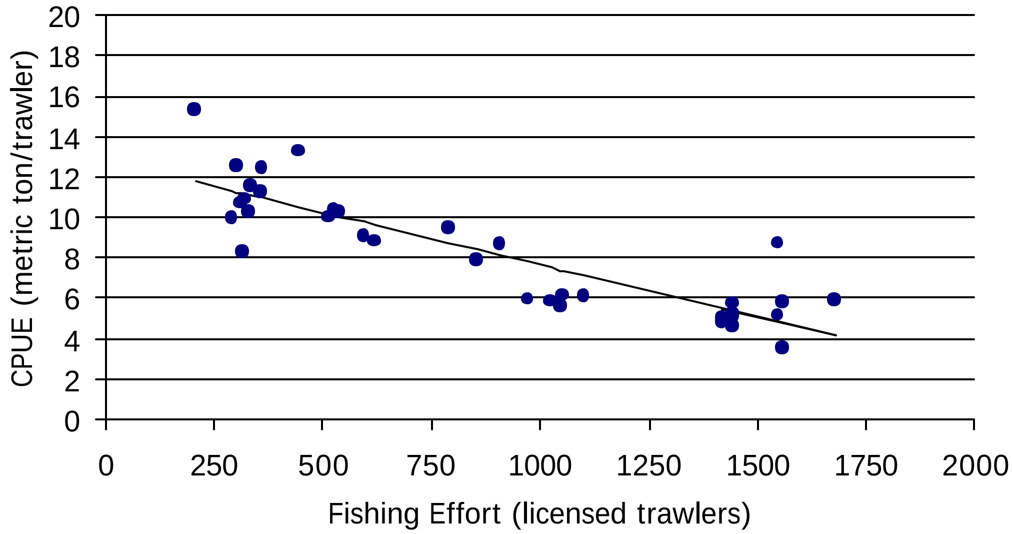
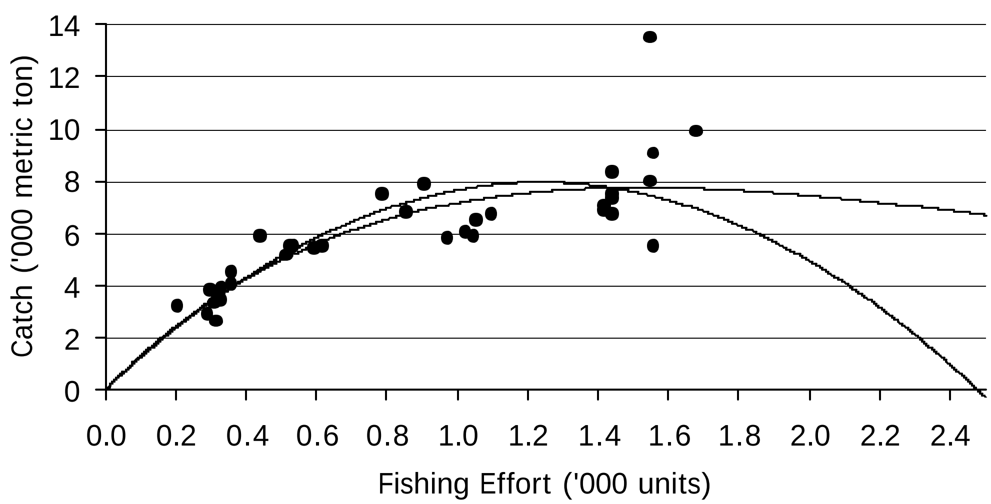


Figure 39d. Stock assessment model of the shrimp-trawler fishery in Sabah (MSY = 7,746-7,942 metric ton; Fopt = 1,239-1,525 units)



To minimize social conflicts between commercial and traditional fishing operations and protect important fish nursery ground in inshore waters, there are regulations that controls trawling in terms of minimum distance of operation from the coast with respect to size. There is also the provision under the Fisheries Act 1985 for the use of a minimum mesh size of 1.5 inches to provide escapement for small or juvenile fish.

Boat Tonnage GRT	<10	10-25	25-40	40-70	>70	>100
Minimum distance	5 fathoms	3 nm	6 nm	12 nm	20 nm	30 nm

Bottom trawling using <10 GRT vessels or small boats powered by outboard engines (baby trawls) is carried out mainly in some estuaries and shallow inshore waters. At present, DOF Sabah is in the process of phasing out all trawlers below 10 GRT size throughout the state. This management measure is made based on three reasons. First, most of encroachment cases into banned trawling zones involved trawlers of this size category. Secondly, this move is made to minimize pressure on fish stocks in inshore waters that had already shown clear signs of overfishing and thirdly to increase opportunities for traditional fishermen operating in inshore waters.

Seine Net

Description: A net roughly rectangular in shape, with or without a bag, which is set vertically in the water so as to surround, from the side and below, a school of fish generally of pelagic nature.

There are two types of seine net fishing in Sabah: the surrounding net without a purse line or beach seine – which are more traditional in nature and operated using much smaller fishing vessels (including outboard engine boats) and commercial type purse seining using larger vessels.

Beach seine and surrounding nets targeting small pelagic fish are operated with or without the aid of boats limited to shallow waters adjacent to the shore. Also included under this gear category is the *anchau bubuk* targeting for seasonal *Acetes* shrimps. This gear is mainly operated along the west coast of Sabah between the *bubuk* fishing months between the months of January to April each year. This shrimp is used for making fermented shrimp paste (*belacan*) a popular traditional dish in Sabah.

The development of commercial purse seining using large vessels began in the mid 80s with fishing technology introduced from Peninsular Malaysia. Purse seines are operated to catch pelagic fish and tuna in the deeper portion of the coastal zone and EEZ waters. On the east coast, purse seines are also used to catch anchovies. The cost of an average 40-50 GRT wooden purse seine boat is in the region of US$100,000. The main purse seining grounds in Sabah are predominantly in the deep waters of the EEZ off the west coast and adjacent to Semporna waters. At present, only a limited number of large purse seine vessels are operating in the waters off Semporna because of unsettled overlapping territorial claims with Indonesia.

In principal, fish schools are caught by physical entrapment – i.e. fish schools are first detected, surrounded and then the bottom net is closed by the use of a purse line to prevent escape. In Sabah, purse seining seldom employ the “search and surround mode-of operation” preferring instead to operate at night using FADs (known as "*tui*" made up of coconut leaves) and artificial lights as auxiliary aids. Fish are first aggregated using FADs and when there are sufficient fish, powerful artificial lights are used to lure them from the *tui*. As the fish aggregate around the light source, the lights are put out progressively causing the fish to come closer to the surface, which are then surrounded and pursed.

To minimize social conflicts between commercial and traditional fishing operations, there are regulations that controls purse seining in terms of minimum distance of operation from the coast with respect to size:

West Coast

Boat Tonnage GRT	<10	10-25	25-40	40-70	>70	>100
Minimum distance	1 nm	3 nm	10 nm	12 nm	20 nm	30 nm

East Coast

Boat Tonnage GRT	<10	10-25	25-40	40-70	>70	>100
Minimum distance	1 nm	3 nm	6 nm	10 nm	12 nm	20 nm

Purse seining using lights is restricted to a minimum distance of 30 nautical miles on the west coast. On the other hand, the minimum distance on the east coast is restricted to only 12 miles with consideration that the fishing grounds are limited. The existing boundary line between the Philippines and Malaysia is only 12 to 30 nautical miles off the east coast of Sabah.

Gill Net

Description: A net wall whose lower end is weighted by sinkers and whose upper ends is raised up by floats and which is set transversely to migrating fish, so that the fish trying to make their way through the net wall are entangled in the meshes.

Gill nets used in Sabah can be categorized into four types:

- Floating gill net (*pukat atas*): operated at the sea surface targeting for schooling fish.
- Bottom gill net (*pukat tenggelam*): operated at the sea bottom of deep and shallow waters targeting for demersal fish.
- Drift gill net (*pukat hanyut*): operated in the open sea targeting for schooling fish.
- Surrounding gill net (*pukat ringi*): operated in shallow coastal waters targeting for demersal and pelagic fish.
- Trammel net (*pukat tiga lapis*): operated in shallow waters including estuaries targeting for shrimps, crabs and miscellaneous fish.

Traditional Gears

Under the DOF Malaysia fisheries statistics, lift net (LN), hook & line (HL: except for long line) and miscellaneous gears are categorized as traditional gears.

Lift Net

Description: A sheet of netting usually square and sometimes conical in shape, stretched by either several rods or ropes or a frame, and set either on the bottom or in mid water for some time and lifted to take fish above it. In Sabah, there is two types of lift nets used: the active *selambau* and the stationary *bagang*.

The *selambau* gear is operated during the daytime using fish aggregating devices or FAD (known locally as "*lawa lawa*" made of coconut leaves). The target species are mainly schooling species including round scad, mackerel, sardine, scad and neritic tuna. Fish schools are aggregated with these FADs, and when it is observed that there are sufficient quantities of fish they are lured away by setting down a string of fronds (coconut fronds). The fish are then led slowly to the preset net, which is then lifted to entrap the fish. This gear is mainly operated in the inshore waters along the west coast.

The *bagang* gear is a traditional fishing gear targeting anchovies (ikan bilis) brought in by Indonesian immigrants to the east coast of Sabah about 20 years ago. In its' original form, the *bagang tetap* consist of a platform built from *nibong* or bamboo posts staked into the seabed. Under the platform the net is set and can be manually lifted or lowered by a worker. Unlike the *selambau* gear, fishing operations are carried out at night using artificial lights sourced from 6-8 kerosene pressure lamps to attract and aggregate fish on top of the set net. When sufficient fish are observed the lights are then progressively dimmed causing the fish to come to the surface and the net is then lifted entrapping the fish. This fishing method had been modified throughout the years by substituting the fixed platform with a floating and movable type (*bagang bergerak*) using tree logs (*bagang batang*) or lashing two boats together (*bagang perahu*). This gives it mobility and the ability to operate in much deeper waters. The *bagang* gear is the principal lift net gear operated on the east coast (Sandakan, Tawau, Lahad Datu and Kunak) and Pitas. The operation of the *bagang bergerak* is limited to Kunak and Lahad waters, while the *bagang tetap* is operated in Sandakan, Tawau, Pitas and until recently in the Kimanis Bay (west coast).

<u>Hook and Line</u>

Description: In general, this gear consists of line(s) and hook(s), to which edible or artificial bait is attached to attract fish or other aquatic animals. In Sabah, commonly used hook and line gears are squid jigger, bottom hand line, bottom long line and tuna long line. Tuna long line, which is considered a commercial gear, is mainly operated in Semporna targeting for oceanic tuna, billfish and shark. The use of hook and line is the best known of all forms of fish catching practices in Sabah. Within this gear group, there are three distinct forms:

- *Jaul* and *Hambur* type
- Trolling gear
- Long line gear

The *jaul* and *hambur* group of handline gears is the most popular artisanal fishing gear. The *haul* gear is a hand rigging gear targeting both fish and squids. Usually cast into a conical shape from lead it has a hollow where mince fish are stuffed and released to lure fish to the baited hook or hooks attached to one end of it via a leader. On the other hand, the *hambur* gear consist of a main line rigged with a solid sinker and hook or hooks attached to the sinker via a leader. Both gears are also operated using other auxiliary aids such as FADs (*lawa-lawa* made of floating coconut fronds for pelagic fish or *rangas* made of tree branches set at the sea bottom for demersal fish) or artificial lights using kerosene pressure lamps.

Trolling (or *lundai*) is a hand line gear operated by trolling in deeper open waters using either bait (live and fresh) or artificial lures targeting for large predatory fishes such as neritic tuna (*bakulan* or *ikan kayu*), billfishes or Spanish mackerels (*ikan tenggiri*).

Bottom and vertical long lines that are operated in deeper waters targeting oceanic tuna, sharks and highly value bottom fish are are considered as commercial gears. Yellowfin and bigeye tunas for the *sashimi* market are normally caught using these gears.

Other Traditional Gears

Description: This category consisted of various miscellaneous traditional gears including push nets (*sadak*), shellfish collectors, crab traps (*bintur*), tidal traps, cast nets, drive-in-nets, portable scoop nets, hand hooks, harpoons, fish spears and other gears not listed under other gear categories. Collectors used by the jellyfish fishery in the Marudu Bay are also included under this category. Among the popular static gears operated by traditional fishermen in estuarine areas and near river mouths are:

- Arrow-head fence traps (*kelong*): A semi-permanent tidal trap consisting of wing fences made up of mangrove poles and galvanized wire netting or synthetic netting materials, 2-3 trap bowls.

- Tidal fence trap (*ampas-ampas*): A V-shaped tidal fence trap permanently set across small bays or estuaries.

- Common fence trap (*belat*): A removable fence trap operating on the same fishing principles of *ampas-ampas* gear

- Tidal shrimp trap (*tugoh*): A permanent tidal trap operated in estuarine areas targeting shrimps and other fish.

Fishermen

There are 20,845 full-time fishermen[118] in Sabah in 2000, which represents 26% of the total fishermen population in the country (81,547) (**Table A30**). There are 15,120 fishermen in the SSME area, which represent 19% respectively of the country total. About 9,833 fishermen or 65% of the SSME total are based in the Sulu Sea and 5,287 (35%) in the Sulawesi Sea. The 5,725 fishermen in the non-SSME area are based in the South China Sea, which represents 27.5% and 19% of the state and country total.

Fishermen in the SSME area represents 72.5% of the state fishermen total, with 5,555in SSME-2 – 38% SSME or 26.6% state total, followed by 5,287 in SSME-3 – 35% SSME or 25.4% state and 4,287 in SSME-1 – 28% SSME or 20.5% state. Districts with high fishermen population are found in the SSME area. Sandakan has the highest number of fishermen (3,987) - 26% of SSME total, followed by Kudat (2,915), Tawau (2,036), Semporna (1,781) and Beluran (1,568) (**Figure 40**). In the SSME area, Kinabatangan has no coastal fishermen – where villagers living along along the Kinabatangan River and its tributaries only practiced subsistence riverine-based fishing activities.

Fishermen in the non-SSME area represents 27.5% of the state fishermen total, with most of them based in Kota Kinabalu (1,719), Kota Belud (1,203), Kuala Penyu (851) and Beaufort (718). Fishermen in these districts totaled 4,491 or 78% of the non-SSME total. Other districts have less than 500 fishermen, with Papar (356), Sipitang (388) and Tuaran (490) having the lowest population. Penampang has no full-time coastal fshermen – where fishing activities carried out along the 12 km coastline in the sub district of Putatan are much confined to recreational or part time fishing.

[118] This figure is probably an underestimation; the number of illegal immigrants involved in fishing including destructive fishing practices has not been ascertained and could be in thousands. The number of illegal immigrants employed as crewmembers onboard licensed fishing vessels alone has been estimated to be around 6,000 or 28% of the total number of fishermen in the state. Some remote fishing villages in SSME-1 (Pitas) have not been covered in the DOF Sabah annual fisheries statistics.

There are 590-odd fishing villages scattered along the coast of Sabah (**Table A31** & **Figure 41**). In the SSME area, there are 389 fishing villages (66% state total), with 360 or 67% of the SSME total confined in four districts: Beluran, Semporna, Kudat and Lahad Datu. In the non-SSME area, there are 201 fishing villages (34% state total), with 147 or 73% non-SSME total confined in four districts: Beaufort, Papar, Kota Kinabalu and Kuala Penyu. The fishing villages in Sabah has an average of 39 fishermen per village, with high densities noted for Sandakan (133), Kota Belud (86), Tawau (57), Kota Kinabalu (49), Pitas (46) and Kudat (45) (**Figure 42**). In general, fishing villages in the SSME area (38.9) has 36% more fishermen than the non-SSME area (28.5), with SSME-2 having 50.0, followed by SSME-1 (41.5) and SSME-3 (30.2).

Out of the 20,845 fishermen in Sabah, 29.4% are involved in gill netting, followed by trawling (24.6%), hook & line fishing (23.1%), seine netting (7.2%), lift netting (6.7%) and 9.1% in other miscellaneous traditional gears (**Figures 43-44** & **Tables A32-A33**). The breakdown of these fishermen by fishing zones and gear involvement (traditional and commercial) are summarized in *Tables 67-70*. The breakdown of fishermen involvement by fishing gear and fishing districts are summarized respectively in *Tables 71-74* for SSME-1, *Tables 75-78* for SSME-2, *Tables 79-82* for SSME-3 and Tabl*es 83-86* for the non-SSME area.

In the SSME area (**Figure 45**), about 75% of the fishermen are involved in trawling (27.5%), gill netting (27.0%) and hook & line fishing (22.7%), followed by seine netting (7.5%), lift netting (6.4%) and other miscellaneous traditional gears (8.9%) (**Figure 46**). In SSME-1, about 75% of the fishermen are involved in gill netting (38%) and hook & line fishing (36%) (**Figures 47-51**). On the other hand, about 76% of the fishermen in the SSME-2 are involved in trawling (49%) and gill netting (28%) (**Figures 52-55**). The high involvement of fishermen in trawling is due to SSME-2 being having the largest trawling fleet in the state. Fishermen in the SSME-3 area are more diverse in fishing gear involvement – with 24% of them engaged in hook & line fishing, followed by gill netting (18%), lift netting (17%), trawling (16%), seine netting (16%) and other miscellaneous traditional gears (8%) (**Figures 56-61**). The highly diverse aquatic habitats distributed in both coastal (Cowie Bay and Darvel Bay) and offshore waters contribute to a wide spectrum and abundance of fisheries resources including shrimps, bottom fish, small pelagics, oceanic tunas and various species of highly value invertebrates that offer opportunities for exploitation using different types of fishing gears.

On the other hand, more than 60% of the fishermen in the non-SSME area are involved in gill netting (35.7%) and hook & line fishing (23.9%), followed by trawling (16.9%), lift netting (7.5%), seine netting (6.4%) and 9.5% involvement in other miscellaneous traditional gears (**Figures 62-63**). In the West Coast – North, 30% of the fishermen are involved in hook & line fishing, followed by gill netting (24%), trawling (20%) and lift netting (11%) (**Figure 64**). On the other hand, gill net fishermen make up 58% of the fishermen population in West Coast – South, with the rest engaged in hook & line fishing (12%), trawling (11%), seine netting (7%) and 10% in other miscellaneous traditional gears (**Figure 65**).

Figure 40. Spatial distribution of fishermen in Sabah, 2000

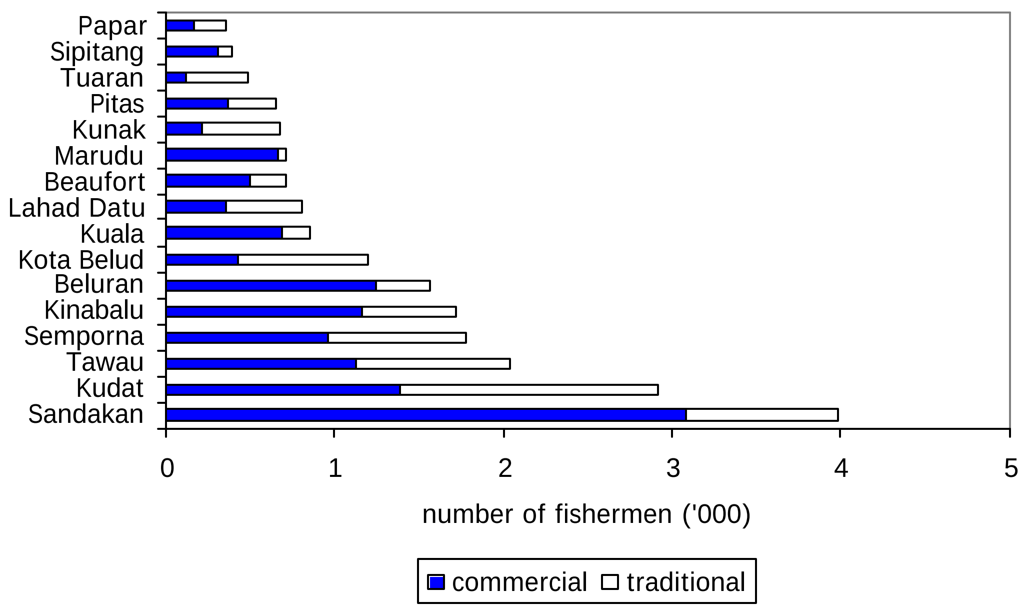


Figure 41. Spatial distribution of fishing villages in Sabah, 2000

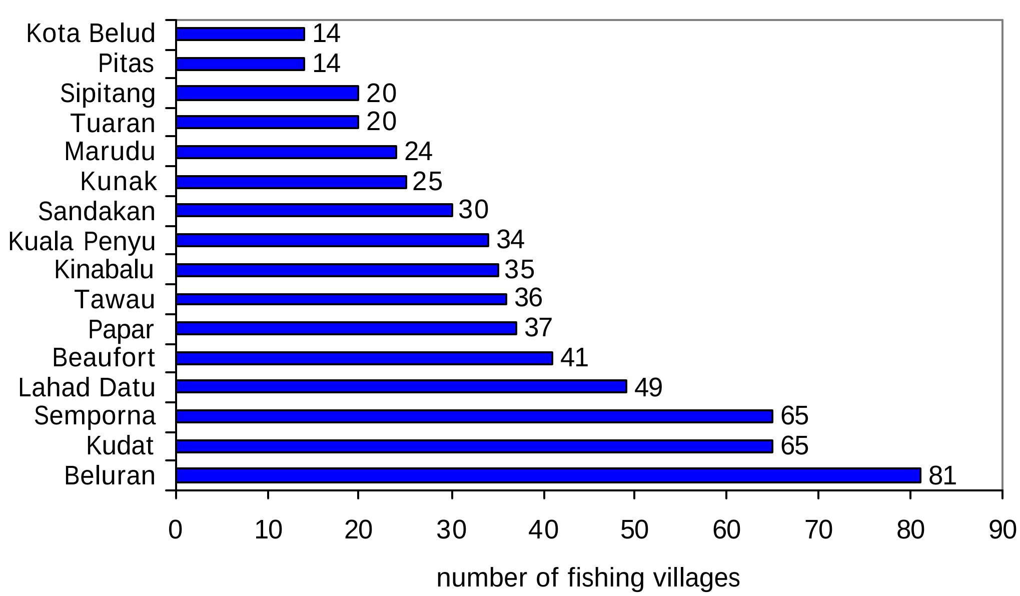


Figure 42. Spatial distribution of fishing village size in Sabah, 1998

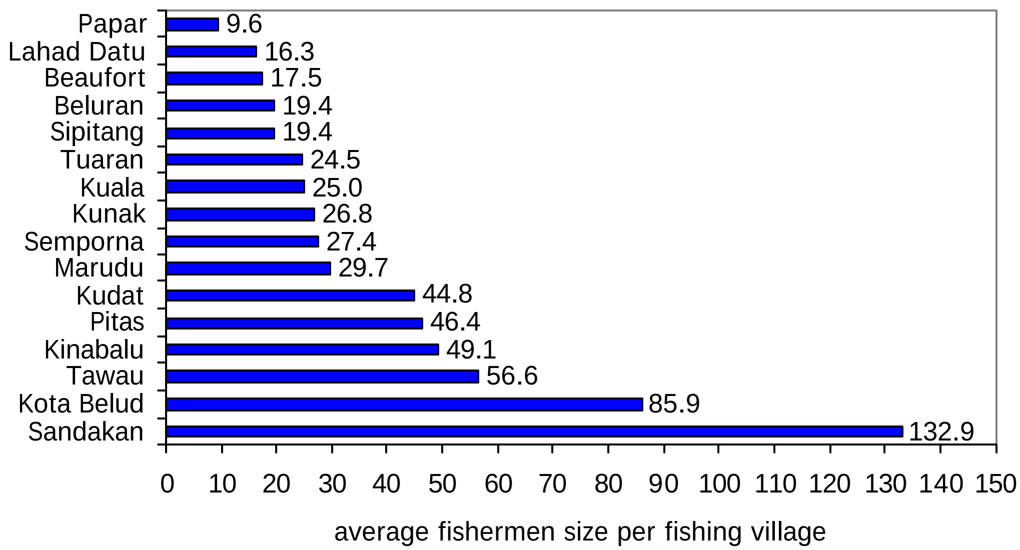


Figure 43. Breakdown of fishermen by fishing region, Sabah 2000

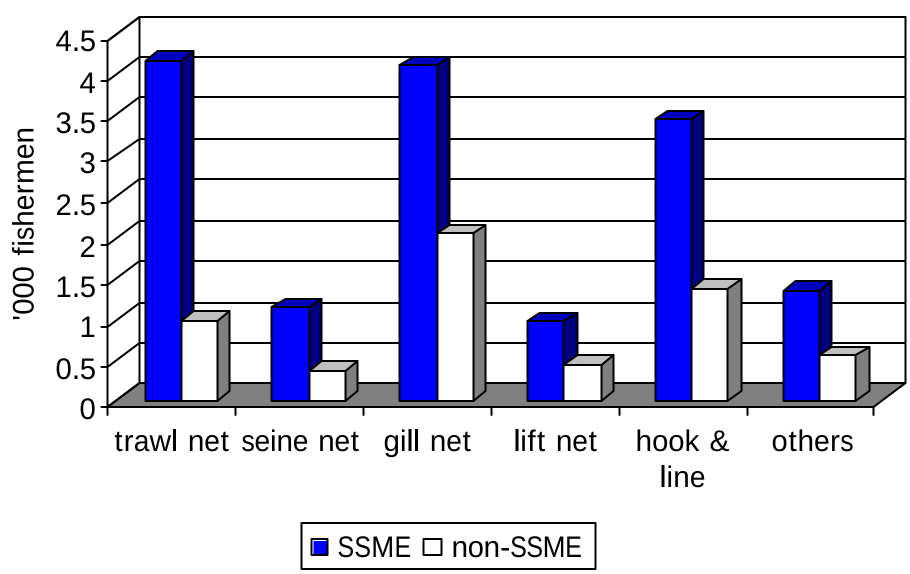


Table 67: *Breakdown of traditional gear fishermen by fishing zone, Sabah 2000*

Gear Type	% fishermen in SSME area SSME-1	SSME-2	SSME-3	SSME TOTAL	% Total fishermen SSME	Non-SSME	TOTAL
LN1	0.0	0.0	100.0	23	5.1	94.9	453
LN2	4.9	0.0	95.1	941	100.0	0.0	941
HL1	51.2	13.4	35.4	2,998	69.2	30.8	4,331
HL2	1.6	46.3	52.1	438	92.2	7.8	475
OT1	3.7	55.2	41.1	594	97.2	2.8	611
OT2	19.4	58.1	22.5	351	59.6	40.4	589
OT3	37.4	62.6	0.0	139	63.5	36.5	219
OT4	52.5	2.7	44.9	263	55.7	44.3	472
TOTAL	32.5	21.4	46.1	5,747	71.0	29.0	8,091

** refer to **Table A32** on gear type

Table 68: *Breakdown of fishing zone by traditional gear fishermen, Sabah 2000*

FISHING ZONE	% Fishing Zone Share LN1	LN2	HL1	HL2	OT1	OT2	OT3	OT4	TOTAL
SSME-1	0.0	2.5	82.2	0.4	1.2	3.6	2.8	7.4	1,869
SSME-2	0.0	0.0	32.6	16.5	26.7	16.6	7.1	0.6	1,230
SSME-3	0.9	33.8	40.1	8.6	9.2	3.0	0.0	4.5	2,648
SSME	0.4	16.4	52.2	7.6	10.3	6.1	2.4	4.6	5,747
Non-SSME	18.3	0.0	56.9	1.6	0.7	10.2	3.4	8.9	2,344
TOTAL	5.6	11.6	53.5	5.9	7.6	7.3	2.7	5.8	8,091

Table 69: *Breakdown of commercial gear fishermen by fishing zone, Sabah 2000*

FISHING ZONE	% Fishing Zone Share TN	SN1	SN2	SN3	GN1	GN2	GN3	TOTAL
SSME-1	25.1	4.7	0.0	2.9	45.7	21.5	0.0	2,409
SSME-2	62.2	2.5	0.0	0.0	32.1	3.2	0.0	4,325
SSME-3	32.4	20.0	10.8	1.1	24.7	10.6	0.3	2,639
SSME	44.3	8.0	3.0	1.1	33.5	10.0	0.1	9,373
Non-SSME	28.7	7.8	0.0	3.0	31.8	28.7	0.0	3,381
TOTAL	40.2	7.9	2.2	1.6	33.1	15.0	0.1	12,754

Table 70: *Breakdown of fishing zone by commercial gear fishermen, Sabah 2000*

Gear Type	% fishermen in SSME area SSME-1	SSME-2	SSME-3	SSME TOTAL	% Total fishermen SSME	Non-SSME	TOTAL
TN	14.6	64.8	20.6	4,153	81.1	18.9	5,123
SN1	15.1	14.2	70.6	746	73.8	26.2	1,011
SN2	0.0	0.0	100.0	285	100.0	0.0	285
SN3	71.0	0.0	29.0	100	49.8	50.2	201
GN1	35.1	44.2	20.7	3,143	74.5	25.5	4,217
GN2	55.3	14.7	30.0	937	49.1	50.9	1,908
GN3	0.0	0.0	100.0	9	100.0	0.0	9
TOTAL	25.7	46.1	28.2	9,373	73.5	26.5	12,754

Table 71: *Breakdown of fishermen by traditional gear type, SSME-1 2000*

FISHING DISTRICT	% DISTRICT SHARE LN1	LN2	HL1	HL2	OT1	OT2	OT3	OT4	SSME-1 TOTAL
Kudat	0.0	0.0	89.0	0.3	0.9	1.0	1.6	7.3	1,531
Kota Marudu	0.0	0.0	18.5	0.0	0.0	29.6	51.9	0.0	54
Pitas	0.0	16.2	57.7	1.1	2.8	13.0	0.0	9.2	284
TOTAL	0.0	2.5	82.2	0.4	1.2	3.6	2.8	7.4	1,869

Table 72: *Breakdown of fishermen by commercial gear type, SSME-1 2000*

FISHING DISTRICT	% DISTRICT SHARE TN	SN1	SN2	SN3	GN1	GN2	GN3	SSME-1 TOTAL
Kudat	40.7	8.2	0.0	5.1	40.2	5.9	0.0	1,384
Kota Marudu	2.7	0.0	0.0	0.0	45.1	52.2	0.0	659
Pitas	6.6	0.0	0.0	0.0	68.0	25.4	0.0	366
TOTAL	25.1	4.7	0.0	2.9	45.7	21.5	0.0	2,409

Table 73: *Breakdown of traditional gear fishermen by district, SSME-1 2000*

GEAR TYPE	% GEAR SHARE Kudat	Kota Marudu	Pitas	SSME-1 TOTAL
LN1	0.00	0.0	0.00	0
LN2	0.00	0.0	100.0	46
HL1	88.7	0.7	10.7	1,536
HL2	57.1	0.0	42.9	7
OT1	63.6	0.0	36.4	22
OT2	22.1	23.5	54.4	68
OT3	46.2	53.9	0.0	52
OT4	81.2	0.0	18.8	138
TOTAL	81.9	2.9	15.2	1,869

Table 74: *Breakdown of commercial gear fishermen by district, SSME-1 2000*

GEAR TYPE	% GEAR SHARE Kudat	Kota Marudu	Pitas	SSME-1 TOTAL
TN	93.1	3.0	4.0	605
SN1	100.0	0.0	0.0	113
SN2	0.0	0.0	0.0	0
SN3	100.0	0.0	0.0	71
GN1	50.5	27.0	22.6	1,102
GN2	15.6	66.4	18.0	518
GN3	0.0	0.0	0.0	0
TOTAL	57.5	27.4	15.2	2,409

Table 75: *Breakdown of fishermen by traditional gear type, SSME-2 2000*

FISHING DISTRICT	% DISTRICT SHARE LN1	LN2	HL1	HL2	OT1	OT2	OT3	OT4	SSME-1 TOTAL
Sandakan	0.0	0.0	44.4	16.8	23.4	15.4	0.0	0.0	903
Beluran	0.0	0.0	0.0	15.6	35.8	19.9	26.6	2.1	327
TOTAL	0.0	0.0	32.6	16.5	26.7	16.6	7.1	0.6	1,230

Table 76: *Breakdown of fishermen by commercial gear type, SSME-2 2000*

FISHING DISTRICT	% DISTRICT SHARE TN	SN1	SN2	SN3	GN1	GN2	GN3	SSME-1 TOTAL
Sandakan	68.5	3.4	0.0	0.0	28.1	0.0	0.0	3,084
Beluran	46.8	0.0	0.0	0.0	42.1	11.1	0.0	1,241
TOTAL	62.2	2.5	0.0	0.0	32.1	3.2	0.0	4,325

Table 77: *Breakdown of traditional gear fishermen by district, SSME-2 2000*

GEAR TYPE	% GEAR SHARE		SSME-2 TOTAL
	Sandakan	Beluran	
LN1	0.00	0.00	0
LN2	0.00	0.00	0
HL1	100.00	0.00	401
HL2	74.88	25.12	203
OT1	64.33	35.67	328
OT2	68.14	31.86	204
OT3	0.00	100.00	87
OT4	0.00	100.00	7
TOTAL	73.41	26.59	1,230

Table 78: *Breakdown of commercial gear fishermen by district, SSME-2 2000*

GEAR TYPE	% GEAR SHARE		SSME-2 TOTAL
	Sandakan	Beluran	
TN	78.4	21.6	2,692
SN1	100.0	0.0	106
SN2	0.0	0.0	0
SN3	0.0	0.0	0
GN1	62.4	37.6	1,389
GN2	0.0	100.0	138
GN3	0.0	0.0	0
TOTAL	71.3	28.7	4,325

Table 79: *Breakdown of fishermen by traditional gear type, SSME-3 2000*

FISHING DISTRICT	% DISTRICT SHARE								SSME-1 TOTAL
	LN1	LN2	HL1	HL2	OT1	OT2	OT3	OT4	
Tawau	1.7	52.9	17.1	7.1	16.1	3.0	0.0	3.3	913
Semporna	0.0	0.0	149.5	50.2	13.8	14.4	0.0	24.8	826
Kunak	0.0	78.6	19.2	0.0	2.2	0.0	0.0	0.0	458
Lahad Datu	1.8	12.6	73.2	0.0	9.8	1.1	0.0	1.6	451
TOTAL	0.9	33.8	40.1	8.6	9.2	3.0	0.0	4.5	2,648

Table 80: *Breakdown of fishermen by commercial gear type, SSME-3 2000*

FISHING DISTRICT	% DISTRICT SHARE							SSME-1 TOTAL
	TN	SN1	SN2	SN3	GN1	GN2	GN3	
Tawau	54.1	0.0	0.0	0.0	21.6	24.2	0.0	1,123
Semporna	13.4	32.1	26.7	2.4	23.7	0.9	0.7	955
Kunak	0.0	73.0	14.2	0.0	12.8	0.0	0.0	211
Lahad Datu	34.3	18.9	0.0	1.7	44.6	0.0	0.6	350
TOTAL	32.4	20.0	10.8	1.1	24.7	10.6	0.3	2,639

Table 81: *Breakdown of traditional gear fishermen by district, SSME-3 2000*

GEAR TYPE	% GEAR SHARE				SSME-3 TOTAL
	Tawau	Semporna	Kunak	Lahad Datu	
LN1	65.2	0.0	0.0	34.8	23
LN2	53.4	0.0	40.2	6.4	895
HL1	14.5	46.1	8.3	31.1	1,061
HL2	28.1	71.9	0.0	0.0	228
OT1	59.4	18.4	4.1	18.0	244
OT2	34.2	59.5	0.0	6.3	79
OT3	0.0	0.0	0.0	0.0	0
OT4	25.4	68.6	0.0	5.9	118
TOTAL	34.5	31.2	17.3	17.0	2,648

Table 82: *Breakdown of commercial gear fishermen by district, SSME-3 2000*

GEAR	% GEAR SHARE				SSME-3
TYPE	Tawau	Semporna	Kunak	Lahad Datu	TOTAL
TN	71.0	15.0	0.0	14.0	856
SN1	0.0	58.3	29.2	12.5	527
SN2	0.0	89.5	10.5	0.0	285
SN3	0.0	79.3	0.0	20.7	29
GN1	37.3	34.7	4.1	23.9	652
GN2	96.8	3.2	0.0	0.0	281
GN3	0.0	77.8	0.0	22.2	9
TOTAL	42.6	36.2	8.0	13.3	2,639

Table 83: *Breakdown of fishermen by traditional gear type, non-SSME area 2000*

FISHING	% DISTRICT SHARE								SSME-1
DISTRICT	LN1	LN2	HL1	HL2	OT1	OT2	OT3	OT4	TOTAL
Kota Belud	4.7	0.0	57.8	0.8	0.0	4.4	8.9	8.9	771
Tuaran	74.0	0.0	22.3	0.0	0.0	17.7	0.0	0.0	373
Kota Kinabalu	15.2	0.0	76.2	0.0	3.1	0.4	0.0	5.1	551
Papar	33.9	0.0	62.3	0.0	0.0	3.8	0.0	0.0	183
Beaufort	0.0	0.0	16.6	0.0	0.0	36.9	0.0	46.5	217
Kuala Penyu	0.0	0.0	52.9	17.6	0.0	29.4	0.0	0.0	170
Sipitang	0.0	0.0	98.7	0.0	0.0	1.3	0.0	0.0	79
TOTAL	18.3	0.0	56.9	1.6	0.7	10.2	3.4	8.9	2,344

Table 84: *Breakdown of fishermen by commercial gear type, non-SSME area 2000*

FISHING	% DISTRICT SHARE							SSME-1
DISTRICT	TN	SN1	SN2	SN3	GN1	GN2	GN3	TOTAL
Kota Belud	0.9	0.0	0.0	0.0	73.8	25.2	0.0	432
Tuaran	0.0	0.0	0.0	0.0	76.9	23.1	0.0	117
Kota Kinabalu	63.4	10.4	0.0	8.6	10.8	6.8	0.0	1,168
Papar	2.9	3.5	0.0	0.0	82.1	11.6	0.0	173
Beaufort	9.6	11.8	0.0	0.0	17.2	61.5	0.0	501
Kuala Penyu	1.8	5.1	0.0	0.0	44.3	48.8	0.0	681
Sipitang	52.1	14.2	0.0	0.0	2.9	30.7	0.0	309
TOTAL	28.7	7.8	0.0	3.0	31.8	28.7	0.0	3,381

Table 85: *Breakdown of traditional gear fishermen by district, non-SSME 2000*

GEAR	% GEAR SHARE							Non-
TYPE	Kota Belud	Tuaran	Kota Kinabalu	Papar	Beaufort	Kuala Penyu	Sipitang	SSME TOTAL
LN1	9.8	56.3	19.5	14.4	0.0	0.0	0.0	430
LN2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
HL1	39.2	5.5	31.1	8.6	2.7	6.8	5.9	1,333
HL2	18.9	0.0	0.0	0.0	0.0	81.1	0.0	37
OT1	0.0	0.0	100.0	0.0	0.0	0.0	0.0	17
OT2	16.8	24.4	0.8	2.9	33.6	21.1	0.4	238
OT3	100.0	0.0	0.0	0.0	0.0	0.0	0.0	80
OT4	38.3	0.0	13.4	0.0	48.3	0.0	0.0	209
TOTAL	32.9	15.9	23.5	7.8	9.3	7.3	3.4	2,344

Table 86: *Breakdown of commercial gear fishermen by district, non-SSME 2000*

GEAR TYPE	% GEAR SHARE							Non-SSME TOTAL
	Kota Belud	Tuaran	Kota Kinabalu	Papar	Beaufort	Kuala Penyu	Sipitang	
TN	0.4	0.0	76.3	0.5	4.9	1.2	16.6	970
SN1	0.0	0.0	45.7	2.3	22.3	13.2	16.6	265
SN2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
SN3	0.0	0.0	100.0	0.0	0.0	0.0	0.0	101
GN1	29.7	8.4	11.7	13.2	8.0	28.1	0.8	1,074
GN2	11.2	2.8	8.2	2.1	31.7	34.2	9.8	971
GN3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
TOTAL	12.8	3.5	34.5	5.1	14.8	20.1	9.1	3,381

The ethnic composition of fishing communities is strongly influenced by human settlements along the coastline. In the SSME area, a large portion of the fishing community comprised of transient fishermen including illegal immigrants from Indonesia and the Philippines. In 2000, transient fishermen makes up at least 28% or (5,767) of the total fishermen population (**Tables A32-A33** & **Figures 66-67**). Local fishermen make up 72% of the state fishermen population, comprising of 98% (14,835) of bumiputeras from various dominant ethnic groups of coastal communities and 2% Chinese (243) (*Table 75*). Chinese fishermen – mainly recruited from Peninsular Malaysia are employed either as skippers or master fishermen onboard large commercial fishing vessels owned by big fishing companies, with 81% of them involved in trawling (143) and purse seining (53%) (**Figure 68**). Bumiputera fishermen are mainly involved in traditional fishing on their own or employed as crewmembers of commercial fishing vessels. About 78.5% (6,051) of them are in traditional fishing and 21.5% as crewmembers of trawlers (2,348) and purse seiners (656) (**Figure 69**). Most of the transient fishermen are involved in commercial fishing, with 65% of them employed as crewmembers, master fishermen or skippers of smaller commercial fishing vessels – trawlers (2,632), purse seiners (788) and gill netters (335) and about 35% in traditional fishing – hook & line fishing (1,168), *bagang* fishing (476) and other miscellaneous fishing gears (368) (**Figure 70**).

Figure 44. Breakdown of fishermen involvement by gear type, Sabah 2000 (20,845 fishermen)

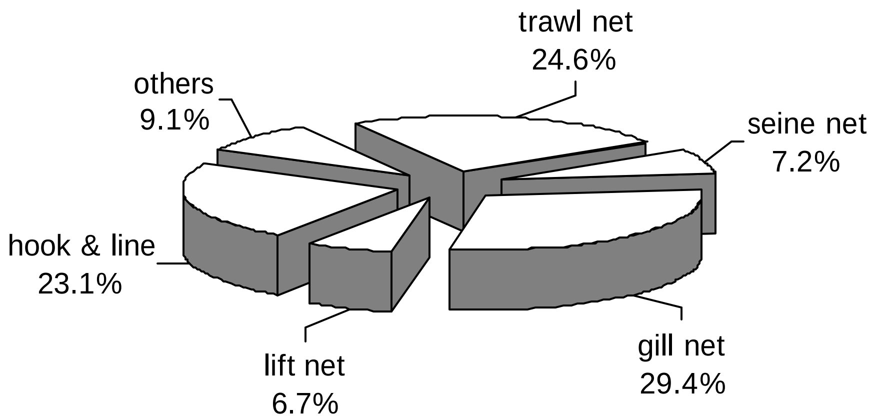


Figure 45. Breakdown of fishermen by district in the SSME area, Sabah 2000 (15,120 fishermen)

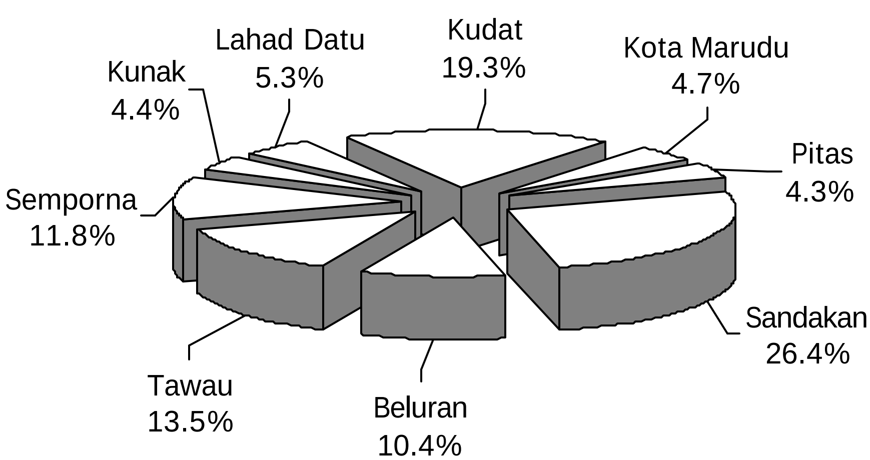


Figure 46. Breakdown of fishermen involvement by gear type in the SSME area, Sabah 2000 (15,120 fishermen)

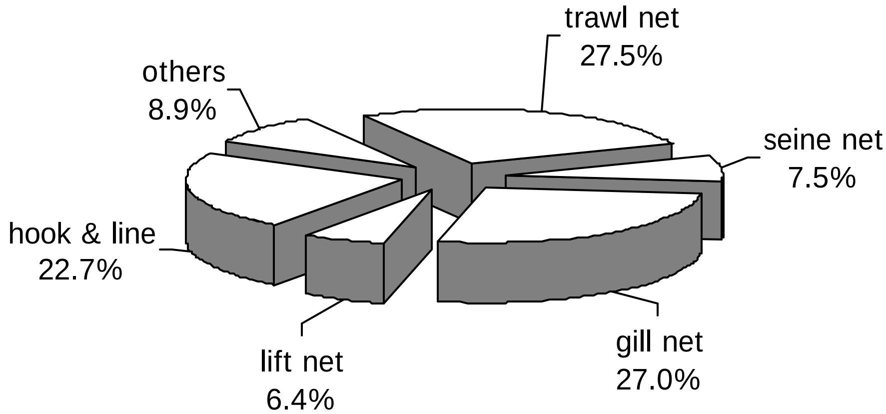


Figure 47. Breakdown of fishermen involvement by gear type in the SSME-1 area, Sabah 2000 (4,278 fishermen)

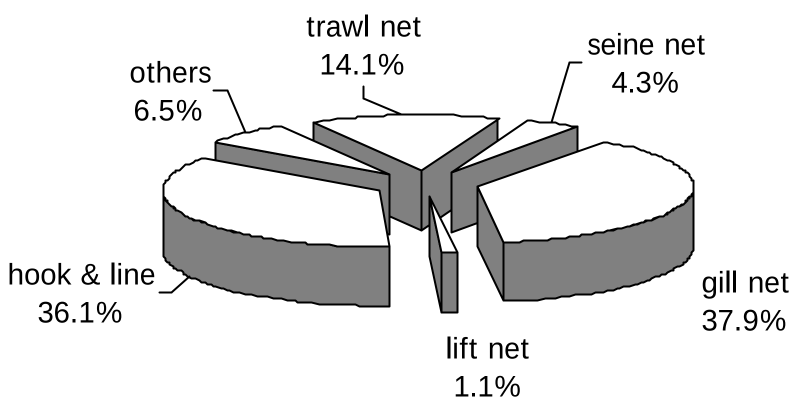


Figure 48. Breakdown of fishermen by district in the SSME-1 area, Sabah 2000 (4,278 fishermen)

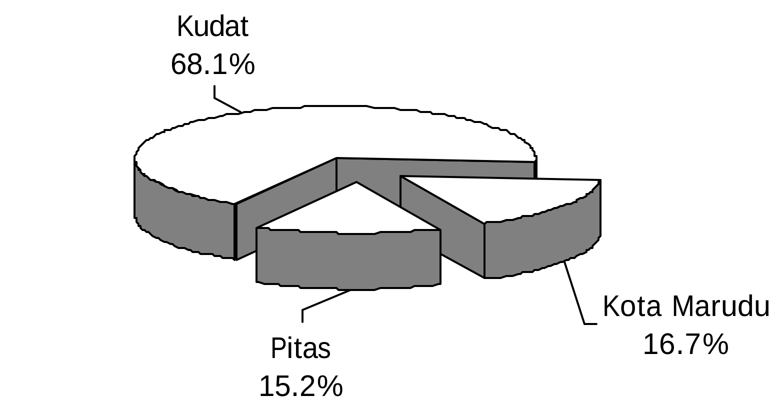


Figure 49. Breakdown of fishermen involvement by gear type in Kudat (SSME-1), Sabah 2000 (2,915 fishermen)

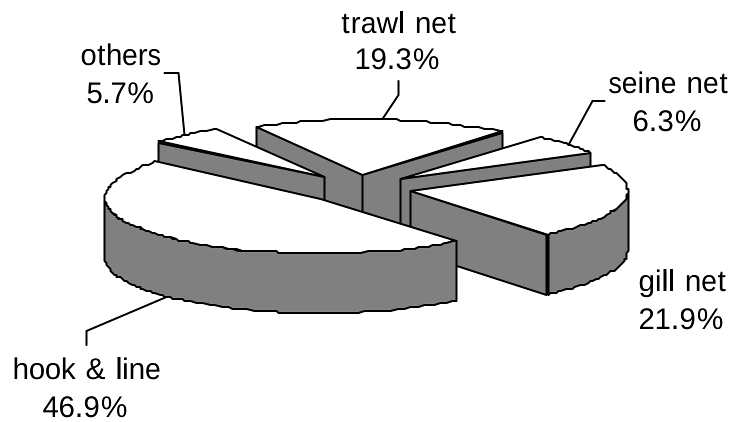


Figure 50. Breakdown of fishermen involvement by gear type in Kota Marudu (SSME-1), Sabah 2000 (713 fishermen)

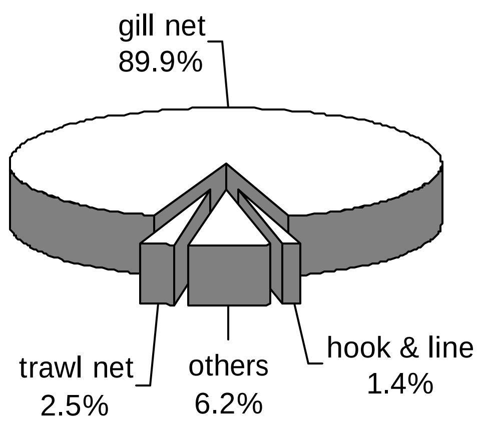


Figure 51. Breakdown of fishermen involvement by gear type in Pitas (SSME-1), Sabah 2000 (650 fishermen)

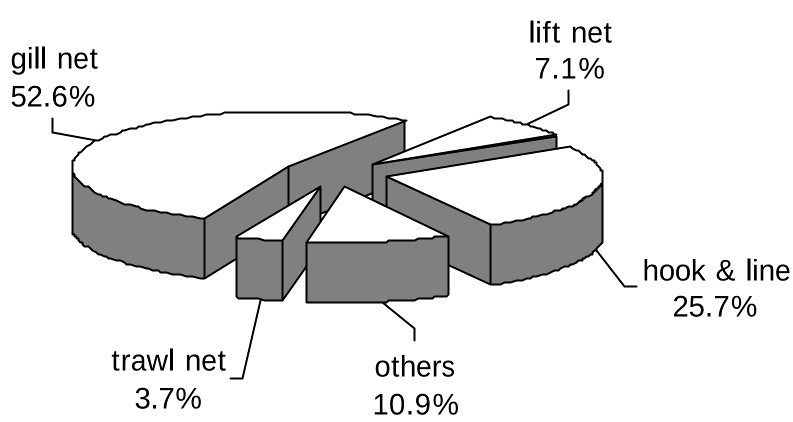


Figure 52. Breakdown of fishermen involvement by gear type in the SSME-2 area, Sabah 2000 (5,555 fishermen)

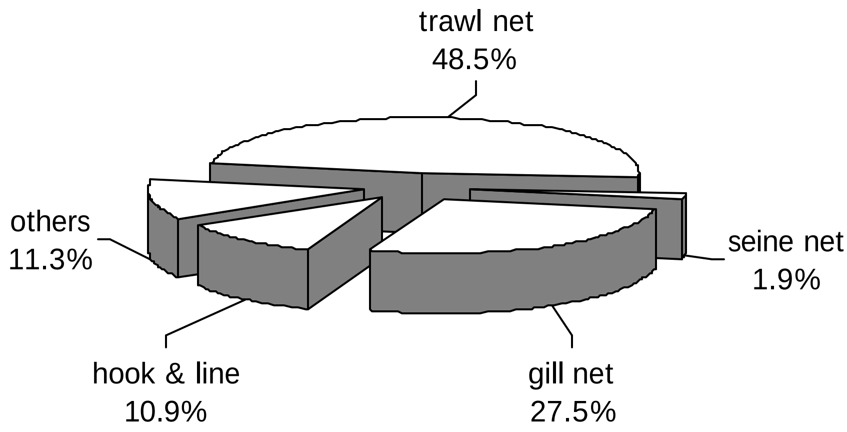


Figure 53. Breakdown of fishermen by district in the SSME-2 area, Sabah 2000 (5,555 fishermen)

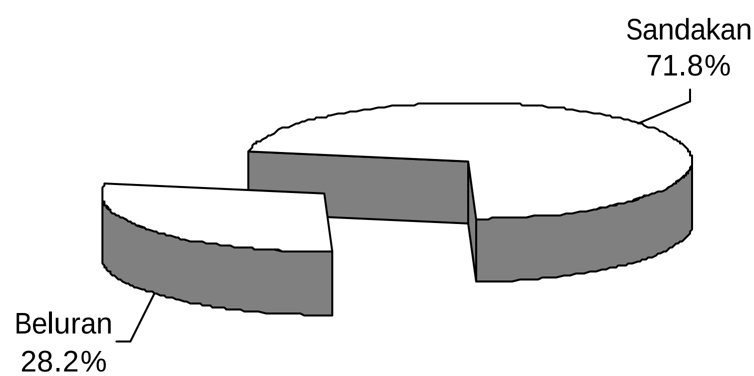


Figure 54. Breakdown of fishermen involvement by gear type in Sandakan (SSME-2), Sabah 2000 (3,987 fishermen)

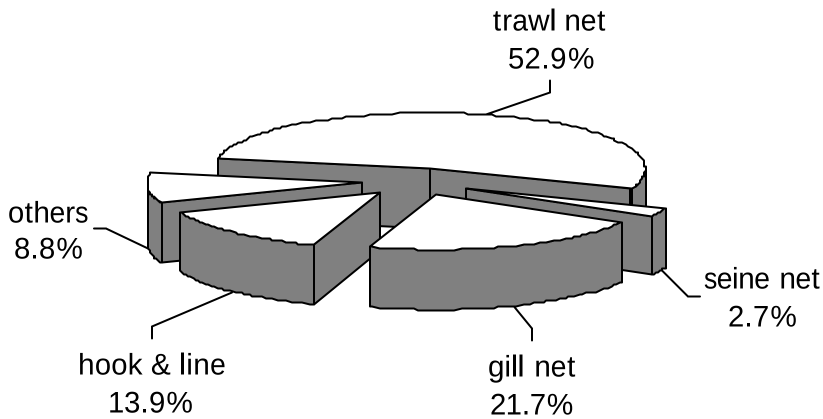


Figure 55. Breakdown of fishermen involvement by gear type in Beluran (SSME-2), Sabah 2000 (1,568 fishermen)

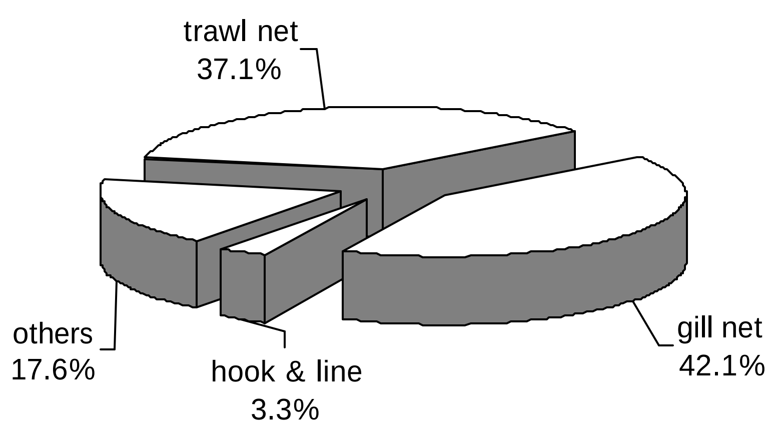


Figure 56. Breakdown of fishermen involvement by gear type in the SSME-3 area, Sabah 2000 (5,287 fishermen)

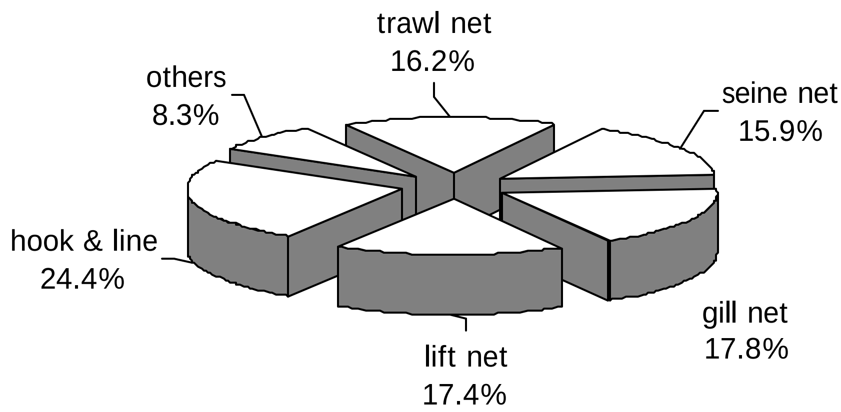


Figure 57. Breakdown of fishermen by district in the SSME-3 area, Sabah 2000 (5,287 fishermen)

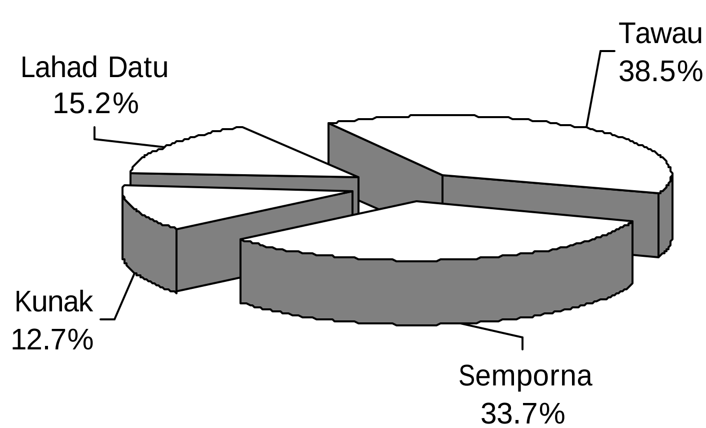


Figure 58. Breakdown of fishermen involvement by gear type in Tawau (SSME-3), Sabah 2000 (2,036 fishermen)

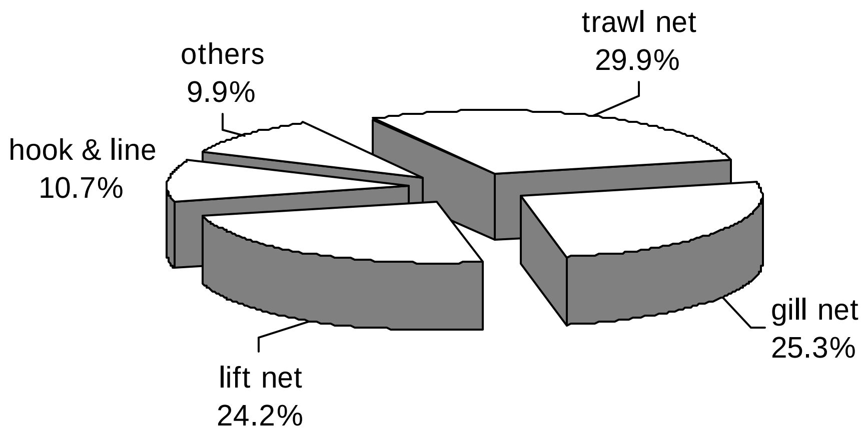


Figure 59. Breakdown of fishermen involvement by gear type in Semporna (SSME-3), Sabah 2000 (1,781 fishermen)

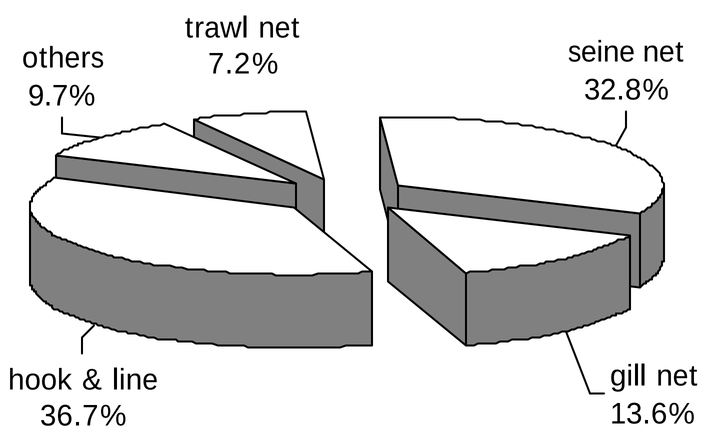


Figure 60. Breakdown of fishermen involvement by gear type in Kunak (SSME-3), Sabah 2000 (669 fishermen)

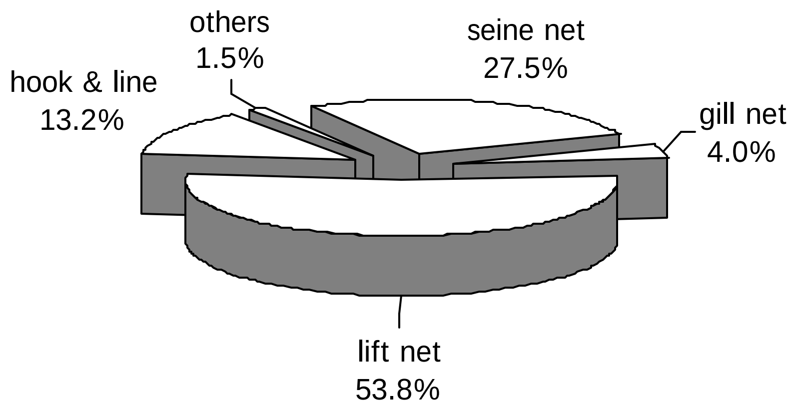


Figure 61. Breakdown of fishermen involvement by gear type in Lahad Datu (SSME-3), Sabah 2000 (801 fishermen)

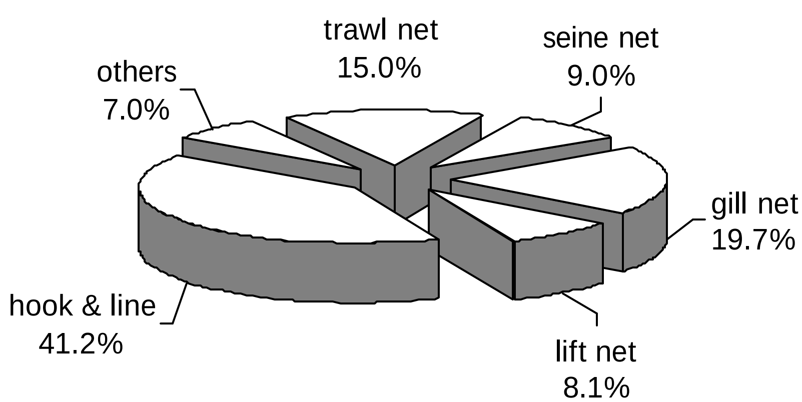


Figure 62. Breakdown of fishermen involvement by gear type in the non-SSME area, Sabah 2000 (5,725 fishermen)

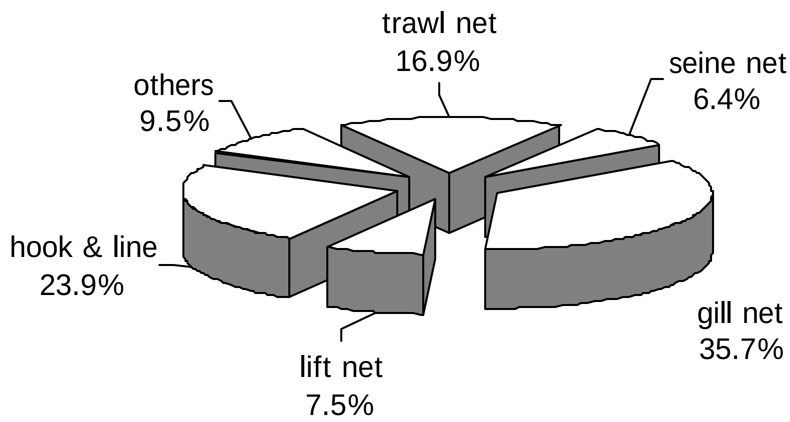


Figure 63. Breakdown of fishermen by district in the non-SSME area, Sabah 2000 (5,725 fishermen)

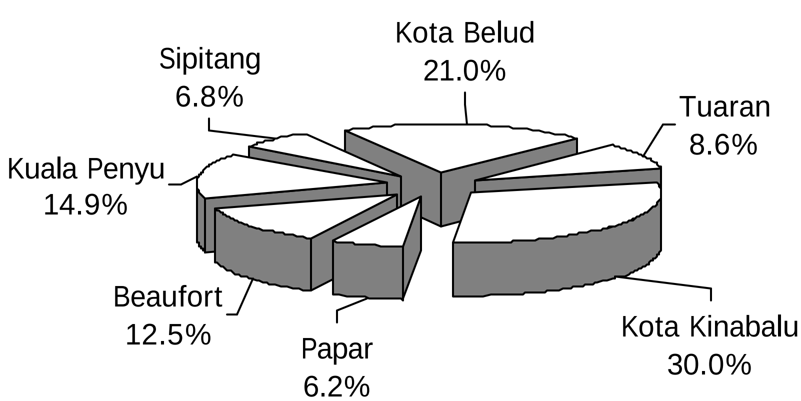


Figure 64. Breakdown of fishermen involvement by gear type in the non-SSME - West Coast North, Sabah 2000 (3,768 fishermen)

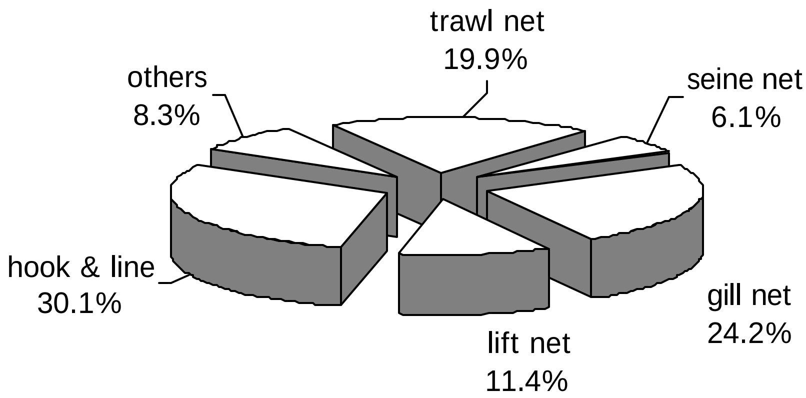


Figure 65. Breakdown of fishermen involvement by gear type in the non-SSME - West Coast South, Sabah 2000 (1,957 fishermen)

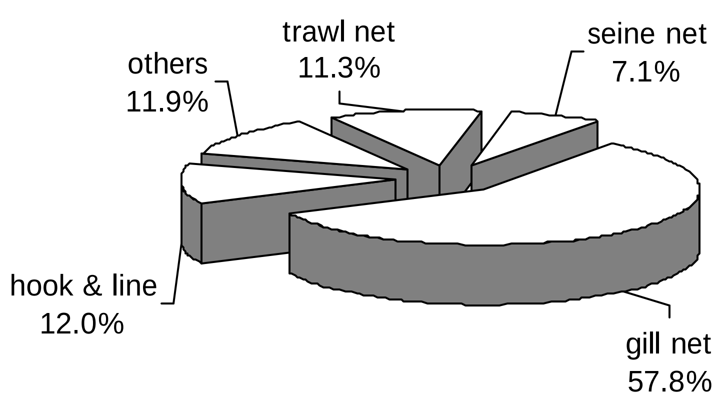


Figure 66. Breakdown of fishermen by gear group and ethnic group, Sabah 2000

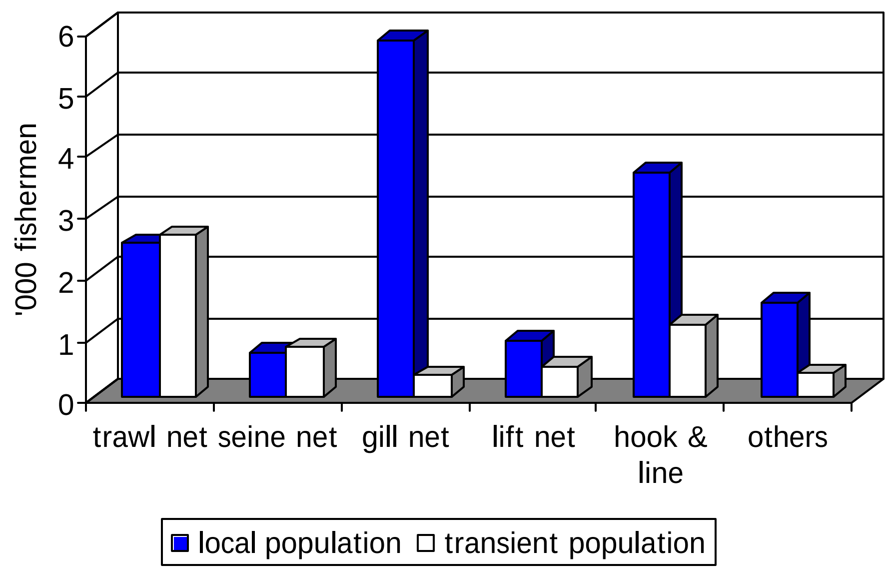


Figure 67. Dominance of transient fishermen employment by gear group, Sabah 2000

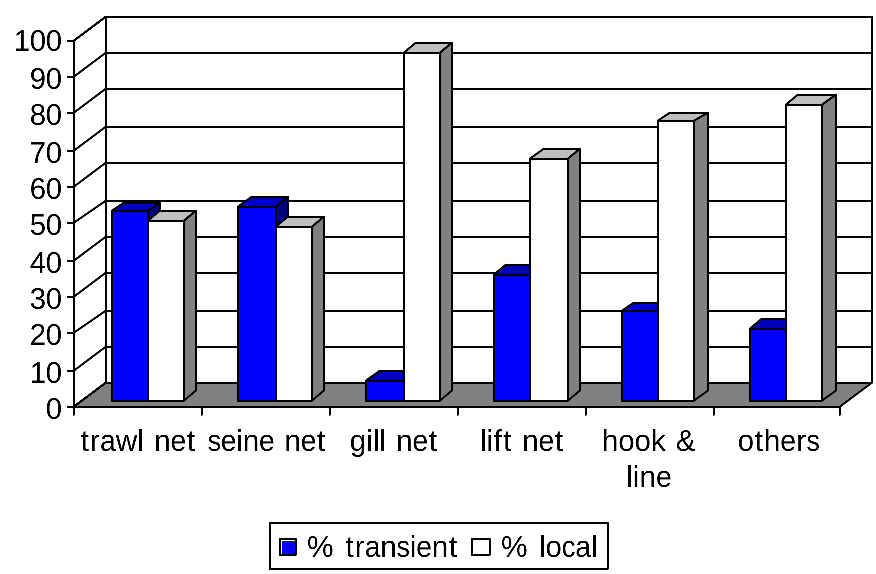


Figure 68. Breakdown of Chinese fishermen involvement by gear type in Sabah 2000 (243 fishermen)

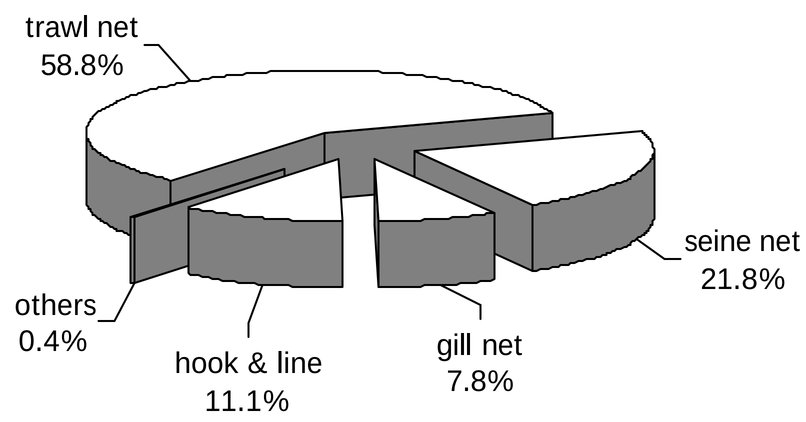
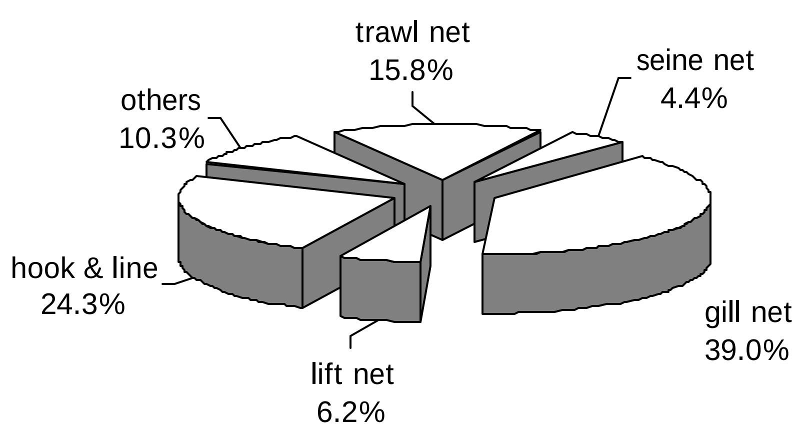


Figure 69. Breakdown of bumiputera fishermen involvement by gear type in Sabah 2000 (14,835 fishermen)



Transient fishermen respectively make up 25% and 29% of the state total fishermen involved in traditional and commercial fishing in Sabah (*Table 87*). It is estimated that 4,561 or 79% of total transient fishermen population[119] are based in the SSME – making up 30% of the total fishermen population in the SSME area (**Figure 71**). In SSME-1, the local fishermen comprised mainly of *Suluk*, *Ubian* and *Orang Sungai* ethnic groups. The transient fishermen population in SSME-1 is mainly based in Kudat – employed either as crewmembers of the commercial fishing fleet based in Kudat Town or engaged in traditional fishing in the Banggi Group of Islands. On the other hand, fishermen in SSME-2 and SSME-3 comprised of locals (*Orang Sungai*, *Suluk*, *Bugis* and *Bajau*) and transient population from the Philippines (*Bajau Laut* or *Suluk* – mainly in Semporna, Kunak, Lahad Datu and Sandakan) and Indonesia (mainly *Bugis* – mainly in Tawau). Limited studies had been done on the social economics of fishing communities in Sabah – with recent work by Sather (1997) on the *Bajau Laut* community in Semporna[120].

Table 87: *Breakdown of fishermen by ethnic group, Sabah 2000*

GROUP	GEAR TYPE	TOTAL	Ethnic Breakdown %			TOTAL
			BM	CN	OT	
TN	Trawl Net	5,123	45.8	2.8	51.4	100
PS	Fish Purse Seine	1,011	38.5	5.2	56.3	100
	Tuna Purse Seine	285	32.3		67.7	100
	Other Seine Net	201	87.1		12.9	100
GN	Gill Net	4,226	92.7	0.4	7.0	100
	Trammel Net	1,908	97.7	0.2	2.1	100
LN	Selambau	453	100.0			100
	Bagang	941	49.4		50.6	100
HL	Hook & line	4,324	76.8	0.6	22.6	100
	Tuna Long Line	475	61.1		38.9	100
	Others HL	7	42.9		57.1	100
OT	Portable Trap	427	74.7	0.2	25.1	100
	Kelong Stake	149	87.2		12.8	100
	Pancang Stake	35	97.1		2.9	100
	Barrier Net	11	100.0			100
	Crab Trap	589	83.7		16.3	100
	Shellfish Collector	219	100.0			100
	Others	461	68.5		31.5	100
GRAND TOTAL		20,845	71.2	1.2	27.7	100

** BM = bumiputer; CN = Chinese; OT = transient population

In the non-SSME area, most of the fishermen in Kota Belud comprised predominantly *Iranun*, *Bajau* and *Ubian* ethnic groups– and further south dominated by *Bajaus* in Kota Kinabalu and Tuaran and *Brunei Malays* in the disricts of Papar, Beaufort, Kuala Penyu and Sipitang. There are at least 1,200-odd transient fishermen based in the non-SSME area, with most of them employed onboard trawlers[121] (mainly Indonesian *bugis*) and purse seiners (mainly Filipinos) based in Kota Kinabalu and surrounding areas.

[119] This is a very conservative estimate considering the fact that the transient population in Sabah including fishermen is very mobile – migrating in and out of Sabah and between districts or changing professions according to availability of jobs. It is an open secret that the transient fishermen represent a large portion of the fishermen population in Kudat, Sandakan, Tawau, Semporna, Kunak, Lahad Datu and Kota Kinabalu.

[120] The Bajau Laut: *Adaptation, history and fate in a maritime fishing society of South Eastern Sabah*.

[121] This trend is also similar in the SSME area – where Indonesians (mainly of *bugis* fishermen) are mainly involved in trawling and bagang fishing. While Filipinos are mostly engaged in purse seining, gill netting and hook & line operations.

There are 8,091 fishermen involved in the operation of traditional gears in Sabah and defined in this report as traditional fishermen[122], which make up 39% of the total fishermen population in the state (**Figure 72**). About 71% of them are engaged in hook & line fishing (59%) and *bagang* fishing (a total of 17% involved in lift netting). About 68% of the traditional fishermen are in six districts: with 52% in the SSME area - Kudat (1,531), Tawau (913), Sandakan (903) and Semporna (826), and 16% in the non-SSME area - Kota Belud (771) and Kota Kinabalu (551) (**Table A32**).

In the SSME area, there are 5,747 traditional fishermen or 71% of the total traditional fishermen population in the state. Traditional fishermen make up 38% of the total fishermen population in the SSME area, where 60% of them are involved in hook & line fishing (83% in SSME-1, 49% in SSME-2 and 49% in SSME-3). In the non-SSME area, there are 2,344 traditional fishermen, which make up 41% of its total fishermen population – where 58% are involved in hook & line fishing.

There are 12,754 fishermen involved in the operation of commercial gears in Sabah and defined in this report as commercial fishermen, which make up 61% of the total fishermen population in the state. About 88% of them are involved in gill netting (48%) and trawling (40%). About 75.5% of them are concentrated 6 districts: with 61% in the SSME area – Sandakan (3,084), Kudat (1,384), Beluran (1,241), Tawau (1,123) and Semporna (955), and 14.5% in the non-SSME area – Kota Kinabalu (1,168) and Kuala Penyu (681).

In the SSME area, there are 9,373 commercial fishermen or 73.5% of the total commercial fishermen population in the state. Commercial fishermen make up 62% of the total fishermen population in the SSME area – where 44% of them are involved in trawling (25% in SSME-1 where 67% are involved in gill netting, 62% in SSME-2 and 32% in SSME-3). In the non-SSME area, there are 3,381 commercial fishermen making up 59% of its total fishermen population – where 60.5% are involved in gill netting.

There are six districts dominated by traditional fishermen, respectively with 3 districts in the non-SSME area - Tuaran (76%), Kota Belud (64%) and Papar (51%), and SSME area – Kunak (68%), Lahad Datu (56%) and Kudat (53%). On the other hand, there are nine districts dominated by commercial fishermen: with 3 districts in the non-SSME area – Kuala Penyu (80%), Beaufort (70%) and Kota Kinabalu (68%), and 6 districts in the SSME area - Kota Marudu (92%), Beluran (70%), Sandakan (77%), Pitas (56%), Tawau (55%) and Semporna (54%).

Although gill nets and surrounding nets (seine net category) are considered as commercial gears in the DOF Malaysia fisheries statistics, most of these gears in Sabah are operated by traditional fishermen in inshore waters. Bearing this in mind, by excluding those involved in these gears – traditional fishermen make up 69% (14,226) of the total fishermen population (**Figures 73-74**). Traditional fishermen make up the bulk of the fishermen population except for three districts, where commercial fishermen are dominant – Sandakan (56% commercial fishermen), Kota Kinabalu (50%) and Sipitang (53%). Commercial fishermen in this new category comprised of crewmembers working onboard trawlers and purse seiners (fish and tuna). There are 6,419 commercial fishermen – with 5,123 or 79.6% of them involved in trawling. About 80.7% of the

[122] Fishermen involved in the operation of lift net, hook & line and other types of traditional gears are classified in this report as traditional fishermen. While fishermen involved in the operation of trawl net, seine net and gill net are considered as commercial fishermen.

commercial fishermen are based in the SSME area – with 80.1% involved in trawling. In the non-SSME area, 78.5% of the 1,235 commercial fishermen are involved in trawling.
In the SSME area, there are 5,184 commercial fishermen (81% state total) – with 54% based in SSME-2, 32% in SSME-3 and 14% in SSME-1. About 42.8% of the SSME total is based in five districts: Sandakan, Semporna (13.3%), Kudat (13.0%), Tawau (11.7%) and Beluran (11.2%). There are four districts with 100% fishermen involvement in trawling - Kota Marudu, Beluran, Pitas, and Tawau. In Kunak, all the commercial fishermen are involved in purse seining (84% fish purse seining). Other districts with commercial fishermen mainly involved in trawling include Sandakan (95% commercial fishermen), Kudat (83%) and Lahad Datu (65%). In Semporna, 81.4% of the commercial fishermen are involved in purse seining (45% in tuna purse seining).

In the non-SSME area, there are 1,235 commercial fishermen (19% state total) – with 95% of them based in Kota Kinabalu (69.7%), Sipitang (16.6%) and Kuala Penyu (8.7%). Only Tuaran has no commercial fishermen – where there are 490 traditional fishermen with 49% of them engaged in *selambau* fishing, gill netting (24%), hook & line fishing (15%) and mangrove crab trapping (12%). Trawler fishermen make up the majority of the commercial fishermen in three districts – Kota Belud (100%), Kota Kinabalu (86%) and Sipitang (79%). On the other hand, purse seining is more dominant in Kuala Penyu (74% commercial fishermen), Beaufort (55%) and Papar (54%).

There are 3,394 transient fishermen involved in commercial fishing operations, which represent 59% of the total transient fishermen population (5,767) in the state. Transient fishermen make up 53% of the state commercial fishermen population (6,419) – where 78% (2,632) of them are involved in trawling and 22% (762) in purse seining. There are 5,123 fishermen involved in commercial trawling, with the transient fishermen making up 51.4% of the total work force. In purse seining, there are 762-odd transient fishermen involved – representing 56.3% (569) and 67.7% (193) respectively of the total number of fishermen engaged in fish purse seining (1,011) and tuna purse seining (285). In traditional fishing, there are at least 2,373 transient fishermen involved – making up 16.5% of the traditional fishermen population, where 49% of them are in hook & line fishing, 20% in *bagang* fishing, 14% in gill netting, 5% in traps, 4% in mangrove crab trapping and 8% in other gears.

There are 4,806 fishermen involved in hook & line fishing in Sabah[123], with 71% and 29% of them respectively based in the SSME and non-SSME areas. In the SSME area, 75% of them are concentrated in three districts: Kudat (1,366) – *mainly in the Banggi Sub District*, Semporna (653) and Sandakan (553). Hook & line fishing is the main activity of traditional fishermen[124] in the three districts – Kudat (90% of the traditional fishermen population), Semporna (79%) and Sandakan (61%). Districts in the SSME area with most of the traditional fishermen involved in hook & line fishing include Pitas (59%) and Lahad Datu (73%). In the non-SSME area, districts with high involvement of traditional fishermen in hook & line fishing include Sipitang (99%), Kota Kinabalu (76%), Kuala Penyu (71%), Kota Belud (69%) and Papar (62%) except for Tuaran (65% involved in *selambau* or lift net fishing) and Beaufort (83% involved in mangrove crab trapping).

[123] Fishermen engaged in long line operation are considered to be traditional fishermen in the report. It is very difficult to ascertain whether they are commercial fishermen or not because the scale of operation and fishing boats used are mainly traditional in nature. There are a total of 475 fishermen involved in long lining operations in Sabah – with 92% of them based in the SSME area (Sandakan – 152, Semporna – 164, Tawau – 64, Beluran – 51, Kudat – 4 and Pitas - 1).

[124] In this report – unless stated, traditional fishermen only include fishermen engaged in lift netting, hook & line fishing and other miscellaneous traditional gears.

Figure 70. Breakdown of transient fishermen involvement by gear type in Sabah 2000 (5,767 fishermen)

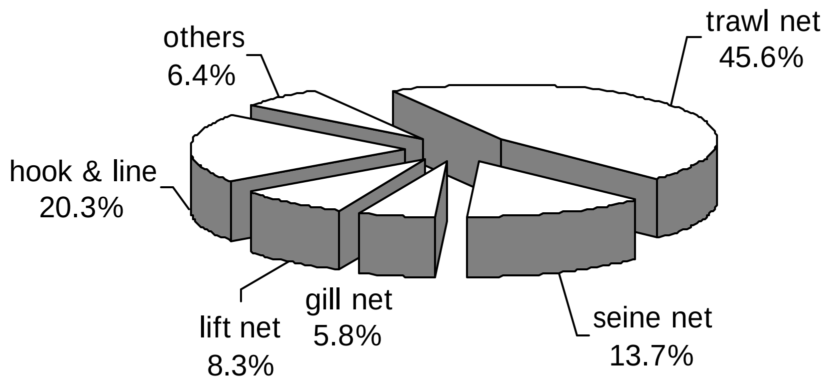
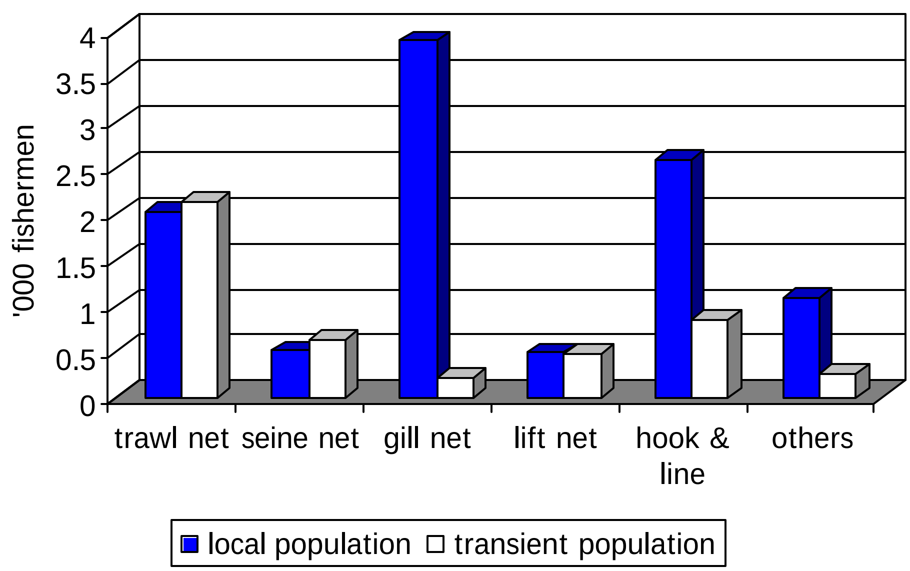


Figure 71. Breakdown of fishermen by gear group and ethnic group in the SSME area, Sabah 2000



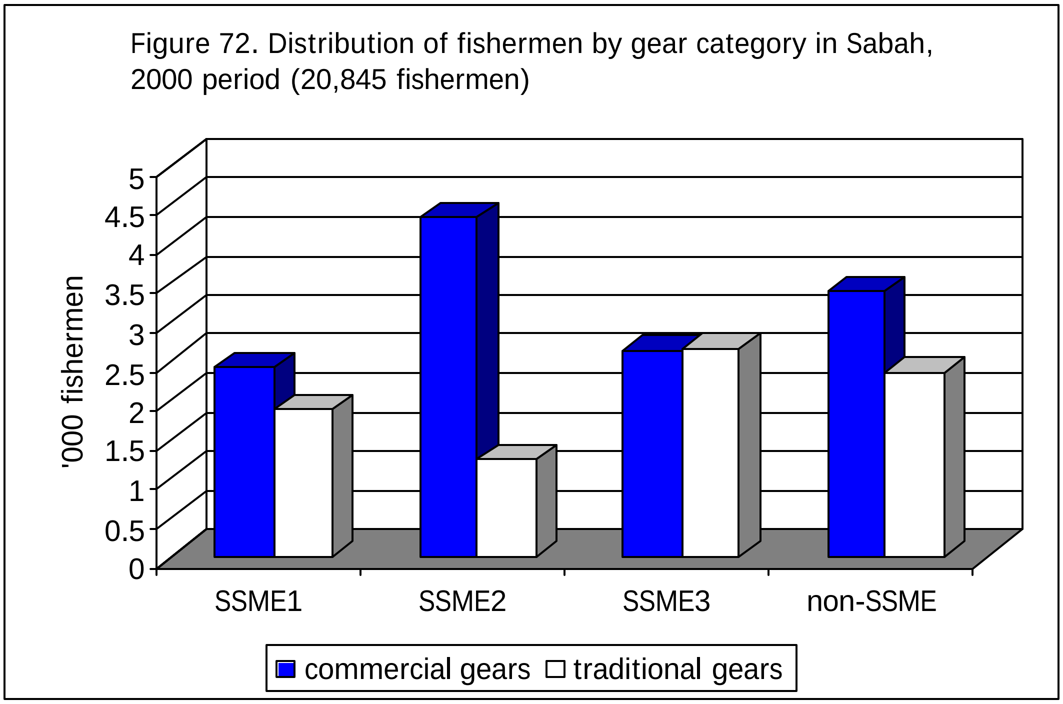


Figure 72. Distribution of fishermen by gear category in Sabah, 2000 period (20,845 fishermen)
'000 fishermen
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
SSME1
SSME2
SSME3
non-SSME
commercial gears
traditional gears

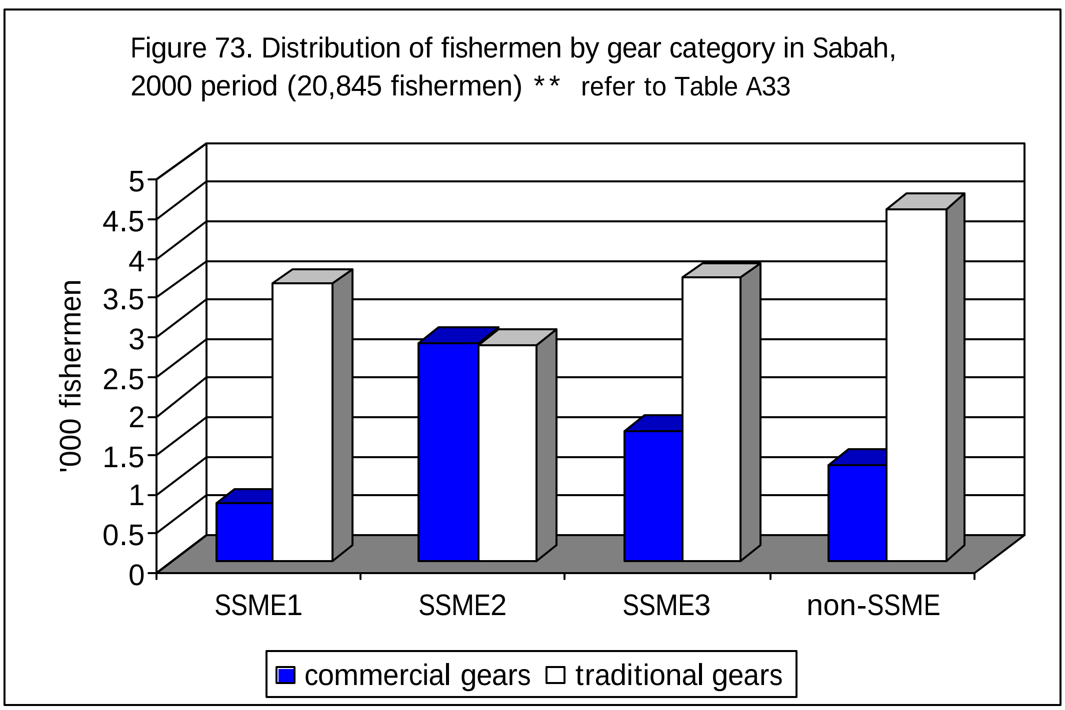


Figure 73. Distribution of fishermen by gear category in Sabah, 2000 period (20,845 fishermen) ** refer to Table A33
'000 fishermen
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
SSME1
SSME2
SSME3
non-SSME
commercial gears
traditional gears

About 71.5% of the 1,394 fishermen engaged in lift netting are based in the SSME area[125] in the districts of Tawau (493), Kunak (360), Lahad Datu (65), Pitas (46) and Sandakan[126]. *Bagang* fishing is the main liftnet activity in the SSME area except for Lahad Datu where 8 fishermen are involved in *selambau* fishing. In Kunak and Tawau, most of the traditional fishermen are involved in *bagang* fishing. In the non-SSME area, 430 *selambau* fishermen are involved liftnet fishing in the districts of Tuaran (242), Kota Kinabalu (84), Papar (62) and Kota Belud (42). In Tuaran, most of the traditional fishermen comprised of *selambau* fishermen.

About 71% of the 1,869 fishermen involved in the operation of miscellaneous traditional gears are based in the SSME area. These fishermen are involved in the operation of portable traps in reef areas and estuarine waters, collection of shellfish in mud flats and reef areas, mangrove crab trapping, tidal traps (tugoh & kelong) in sheltered bays and estuaries, jellyfish collection, barrier nets and other gears. In the SSME area, 86% of these fishermen are based in five districts: Sandakan (350), Beluran (276), Tawau (202), Semporna (173) and Kudat (165). In Beluran, these fishermen make up 84% of the traditional fishermen population – where out of 276 fishermen, 42% are using portable traps, 32% using shellfish collectors, 24% using mangrove crab traps and 2% using other gears. Most of these fishermen are based in the sub district of Paitan. In the non-SSME area, there are 544 fishermen, with 81% of them based in three districts: Kota Belud (529), Beaufort (181) and Kota Kinabalu. In Beaufort, 83% of the traditional fishermen are involved in the operation of these gears.

Gill netting is the most popular commercial gear in Sabah. There are 6,134 fishermen involved in gill netting in Sabah, with 67% and 23% of them respectively in the SSME and non-SSME areas. In the SSME area, there are 4,089 fishermen – with 81% based in five districts: Sandakan (867), Beluran (660), Kota Marudu (641), Kudat (637) and Tawau (515). In the non-SSME area, 2,045 fishermen involved in gillnet fishing, with 81% of them based in four districts: Kuala Penyu (634), Kota Belud (428), Beaufort (394) and Kota Kinabalu (206).

There are 5,123 fishermen involved in commercial trawling in Sabah, where 81% and 19% of them respectively based in the SSME and non-SSME areas. In the SSME area, there are 4,153 trawler fishermen, with 93% of them based in Sandakan (2,111), Tawau (608), Beluran (581) and Kudat (563). About 51% of the trawler fishermen in the SSME area are based in Sandakan, which has the largest trawler fleet in the state. Trawler fishermen formed the majority of the commercial fishermen population in the districts of Sandakan (69%) and Tawau (54%). In the non-SSME area, there are 970 trawler fishermen, with 93% of them based in Kota Kinabalu (740) and Spitang (161) – where they make up the bulk of the commercial fishermen in these districts.

There are 1,497 fishermen invoved in seine net fishing in Sabah, where 76% and 24% of them are respectively based in the SSME and non-SSME areas. Fishermen engaged in purse seining make up 80% of the seine net fishermen population. In the SSME area, there are 1,131 seine net fishermen, with 84% of them based in three districts: Semporna (585), Kunak (184) and Kudat (184). About 52% of the seine net fishermen in the SSME area are based in Semporna – with the majority of them involved both fish and tuna purse seining. In the non-SSME area, the seine net fishermen are concentrated in five districts: Kota Kinabalu (222), Beaufort (59), Sipitang (44), Kuala Penyu (35) and Papar (6).

[125] In late 2000, the *bagang* fishery began to extend to the non-SSME area (Kimanis Bay). At present, there are 15-odd units in operation.

[126] In Sandakan, there are about 500-odd illegal bagangs operated mainly by illegal immigrants. The number of fishermen involved is unknown and not included in this report because these fishing operations are not covered in the DOF Sabah fisheries statistics.

The temporal and spatial changes in the fishermen population of Sabah for the 1991-2000 period given in **Tables A32-A37** are summarized in *Tables 88-90* and **Figures 75-78** which are self-explanatory. During the 10-year period, the fishermen population had increased by 33% from 15,662 in 1991 to 20,845 in 2000. Overall, the population increase in the SSME area is almost 2-fold (39%) compared to the non-SSME area (20%).

Table 88: *Fishermen population change by district, 1991-2000*

ZONE	FISHING DISTRICT	Fishermen Population		%
		1991	2000	change
SSME-1	Kudat	1,036	2,915	181.4
	Kota Marudu	666	713	7.1
	Pitas	153	650	324.8
	SSME-1 Total	1,855	4,278	130.6
SSME-2	Sandakan	2,906	3,987	37.2
	Beluran	907	1,568	72.9
	SSME-2 Total	3,813	5,555	45.7
SSME-3	Tawau	967	2,036	110.5
	Semporna	3,421	1,781	-47.9
	Kunak	287	669	133.1
	Lahad Datu	544	801	47.2
	SSME-3 Total	5,219	5,287	1.3
Non-SSME	Kota Belud	1,012	1,203	18.9
	Tuaran	508	490	-3.5
	Kota Kinabalu	1,330	1,719	29.2
	Papar	462	356	-22.9
	Beaufort	519	718	38.3
	Kuala Penyu	691	851	23.2
	Sipitang	253	388	53.4
	Non-SSME Total	4,775	5,725	19.9
SSME Fishermen Population		10,887	15,120	38.9
Non-SSME Fishermen Population		4,775	5,725	19.9
TOTAL Fishermen Population		15,662	20,845	33.1

The population increase in the SSME area was due to substantial entry of new fishermen in the SSME-1 and SSME-2 areas. In SSME-3, there is only an increase of 1% over the 10-year period. The combined fishermen population of SSME-1 and SSME-2 had increased by 74%, from 5,668 in 1991 up to 9,833 in 2000.

In SSME-1, the fishermen population had increased by 131% with the entry of 2,423 fishermen – involving 85% engaged in hook & line fishing (1,180) and gill netting (881) and 15% engaged in seine netting (184), trawling (135) and other miscellaneous traditional gears (113). During the same period, the number of lift net fishermen had decreased by 60% - from 116 in 1991 down to only 46 in 2000.

In Kudat, the fishermen population had increased by 181%, from 1,036 in 1991 to 2,915 in 2000. This significant change is due to a 325% increase in the number of fishermen engaged in hook & line fishing, from 321 in 1991 to 1,362 in 2000. Most of these hook & line fishermen are based in the remote Banggi Group of Islands in the north – that had not been covered by the DOF Sabah SMPP sampling coverage in the early 90s. During that time there was no regular ferry services connecting Banggi with mainland Kudat making it difficult for DOF Sabah to visit the area. The DOF Sabah office in Banggi was only established right after it was upgraded as a sub district of Kudat. Due to the "sudden" population increase of hook & line fishermen, the percentage of fishermen involved in traditional gears had somehow increased from a low 38.3% in 1991 to 52.5% in 2001. Excluding hook & line fishermen, the fishermen structure in Kudat is more oriented towards significant involvement in commercial gear operations – with the entry of 745 commercial fishermen involved in gill netting (398), trawling (163), purse seine (113) and other seine net (71). There was also an entry of 150 fishermen involved in traditional gears into the fishery – mainly from Banggi, which might have been due to insufficient sampling coverage in the early 90s. During the 10-year period, there was an exit of 66 fishermen involved in *selambau* fishing into other gears or other types of economic activities.

Table 89: *Fishermen involvement in traditional gears, 1991-2000*

ZONE	FISHING GEAR	Fishermen Population		% change
		1991	2000	
SSME-1	Lift Net	116	46	-60.3
	Hook & Line	363	1,543	325.1
	Others	167	280	67.7
	SSME-1 Total	646	1,869	189.3
SSME-2	Lift Net	0	0	0.0
	Hook & Line	308	653	112.0
	Others	152	626	311.8
	SSME-2 Total	460	1,279	178.0
SSME-3	Lift Net	242	918	279.3
	Hook & Line	876	1,289	47.1
	Others	412	441	7.0
	SSME-3 Total	1,530	2,648	73.1
SSME Area	Lift Net	358	964	169.27
	Hook & Line	1,547	3,436	122.11
	Others	731	1,347	84.27
	SSME Area Total	2,636	5,747	118.02
Non-SSME Area	Lift Net	490	430	-12.24
	Hook & Line	1,087	1,370	26.03
	Others	273	544	99.27
	Non-SSME Total	1,850	2,344	26.70
Sabah	Lift Net	848	1,394	64.39
	Hook & Line	2,634	4,806	82.46
	Others	1,004	1,891	88.35
	Sabah Total	4,486	8,091	80.36

In Kota Marudu, the overall fishermen population remains relatively unchanged during the 10-year period, where there was only a 7% increase with the additional entry of some 50-odd fishermen into the district in 2000. There was shift in the percentage of fishermen involvement in commercial gears during the 10-year period, from 77% in 1991 to a high 92% in 2000. The number of gillnet fishermen had increased by 44% from 445 in 1991 to 641 in 2000. During the same period, the number of fishermen involved in trawling had decreased by 74% from 70 in 1991 down to only 18 in 2000.

In Pitas, the fishermen population had increased by 325%, from 153 in 1991 to 650 in 2000. There was a shift in the percentage of fishermen involvement in commercial gears (trawling and gillnetting), from only 36% in 1991 to 56% in 2000. The number of hook & line fishermen have increased by 369% from 55 in 1991 to 164 in 2000. There was also an entry of 24 fishermen engaged in trawling during the same period. It is not known whether this entry was due to in-migration of trawler fishermen from nearby Kota Marudu or from other districts. The number of *bagang* fishermen remains unchanged during the 10-year period, and only recently had increased to 100-odd during the author's visit in mid June 2001. Most of these new *bagang* fishermen are Indonesians *Bugis* previously working as workers of particleboard factories in Pitas, which had closed down due to dwindling supplies of raw materials from nearby timber concession areas.

Table 90: *Fishermen involvement in commercial gears, 1991-2000*

ZONE	FISHING GEAR	Fishermen Population		% change
		1991	2000	
SSME-1	Trawl Net	470	605	28.7
	Seine Net	0	184	
	Gillnet	739	1,620	119.2
	SSME-1 Total	1,209	2,409	99.3
SSME-2	Trawl Net	2,457	2,692	9.6
	Seine Net	113	106	-6.2
	Gillnet	783	1,527	95.0
	SSME-2 Total	3,353	4,325	29.0
SSME-3	Trawl Net	730	856	17.3
	Seine Net	2,047	841	-58.9
	Gillnet	912	942	3.3
	SSME-3 Total	3,689	2,639	-28.5
SSME Area	Trawl Net	3,657	4,153	13.56
	Seine Net	2,160	1,131	-47.64
	Gillnet	2,434	4,089	68.00
	SSME Area Total	8,251	9,373	13.60
Non-SSME Area	Trawl Net	922	970	5.21
	Seine Net	195	366	87.69
	Gillnet	1,808	2,227	23.17
	Non-SSME Total	2,925	3,563	21.81
Sabah	Trawl Net	4,579	5,123	11.88
	Seine Net	2,355	1,497	-36.43
	Gillnet	4,242	6,134	44.60
	Sabah Total	11,176	12,754	14.12

In SSME-2, the fishermen population had increased by 46% from 3,813 in 1991 to 5,555 in 2000 with the entry of 1,742 fishermen into the fishery – with 90% of them involved in gill netting (744), hook & line fishing (345) and other miscellaneous traditional gears (474). During the same period, the number of fishermen involved in purse seining had decreased by 6% - from 113 in 1991 down to 106 in 2000. The number of trawler fishermen had also increased by 10% from 2,457 to 2,692 in 2001. The relatively low increase in the trawler fishermen population is due to the limited entry of new trawlers into the fishery where most fishing grounds are now being exploited near or beyond saturation levels besides the non-renewal of fishing licenses of smaller shrimp trawler that is gradually being phased out of the industry.

In Beluran, the fishermen population had increased by 79% or 661 fishermen, from 907 in 1991 to 1,568 in 2000. There was a shift in the percentage of fishermen involvement in traditional gears (hook & line fishing and other gears), from only 7% in 1991 up to 21% in 2000. There was an increase of 45 hook & line fishermen and 219 in other traditional gears. During the same period, the number of gill net fishermen had increased by 134% from 282 in 1991 to 378 in 2000. There was not much increase in the number of trawler fishermen – where there was only an increase of 3% or entry of 19 fishermen into the fishery within the 10-year period.

In Sandakan, the fishermen population had increased by 37% or 1,081 fishermen, from 2,906 in 1991 to 3,987 in 2000. There was also a similar shift in the percentage of fishermen involvement in traditional gears (hook & line fishing and other gears), from only 14% in 1991 up to 21% in 2000. There was an additional entry of 506 traditional fishermen into the fishery – comprising of 251 in hook & line fishing and 255 in other gears. In commercial fishing, there was an additional entry of 366 fishermen in gill netting and 216 in trawling. During the same period, the number of fishermen involved in purse seining had decreased by 6% from 113 in 1991 to 106 in 2000.

In SSME-3, the fishermen population had increased only by 1% from 5,219 in 1991 to 5,287 in 2000 with the entry of only 68 fishermen into the fishery. However, there are dramatic changes in the fishermen structure during the 10-year period – with significant decrease (-59%) in the number of fishermen involved in seine netting, from 2,047 in 1991 down to only 841 in 2000. During the same period, the number of fishermen involved in traditional gears had increased by 73% from 1,530 in 1991 to 2,648 in 2000. The significant increase was due to an additional entry of 653 fishermen in *bagang* fishing and 413 fishermen in hook & line fishing into the fishery. Consequently, the percentage of fishermen involved in commercial fishing had decreased from 71% in 1991 to only 50% in 2000. One of the main reasons is due to the reduced number of purse seiners in all districts in SSME-3 (**Tables A37-A38**). The number of purse seiners had decreased by 44% from 222 units in 1991 down to only 124 units in 2000. The main reasons for this decline remains unknown but the folding up some fishing companies in the red including failed joint venture fishing operations with Filipino partners might be a possible answer.

In Tawau, the fishermen population has increased by 111%, from 967 in 1991 up to 2,036 in 2000. This significant increase is due to entry the of 1,069 fishermen mainly in *bagang* fishing (406), gill netting (319), hook & line fishing (178), trawling (123) and miscellaneous traditional fishing gears (68). Because of the significant entry of fishermen engaged in traditional gears into the fishery, the percentage involvement of this group had increased from only 27% in 1991 to almost 45% in 2001. During the same period, there was an exit of 25 seine net fishermen into other gears or other types of economic activities.

In Semporna, the fishermen population has decreased by 48%, from 3,421 in 1991 down to only 1,781 in 2000. This significant decrease is due to exit of 1,620 fishermen from the fishery, which comprised of fishermen involved in purse seining (1,207), gill netting (409), trawling (4) and other miscellaneous traditional gears (59). During the same period, the fishing community is only supplemented by an additional entry of 39 hook & line fishermen. Most of the fishermen in Semporna comprised of highly mobile transient fishermen. Most of the purse seine and gill net fishermen in Semporna are Filipinos who might have moved elsewhere in search of employment – including non-purse seining activities in nearby districts including other districts in SSME-1 and SSME-2 or could have returned to their homeland after the folding up of some purse seiner operations in Semporna. Consequently, the percentage of fishermen engaged in the operation of commercial gears had decreased from 75% in 1991 to only 54% in 2001.

In Kunak, the fishermen population had increased by 133% from 287 in 1991 up to 669 in 2000. This significant increase is mainly due to the additional entry of fishermen into the fishery, mainly engaged in *bagang* fishing (228), purse seining (82) and hook & line fishing (73). During the 10-year period, there was also an exit of 20 trawler fishermen from the fishery – and at present, there is no existing trawler fleet left in Kunak. The involvement of traditional fishermen in the fishery had consequently increased from 51% in 1991 to 68.5% in 2001. *Bagang* fishing, purse seining and hook & line fishing are the major fishing activities in Kunak.

In Lahad Datu, the fishermen population had increased by 47%, from 544 in 1991 up to 801 in 2000. There was significant increase in the number of fishermen engaged in various kinds of commercial and traditional gears except for purse seine fishermen, which had decreased by 48% from 128 in 1991 down to only 66 in 2000. The increase is due to the additional entry of fishermen engaged in traditional gears - hook & line fishing (123) and *bagang* fishing (42), and gill netting (111). Traditional fishermen make up 56% of the total fishermen population in 2000 compared to 51% in 1991.

In the non-SSME area, the fishermen population increased by 20%, from 4,775 in 1991 to 5,725 in 2000. Overall, there was an increase in the number of fishermen involved in most gear groups, except for *selambau* fishermen, which had decreased by 12% from 490 in 1991 to 430 in 2000. In the West Coast – north, the fishermen population had increased by 14%, from 3,312 in 1991 to 3,768 in 2000, which comprised of 279 traditional and 177 commercial fishermen. During the 10-year period, there was substantial increase in the number of fishermen by gear involvement except for lift net and gill net fishermen. The number of *selambau* fishermen had decreased by 10%, from 478 in 1991 to 430 in 2000. On the other hand, the 5% decline in gill net fishermen was due to a sharp decrease in drift net fishermen (29% from 1,071 in 1991 to 1,014 in 2000) and increase in trammel net fishermen (127% from 104 in 1991 to 235 in 2000. In the West Coast – south, the number of fishermen had increased by 13%, from 1,563 in 1991 to 1,648 in 2000. This change involves an increase of 215 traditional fishermen and exit of 30 commercial fishermen into traditional gears.

Figure 74. Spatial distribution of fishermen in Sabah, 2000 period (20,845 fishermen) ** refer to Table A33

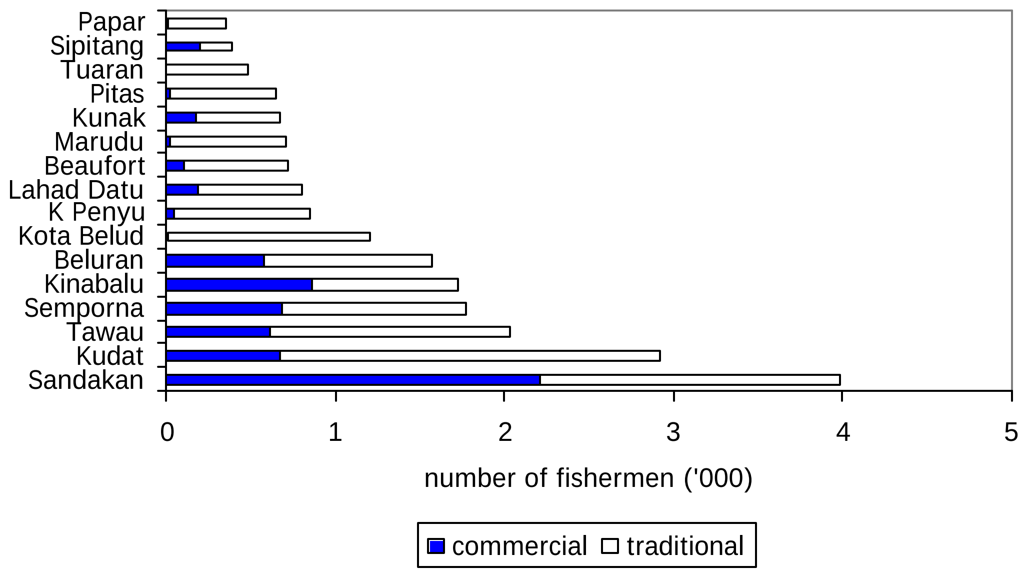


Figure 75. Spatial distribution of fishermen by gear type in Sabah during the 1991 period (15,662 fishermen)

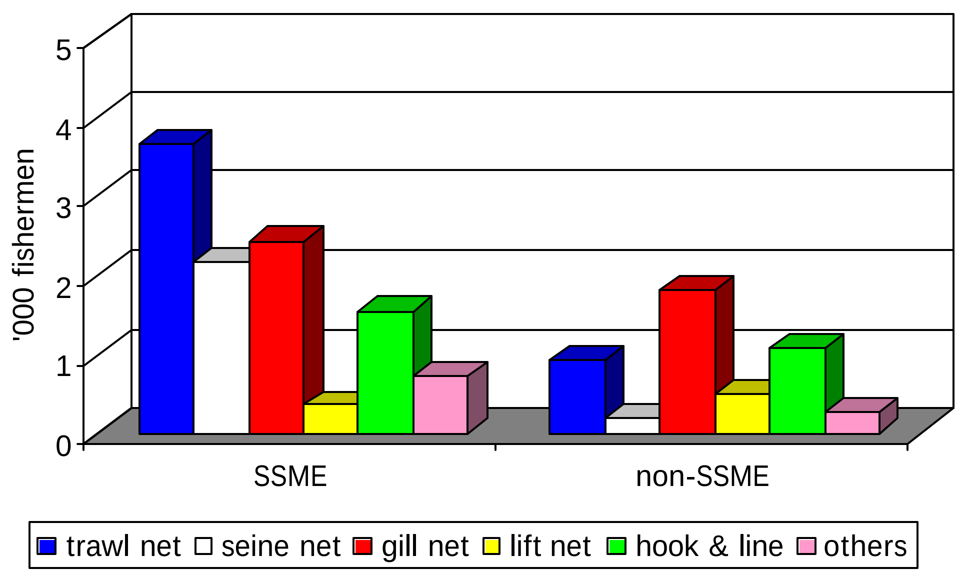


Figure 76. Spatial distribution of fishermen by gear type in Sabah during the 2000 period (20,845 fishermen)

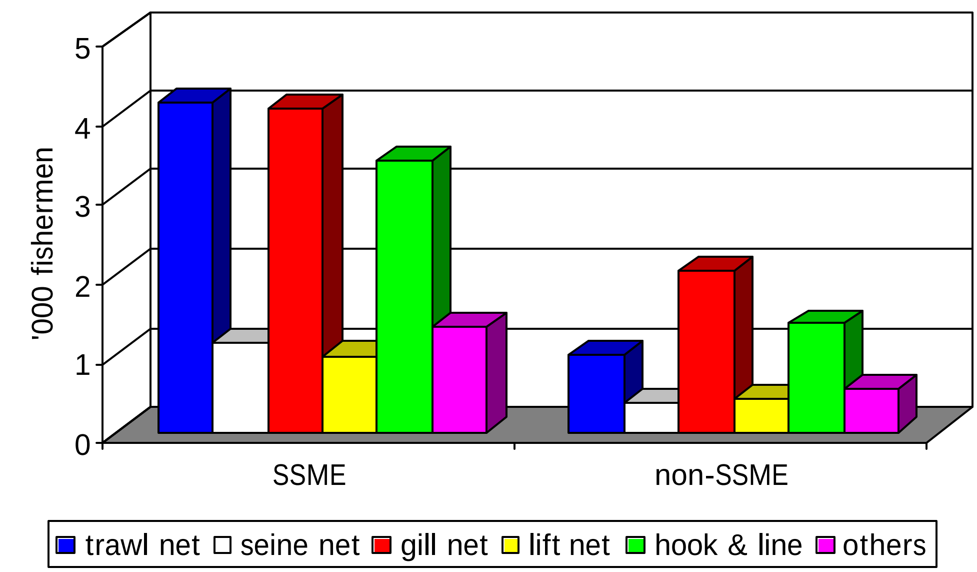


Figure 77. Breakdown of fishermen by fishing region and gear group, Sabah 1991 period

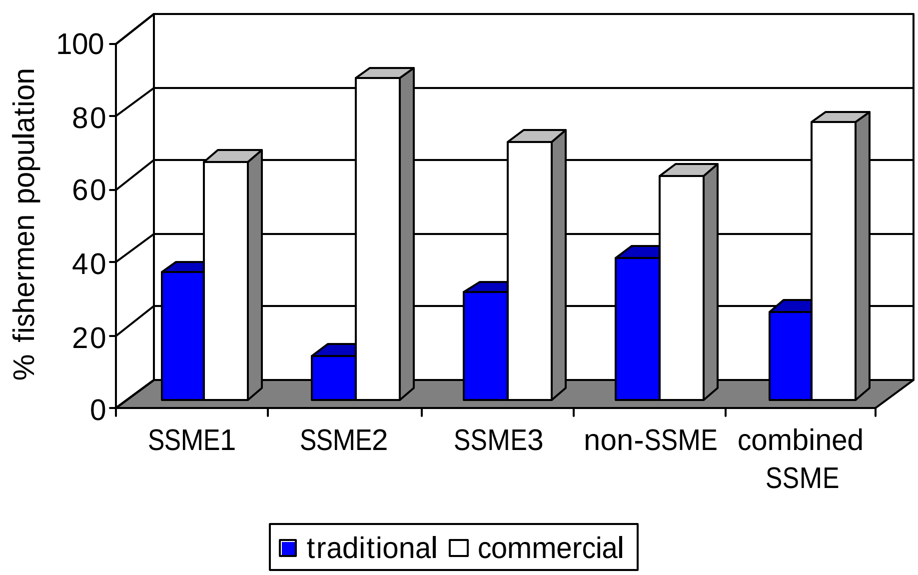


Figure 78. Breakdown of fishermen by fishing region and gear group, Sabah 2000 period

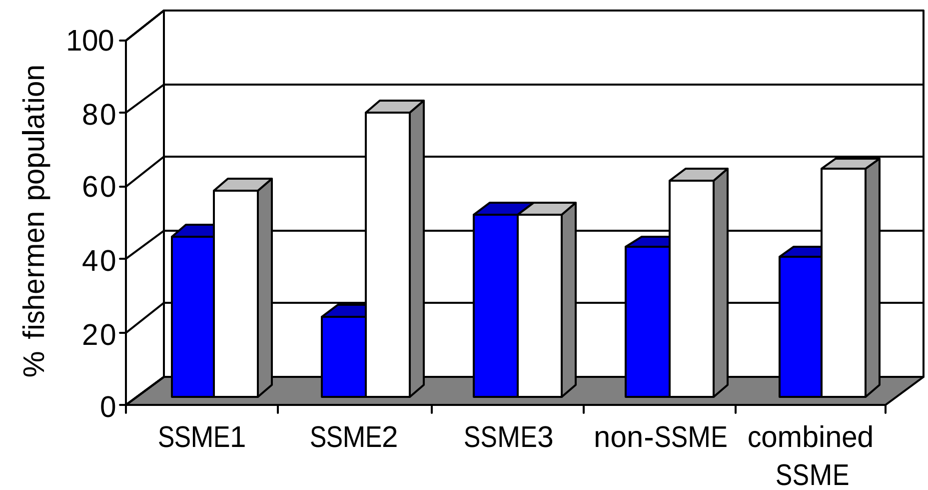


Figure 79. Spatial distribution of combined fishing effort in Sabah, 1991 (6,689 gear units) (fishing district)

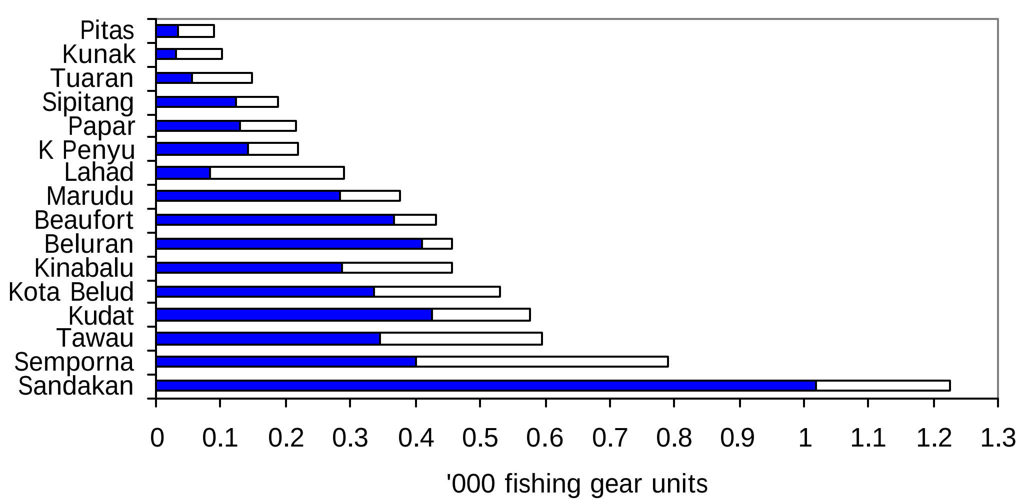


Figure 80. Spatial distribution of combined fishing effort in Sabah, 1991 (6,689 gear units) (fishing zone)

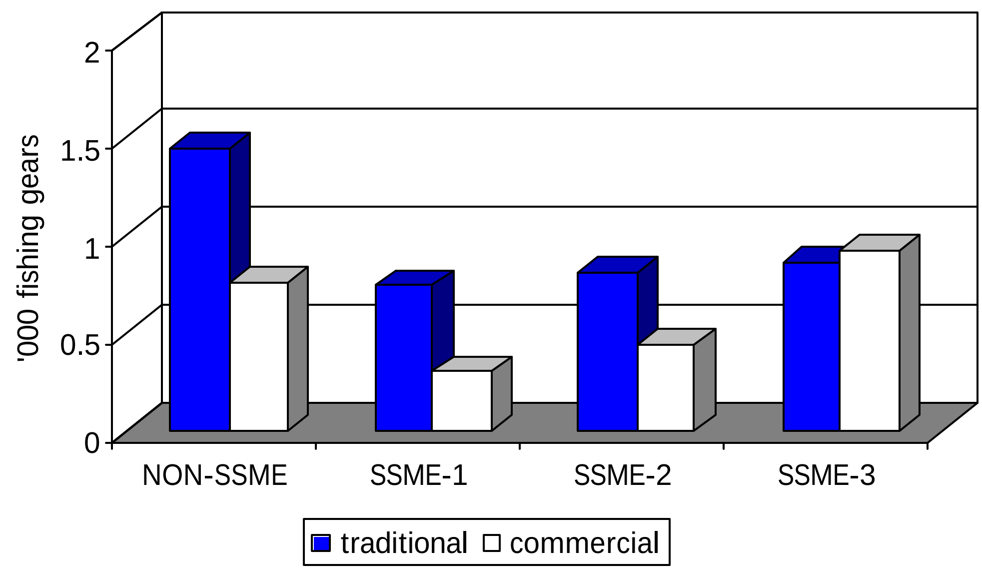
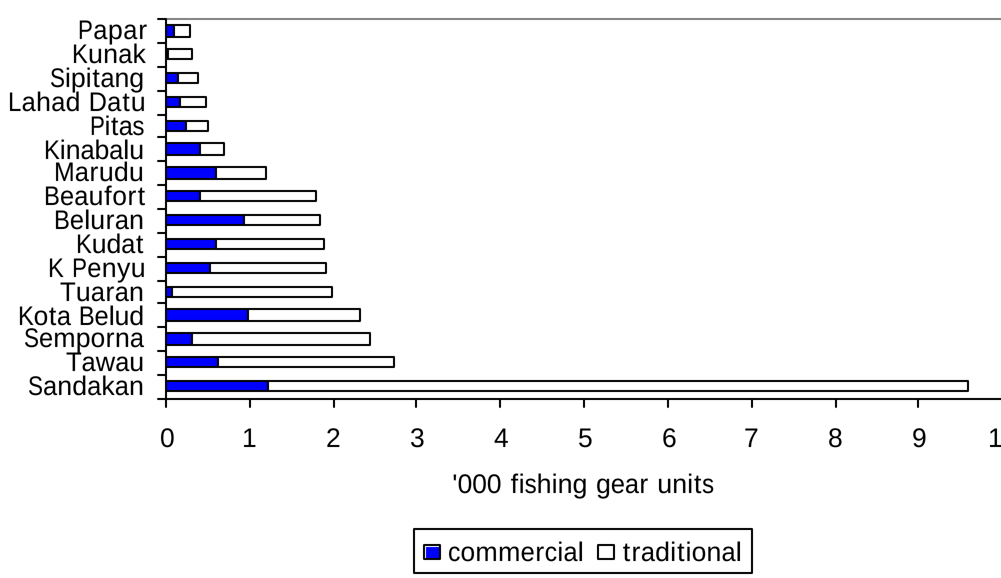


Figure 81. Spatial distribution of total fishing effort in Sabah, 2000 (30,360 gear units)



Fishing Gears

In 1991, commercial gears make up 67% of the total estimated fishing effort, comprising of 2,523 gill nets, 1,679 trawl nets and 265 seine nets. Traditional gears only make up 33% of the total fishing effort, comprising of 2,129 hook & lines, 288 lift nets and 715 units of other types of miscellaneous gears (**Figures 79-80**). Bearing in mind that the SMPP program only started in 1991, there is a great possibility that there was incomplete coverage of the traditional gear sampling frame for that particular year and since then had been greatly improved throughout the years attributing to the significant increase in the number of traditional gears until 1999. In 1999, there are 36,360 fishing gear units operating in Sabah (**Tables A36-A39**), showing an increase of 444% over the 1991 period (6,689 units). Commercial gears make up 24% of the total, comprising 5,775 gill nets, 1,442 trawl nets and 255 seine nets. While traditional gears make up 76%, comprising of 6,415 hook & lines, 692 lift nets and 15,891 units of other types of miscellaneous gears (**Figures 81-82**).

The spatial distribution of commercial and traditional fishing effort by fishing zone in Sabah for the 1991 and 1999 period is respectively summarized in **Figures 83-86** and **Figures 87-90**. The spatial distribution of commercial and traditional fishing effort by fishing districts in the non-SSME and SSME areas are given respectively in **Figures 91-92** and **Figures 93-94**. The breakdown of fishing effort by gear type is given respectively in **Figures 95-96** (Sabah total), **Figures 97-98** (SSME area) and **Figures 99-100** (non-SSME area). The breakdown of fishing effort by gear group and fishing zone is given in **Figures 101-103**. The comparison of fishing effort between 1991 and 1999 is given in *Table 91*. The distribution of commercial and traditional gears by fishing region in Sabah for the 1999 period is given in *Table 92*.

Table 91: *Changes in fishing units by gear tyoes, Sabah 1991-2000 period*

GEAR GROUP	GEAR TYPE	Number of gears				% change 1991-2000
		1991	% TOTAL	2000	% TOTAL	
TN	Trawl Net	1,679	25.10	1,442	4.77	-14.1
SN	Fish Purse Seine	112	1.67	132	0.44	17.9
	Tuna Purse Seine	25	0.37	42	0.14	68.0
	Other Seine Net	128	1.91	81	0.27	-36.7
	Sub Total SN	265	3.96	255	0.84	-3.8
GN	Gill Net	1,871	27.97	3,546	11.73	89.5
	Trammel Net	652	9.75	2,119	7.01	225.0
	Sub Total GN	2,523	37.72	5,665	18.74	124.5
LN	Selambau	96	1.44	120	0.40	25.0
	Bagang	192	2.87	572	1.89	197.9
	Sub Total LN	288	4.31	692	2.29	140.3
HL	Hook & line	1,167	17.45	5,535	17.87	363.0
	Tuna Long Line	52	0.78	880	2.91	1,592.3
	Sub Total HL	1,219	18.22	6,283	20.79	415.4
OT	Portable Trap	141	2.11	3,314	10.96	2,250.4
	Kelong Stake	142	2.12	139	0.46	-2.1
	Pancang Stake	14	0.21	35	0.12	150.0
	Barrier Net	38	0.57	20	0.07	-47.4
	Crab Trap	163	2.44	11,250	37.22	6,801.8
	Shellfish Collector	28	0.42	383	1.27	1,267.9
	Others	189	2.83	750	2.48	296.8
	Sub Total OT	715	10.69	15,891	52.57	2,122.5
	GRAND TOTAL	6,689	100%	30,360	100%	353.9

Table 92: *Breakdown of fishing gears by fishing zone, Sabah 1999*

FISHING GEARS	% FISHING ZONE SHARE					TOTAL
	SSME1 area	SSME2 area	SSME3 area	Total SSME	Non-SSME	
Commercial Gears						
% Trawler net	10.7	59.1	12.9	82.7	17.3	1,442
% Seine net	9.8	2.0	48.6	60.4	39.6	255
% Gill net	22.1	23.4	14.5	60.0	40.0	5,665
% TOTAL	19.5	29.6	15.4	64.5	35.5	7.362
	% FISHING ZONE SHARE					
FISHING GEARS	SSME1 area	SSME2 area	SSME3 area	Total SSME	Non-SSME	TOTAL
Traditional Gears						
% Lift net	6.6	0.0	78.8	85.4	14.6	692
% Hook & line	14.4	43.6	14.3	72.3	27.7	6,415
% Misc. gears	7.4	40.6	21.2	69.3	30.7	15,891
% TOTAL	9.3	40.2	21.0	70.6	29.4	22,998

There are 20,976 fishing gears operating in the SSME area in 1999 (69% state total), which is 2.2-fold of the fishing effort in the non-SSME area. Traditional gears represents 77% of the total fishing effort, with miscellaneous gears making up 68%, followed by hook & lines (28%) and lift net (4%). Commercial gears represents 23% of the SSME total fishing effort, comprising of gill nets (72% total), (25%) and seine nets (3%). Overall, 53% of the total fishing effort comprised of miscellaneous traditional gears, followed by hook & lines (22.1%), gill nets (16.2%), trawl nets (5.7%), lift nets (2.8%) and seine nets (0.7%). Excluding other miscellaneous traditional gears, hook & lines make up 46.5% of the total fishing effort, followed by gill nets (34.1%), trawler nets (12.0%), lift nets (5.9%) and seine nets (1.5%). The breakdown of fishing gears by district in each of the SSME sub zones is given in *Tables 93-95*.

There are 9,384 fishing gears operating in the non-SSME area in 1999 (31% state total), which is about 50% of the SSME total fishing effort. Traditional gears represents 72% of the non-SSME total, with miscellaneous gears making up 72%, followed by hook & lines (26%) and lift net (2%). Commercial gears represents 23% of the non-SSME total fishing effort, where gill nets make up 86.6% of the total, followed by trawler nets (9.5%) and seine nets (3.9%). Overall, 52.1% of the non-SSME total fishing effort comprised of other miscellaneous traditional gears, followed by hook & lines (19.0%), gill nets (24.2%), trawl nets (2.7%), lift nets (1.1%) and seine nets (1.1%). Excluding other miscellaneous traditional gears, gill nets make up 50.4% of the total fishing effort in the non-SSME area, followed by hook & lines (39.6%), trawl nets (5.5%), lift nets (2.2%) and seine nets (2.2%). The breakdown of fishing gears by district in the non-SSME are is given in *Tables 96*.

Table 93: *Breakdown of fishing gears by district in SSME-1, 1999*

FISHING GEARS	% Fishing District Share			SSME-1 TOTAL
	Kudat	Kota Marudu	Pitas	
Traditional Gears				
% Lift net	0.0	0.0	100.0	46
% Hook & line	84.3	4.5	11.3	921
% Misc. gears	41.8	48.2	10.0	1,177
% TOTAL	59.1	28.4	12.5	2,144
Commercial Gears				
% Trawler net	91.0	3.9	5.2	404
% Seine net	100.0	0.0	0.0	126
% Gill net	35.4	46.9	17.6	3,520
% TOTAL	42.6	41.5	16.0	4,050

Table 94: *Breakdown of fishing gears by district in SSME-2, 1999*

FISHING GEARS	% Fishing District Share			SSME-2 TOTAL
	Sandakan	Beluran	Kinabatangan	
% Lift net	0.0	0.0	0.0	0
% Hook & line	97.0	3.0	0.0	2,799
% Misc. gears	87.4	12.6	0.0	6,494
% TOTAL	90.3	9.7	0.0	9,253
Commercial Gears			0.0	
% Trawler net	80.2	19.8	0.0	852
% Seine net	100.0	0.0	0.0	5
% Gill net	41.3	58.7	0.0	1,323
% TOTAL	56.6	43.4	0.0	2,180

Table 95: *Breakdown of fishing gears by district in SSME-3, 1999*

FISHING GEARS	% Fishing District Share				SSME-3 TOTAL
	Tawau	Semporna	Kunak	Lahad Datu	
Traditional Gears					
% Lift net	72.8	0.0	22.0	5.1	545
% Hook & line	23.8	47.0	5.2	23.9	915
% Misc. gears	44.2	49.9	4.0	1.9	3,374
% TOTAL	43.5	43.7	6.3	6.4	4,834
Commercial Gears					
% Trawler net	59.1	24.2	0.0	16.7	186
% Seine net	0.0	75.8	11.3	12.9	124
% Gill net	62.7	22.9	1.1	13.4	822
% TOTAL	55.2	28.9	2.0	13.9	1,132

Table 96: *Breakdown of licensed gears by district in non-SSME area, 1999*

FISHING GEARS	% Fishing District Share							non SSME TOTAL
	Kota Belud	Tuaran	Kota Kinabalu	Papar	Beaufort	Kuala Penyu	Sipitang	
Traditional Gears								
% Lift net	31.7	36.6	19.8	11.9	0.0	0.0	0.0	101
% Hook & line	48.5	6.6	7.0	5.6	2.3	16.9	13.1	1,780
% Misc. gears	9.4	35.6	2.9	1.5	27.7	22.5	0.4	4,886
% TOTAL	20.0	28.0	4.2	2.7	20.6	20.7	3.8	6,767
Commercial Gears								
% Trawler net	0.8	0.0	72.3	0.4	8.4	1.6	16.5	249
% Seine net	0.0	0.0	40.6	2.0	26.7	21.8	8.9	101
% Gill net	42.7	3.4	8.2	4.1	16.0	21.8	3.9	2,267
% TOTAL	37.1	2.9	15.5	3.7	15.7	19.9	5.3	2,617

Figure 82. Spatial distribution of total fishing effort in Sabah, 1999 (30,360 gear units) (fishing zone)

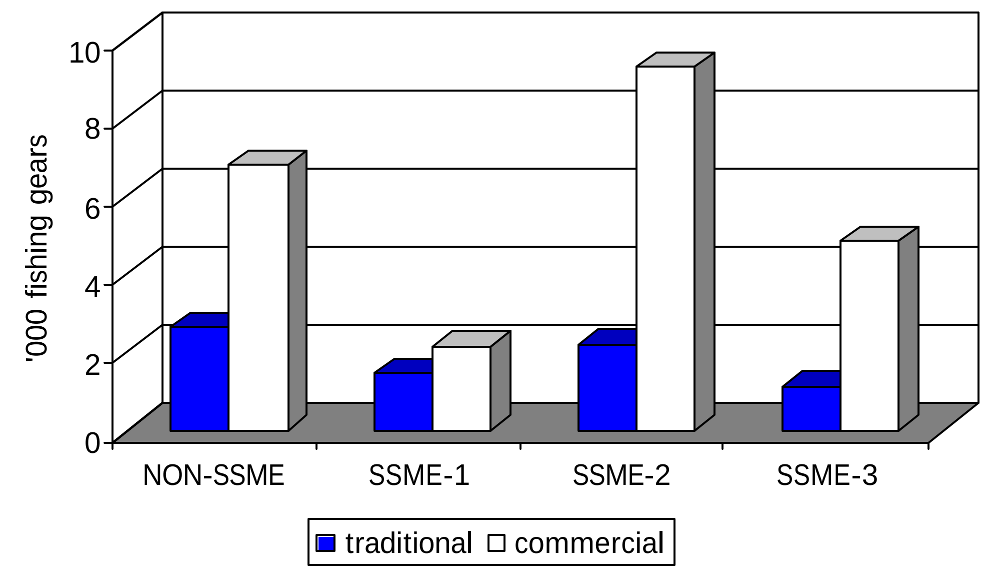


Figure 83. Spatial distribution of commercial fishing effort in Sabah, 1991 (4,467 gear units)

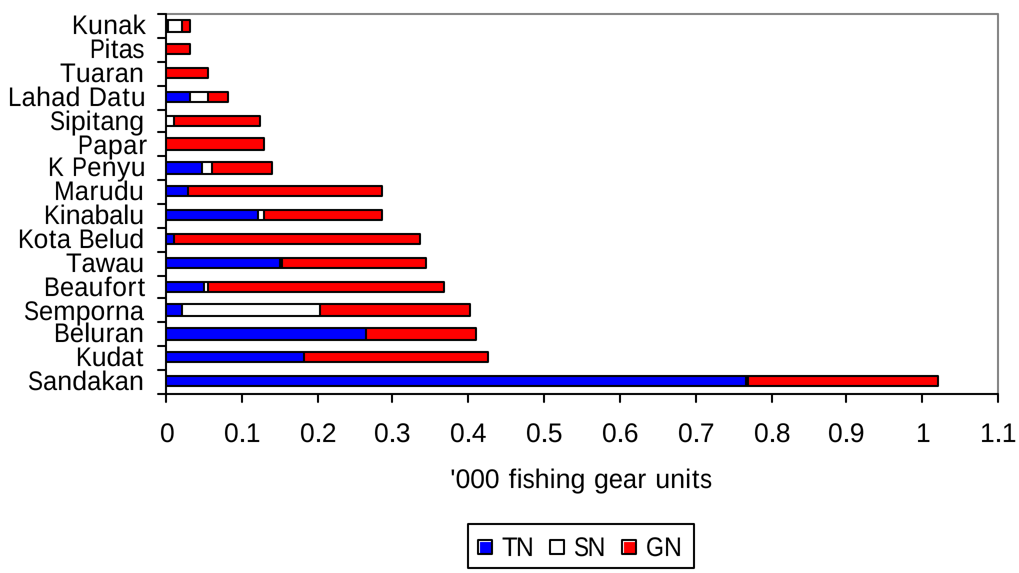


Figure 84. Spatial distribution of commercial fishing effort in Sabah, 1991 (4,467 gear units) (fishing zone)

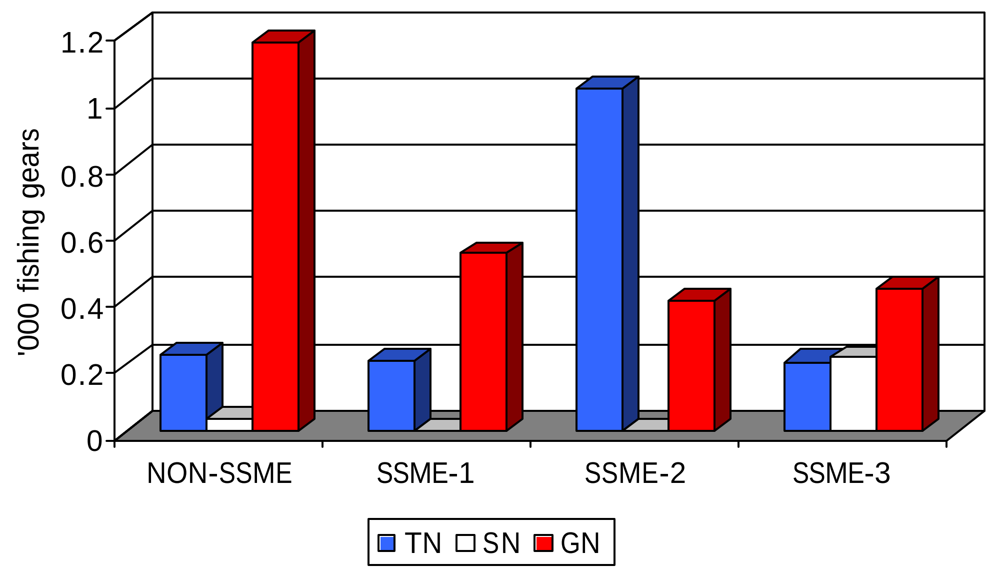


Figure 85. Spatial distribution of commercial fishing effort in Sabah, 1999 (7,362 gear units)

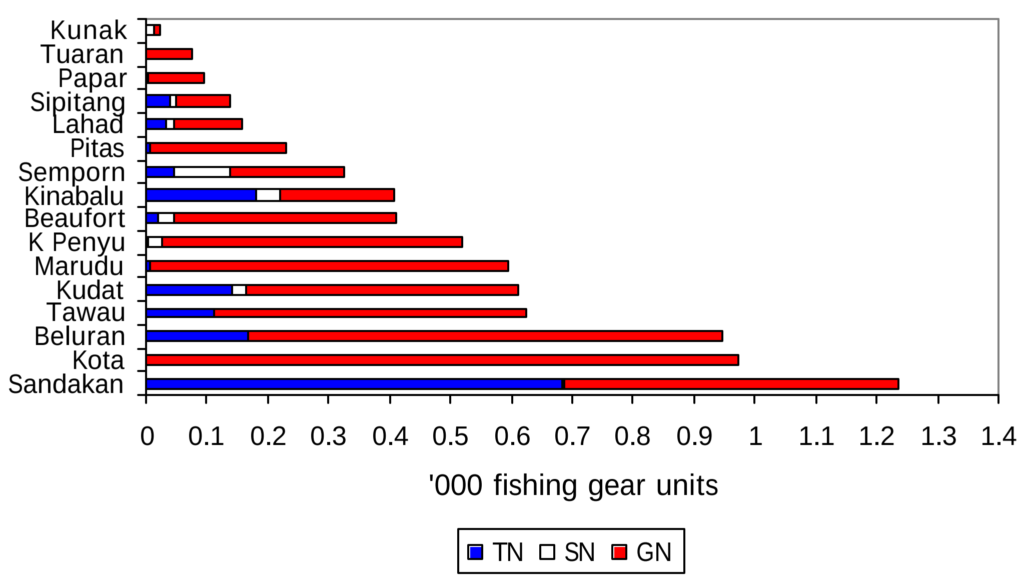


Figure 86. Spatial distribution of commercial fishing effort in Sabah, 1999 (7,362 gear units) (fishing zone)

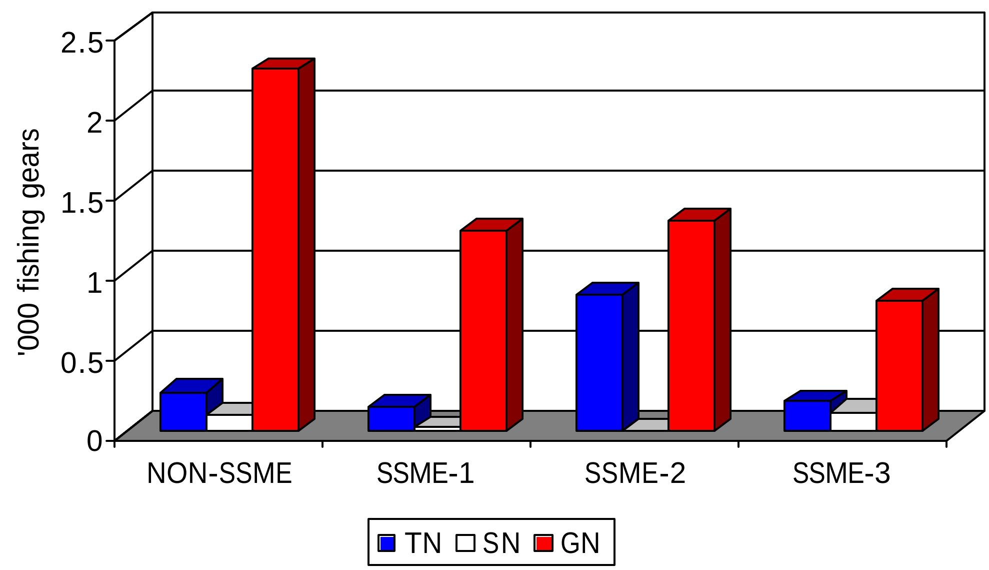


Figure 87. Spatial distribution of traditional fishing effort in Sabah, 1991 (2,222 gear units)

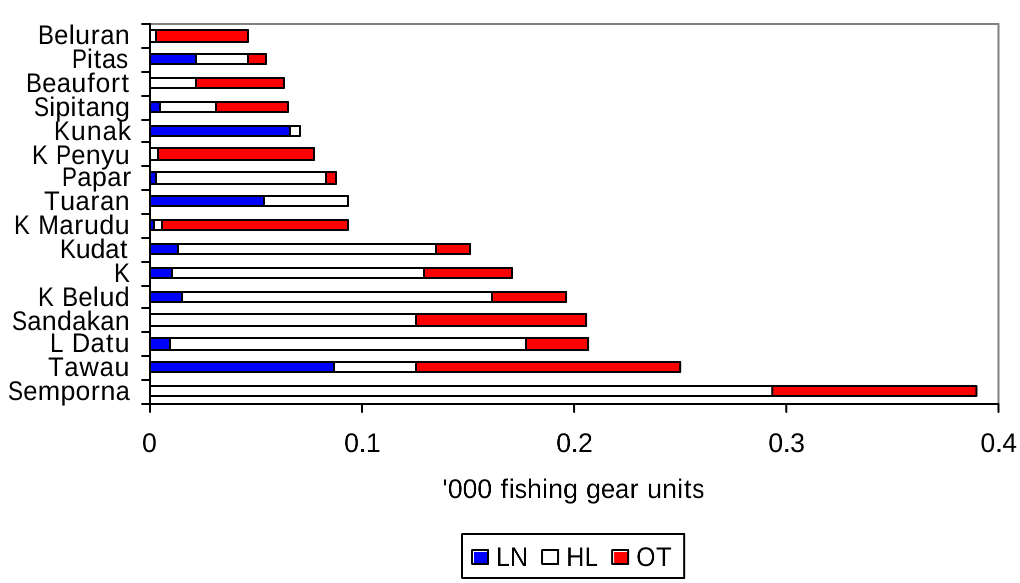


Figure 88. Spatial distribution of traditional fishing effort in Sabah, 1991 (2,222 gear units) (fishing zone)

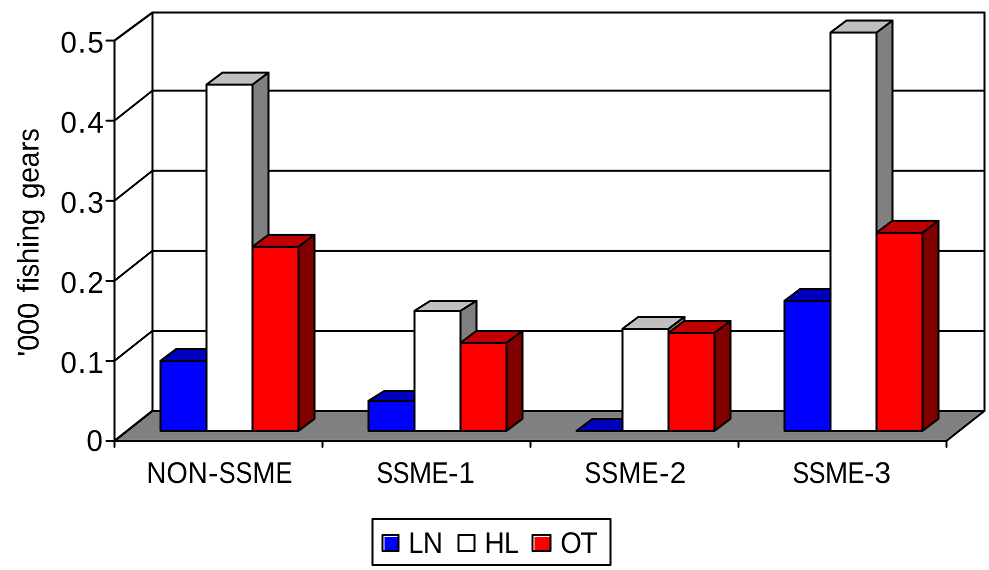


Figure 89. Spatial distribution of traditional fishing effort in Sabah, 1999 (22,998 gear units)

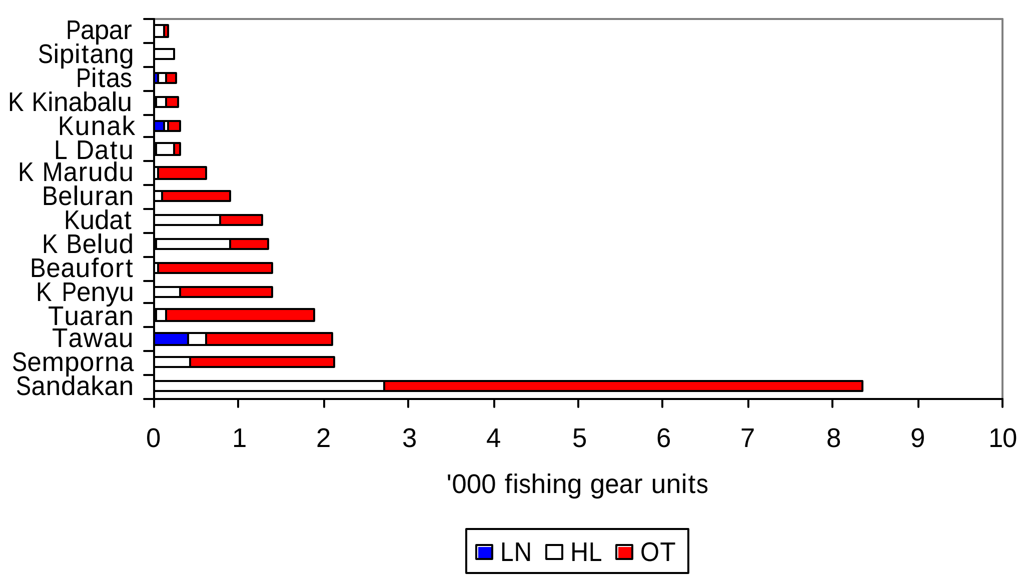


Figure 90. Spatial distribution of traditional fishing effort in Sabah, 1999 (22,998 gear units) (fishing zone)

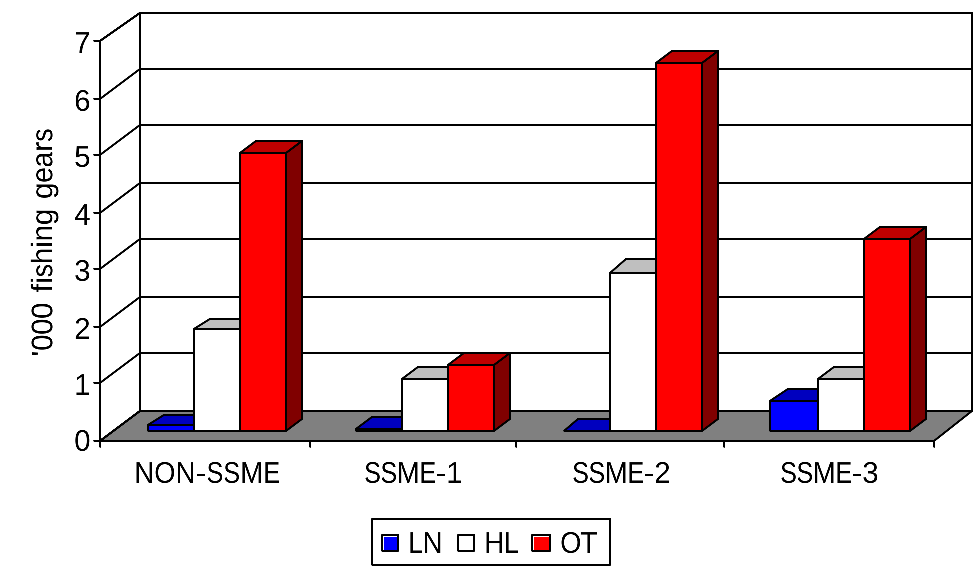


Figure 91. Spatial distribution of commercial fishing gears in the non-SSME area in Sabah, 1999 (2,617 gear units)

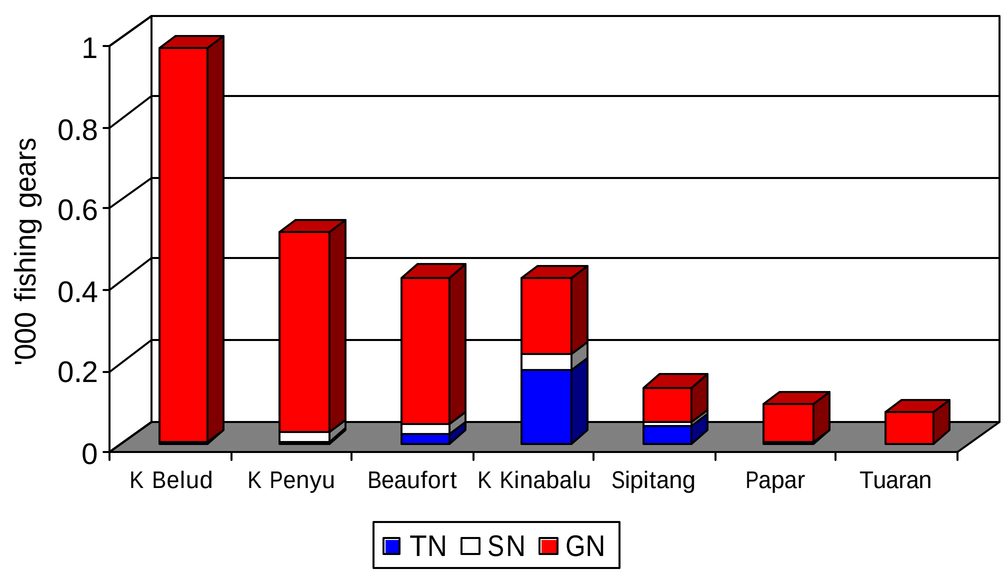


Figure 92. Spatial distribution of commercial fishing gears in the SSME area in Sabah, 1999 (4,745 gear units)

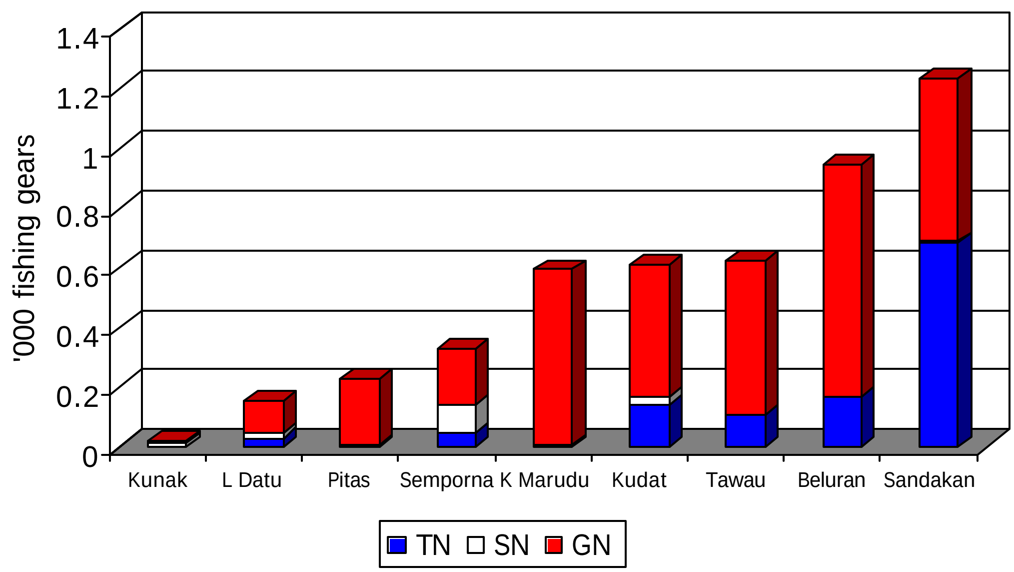


Figure 93. Spatial distribution of traditional fishing gears in the non-SSME area in Sabah, 1999 (1,881 gear units)

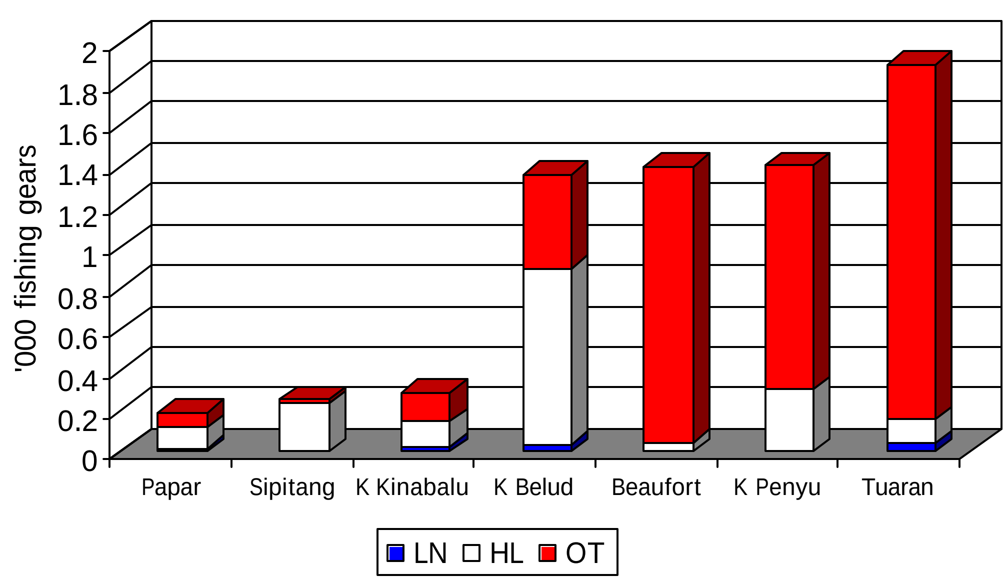


Figure 94. Spatial distribution of traditional fishing gears in the SSME area in Sabah, 1999 (16,231 gear units)

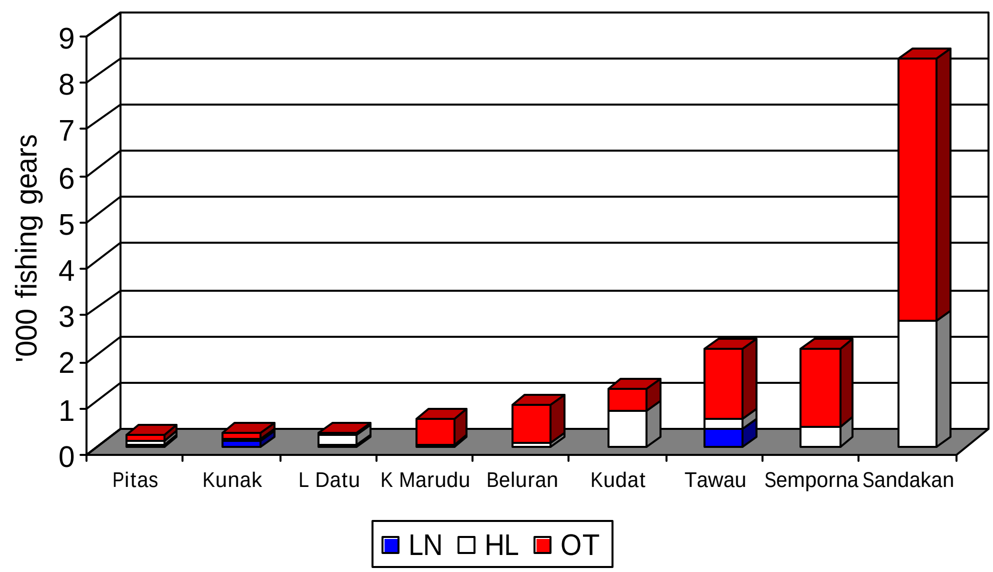


Figure 95. Breakdown of combined fishing effort in Sabah, 1999 (30,360 gear units)

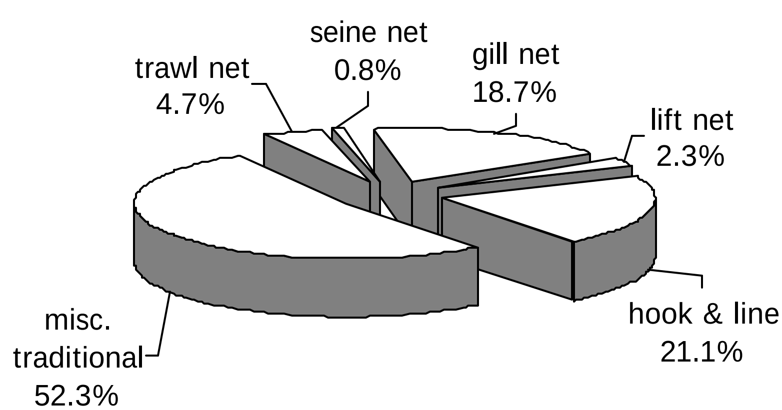


Figure 96. Breakdown of selected fishing effort in Sabah, 1999 (14,469 gear units)

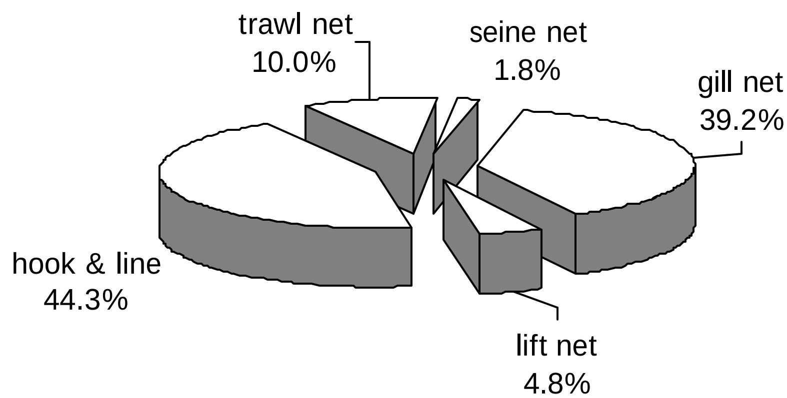


Figure 97. Breakdown of combined fishing effort in the SSME area, Sabah 1999 (20,976 gear units)

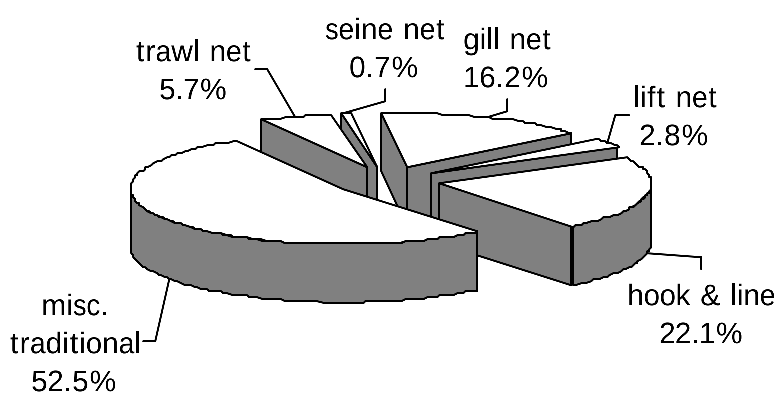


Figure 98. Breakdown of selected fishing effort in the SSME area, Sabah 1999 (9,971 gear units)

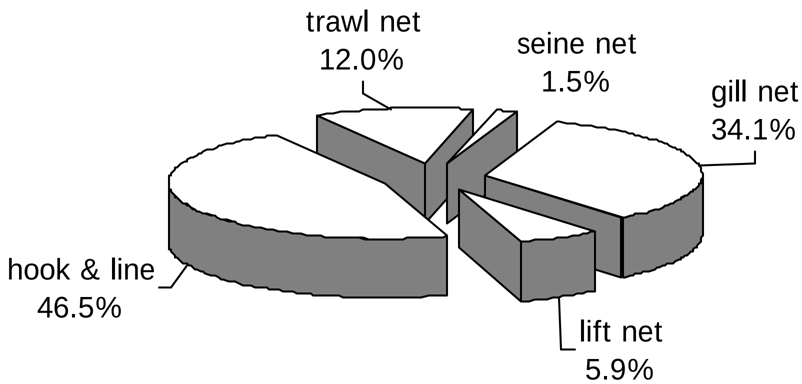


Figure 99. Breakdown of combined fishing effort in the non-SSME area, Sabah 1999 (9,384 gear units)

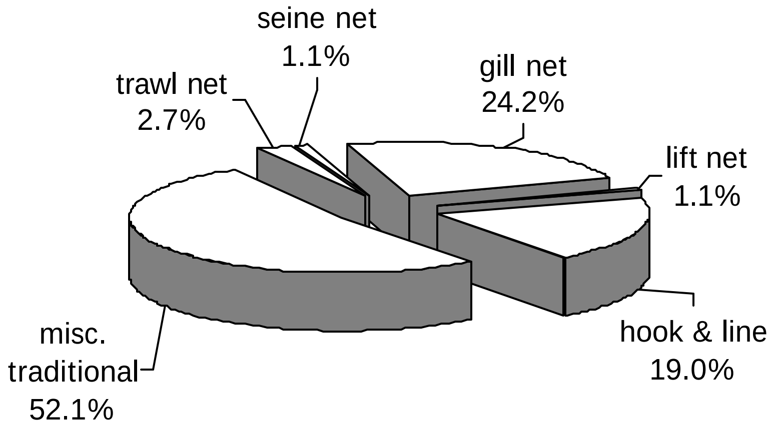


Figure 100. Breakdown of selected fishing effort in the non-SSME area, Sabah 1999 (4,498 gear units)

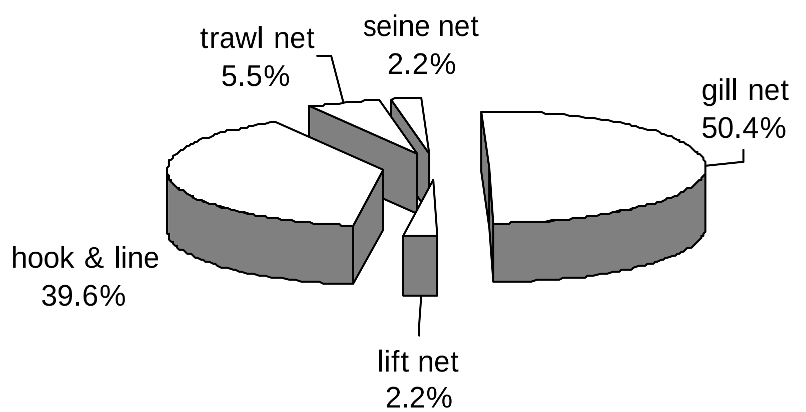


Figure 101. Spatial distribution of combined fishing effort in Sabah during the 1999 period (30,360 units)

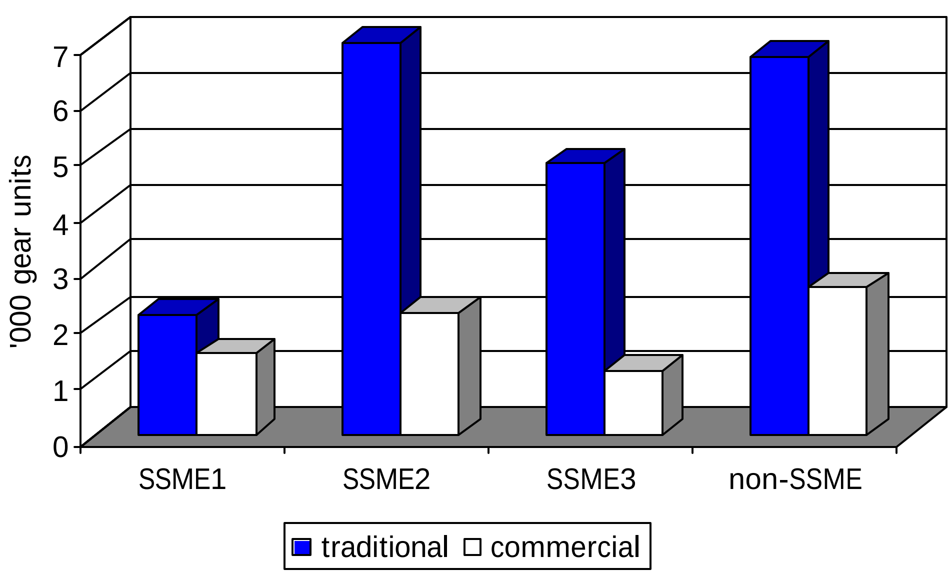


Figure 101. Spatial distribution of selected fishing effort in Sabah during the 1999 period (14,469 units)

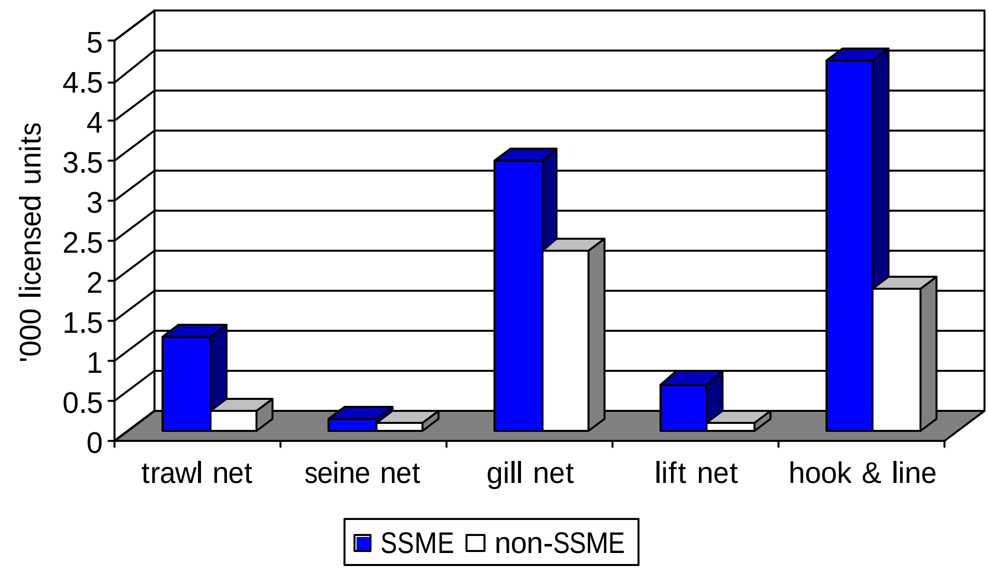


Figure 102. Spatial distribution of selected fishing effort in the SSME area during the 1999 period (9,971 units)

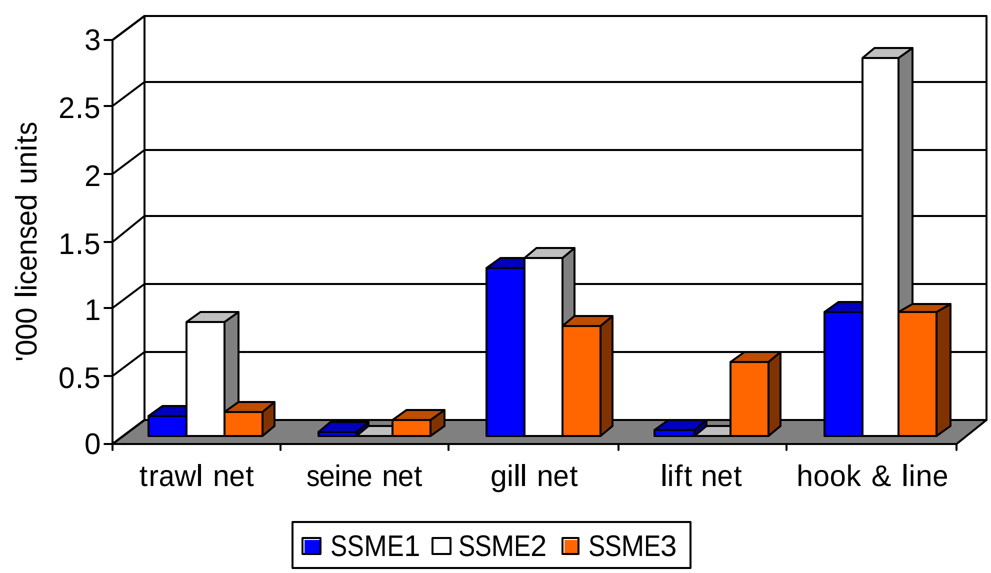


Figure 103a. Number of licences issued for commercial trawlers in Sabah, 1991-1999

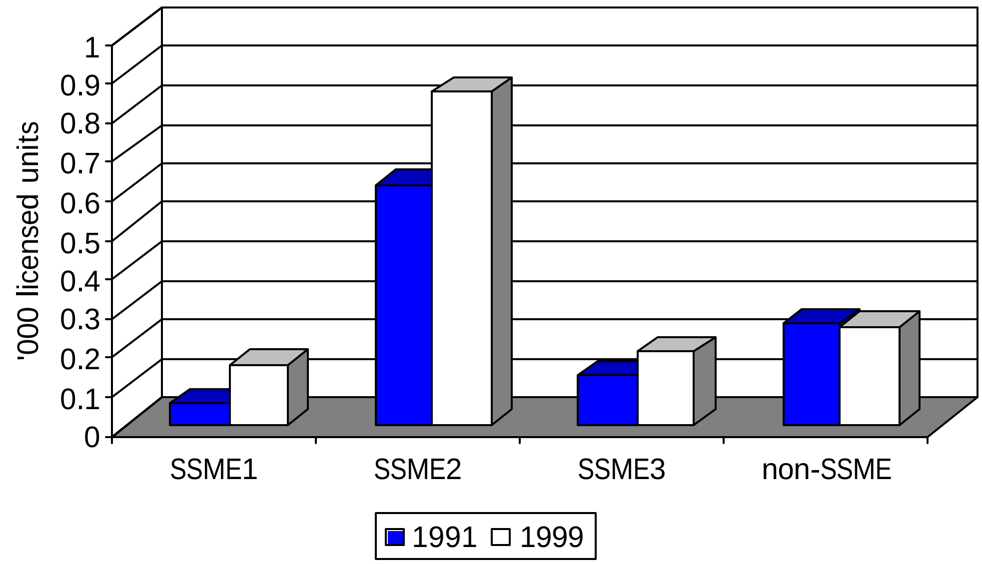
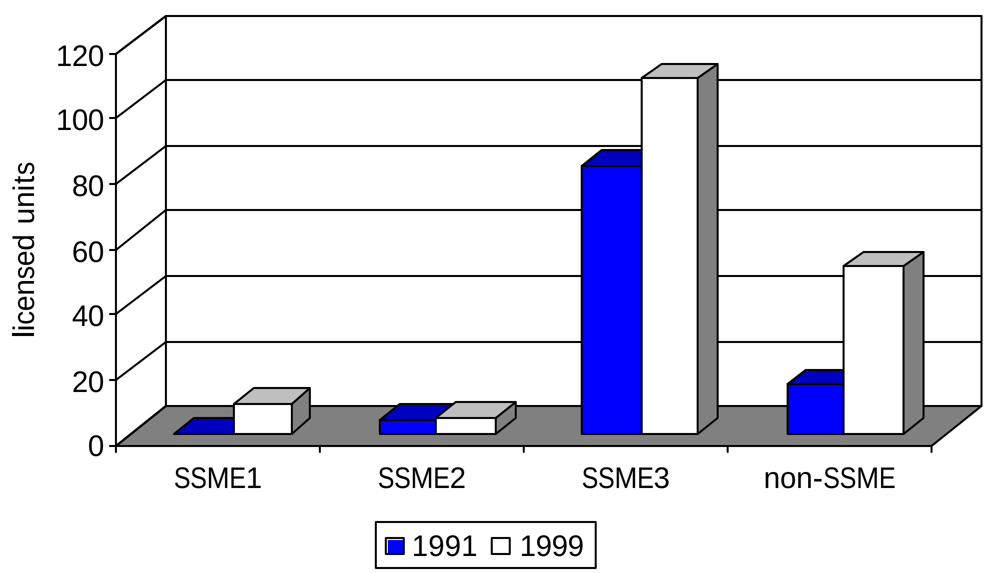


Figure 103b. Number of licences issued for commercial purse seiners in Sabah, 1991-1999



Fishing Vessels

In 1999, there are 10,456 fishing vessels in Sabah, comprising of 2,524 non-motorized NB units (24% total), 4,653 outboard engine OE units (45%), and 3,279 inboard engine IE units (31%). Compared to 1991, there was an increase of 75% for NB boats, 56% for OE boats and 54% for IE boats. Overall, the fishing fleet in 1999 had increased by 59% over the 1991 period (6,562 units). The spatial and temporal distribution of the fishing fleet in Sabah during the 1991 and 1999 periods by vessel type, gear usage and fishing districts are given in **Table A38-A41**. The spatial distribution of the fishing fleet by vessel type and fishing zone in 1991 and 1999 are given in **Figures 104-105**, which is summarized in *Table 97-98*.

Table 97: *Comparison of fishing fleet by fishing zone in Sabah, 1991-1999*

Fishing Zone	1991 Fishing Fleet			1999 Fishing Fleet			% change 1991-1999		
	NB boats	MB boats	Total	NB boats	MB boats	Total	NB boats	MB boats	Total
SSME-1	246	796	1,042	335	1,905	2,240	36.2	139.3	115.0
SSME-2	299	1,368	1,667	663	2,102	2,765	121.7	53.7	65.9
SSME-3	429	1,260	1,689	780	1,797	2,577	81.8	42.6	52.6
Total SSME	974	3,424	4,398	1,778	5,804	7,582	82.5	69.5	72.4
Non-SSME	466	1,698	2,164	746	2,218	2,964	60.1	30.6	37.0
TOTAL	1,440	5,122	6,562	2,524	8,022	10,546	75.3	56.6	60.7

** NB: non-motorized, MB: motorized

Table 98: *Comparison of motorized fishing fleet by fishing zone in Sabah, 1991-1999*

Fishing Zone	1991 Fishing Fleet			1999 Fishing Fleet			% change 1991-1999		
	OE boats	IE boats	Total	OE boats	IE boats	Total	OE boats	IE boats	Total
SSME-1	485	311	796	865	1,040	1,905	78.4	234.4	139.3
SSME-2	209	1,159	1,368	994	1,108	2,102	375.6	-4.4	53.7
SSME-3	886	374	1,260	1,037	760	1,797	17.0	103.2	42.6
Total SSME	1,580	1,844	3,424	2,896	2,908	5,804	83.3	57.7	69.5
Non-SSME	1,406	292	1,698	1,757	461	2,218	25.0	57.9	30.6
TOTAL	2,986	2,136	5,122	4,653	3,369	8,022	55.8	57.7	56.6

** OE: outboard engine, IE: inboard engine

The spatial fishing fleet characteristics in 1991 and 1999 are given respectively in *Tables 99-100* and *Tables 101-102* and **Figure 106**.

Table 99: *Distribution of fishing fleet by fishing zone, Sabah 1991*

Fishing Zone	% FISHING FLEET SHARE			TOTAL
	NB	OE	IE	
SSME-1	23.6	46.5	29.8	1,042
SSME-2	17.9	12.5	69.5	1,667
SSME-3	25.4	52.5	22.1	1,689
Total SSME	22.1	35.9	41.9	4,398
Non-SSME	21.5	65.0	13.5	2,164
TOTAL	21.9	45.5	32.6	6,562

Table 100: *Distribution of fishing zone by fishing fleet, Sabah 1991*

Fishing Fleet	% FISHING ZONE SHARE					TOTAL
	SSME-1	SSME-2	SSME-3	SSME	Non-SSME	
NB Vessels	17.1	20.8	29.8	67.7	32.4	1,440
OE Vessels	16.2	7.0	29.7	52.9	47.1	2,986
IE Vessels	14.6	54.3	17.5	86.4	13.7	2,136
TOTAL	15.9	25.4	25.7	67.0	33.0	6,562

Table 101: *Distribution of fishing fleet by fishing zone, Sabah 1999*

Fishing Zone	% FISHING FLEET SHARE			TOTAL
	NB	OE	IE	
SSME-1	15.0	38.6	46.4	2,240
SSME-2	24.0	35.9	40.1	2,765
SSME-3	30.3	40.2	29.5	2,577
Total SSME	23.5	38.2	38.4	7,582
Non-SSME	25.2	59.3	15.6	2,964
TOTAL	23.9	44.1	31.9	10,546

Table 102: *Distribution of fishing zone by fishing fleet, Sabah 1999*

Fishing Fleet	% FISHING ZONE SHARE					TOTAL
	SSME-1	SSME-2	SSME-3	SSME	Non-SSME	
NB Vessels	13.3	26.3	30.9	70.5	29.6	2,524
OE Vessels	18.6	21.4	22.3	62.3	37.8	4,653
IE Vessels	30.9	32.9	22.6	86.4	13.7	3,369
TOTAL	21.2	26.2	24.4	71.8	28.1	10,546

The spatial distribution of inboard engine fishing vessels by GRT and gear deployment in 1991 and 1999 are given respectively in **Figures 107-110** and **Table A38-A40**.

Figure 104. Spatial breakdown of fishing fleet by vessel type in Sabah during the 1991 period (6,562 units)

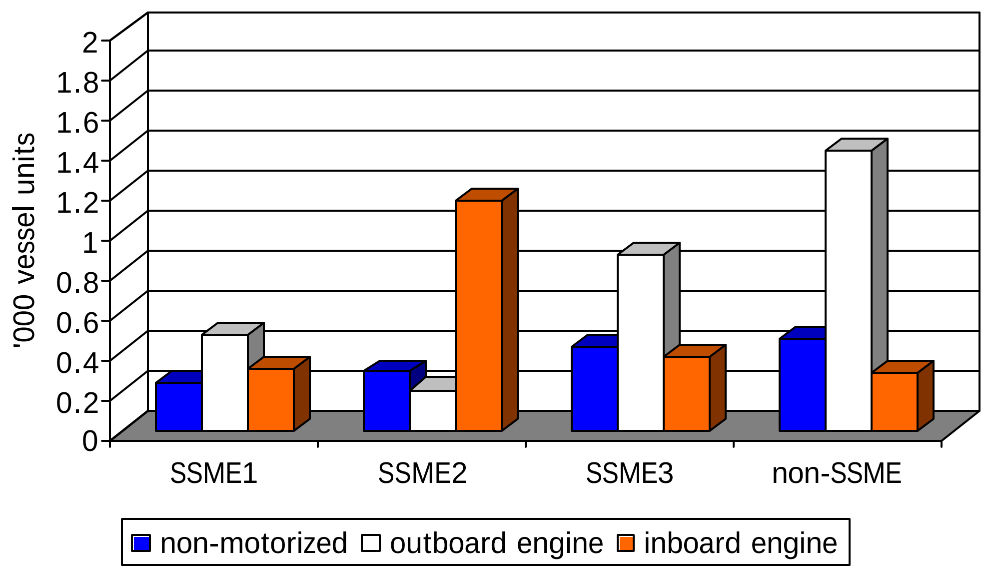


Figure 105 Spatial breakdown of fishing fleet by vessel type in Sabah during the 1999 period (10,546 units)

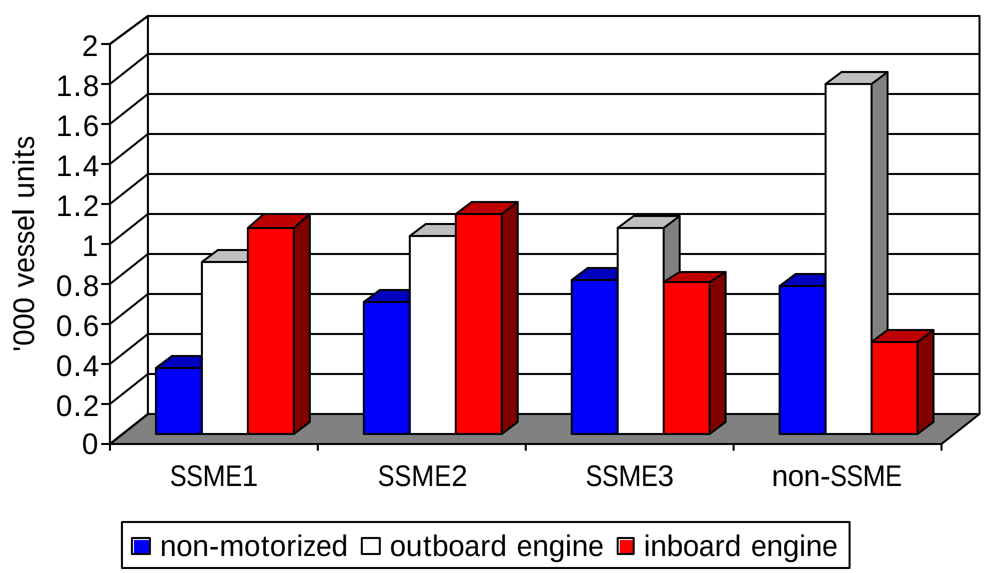


Figure 106. Temporal breakdown of fishing fleet by vessel type in the SSME area during the 1991-1999 period

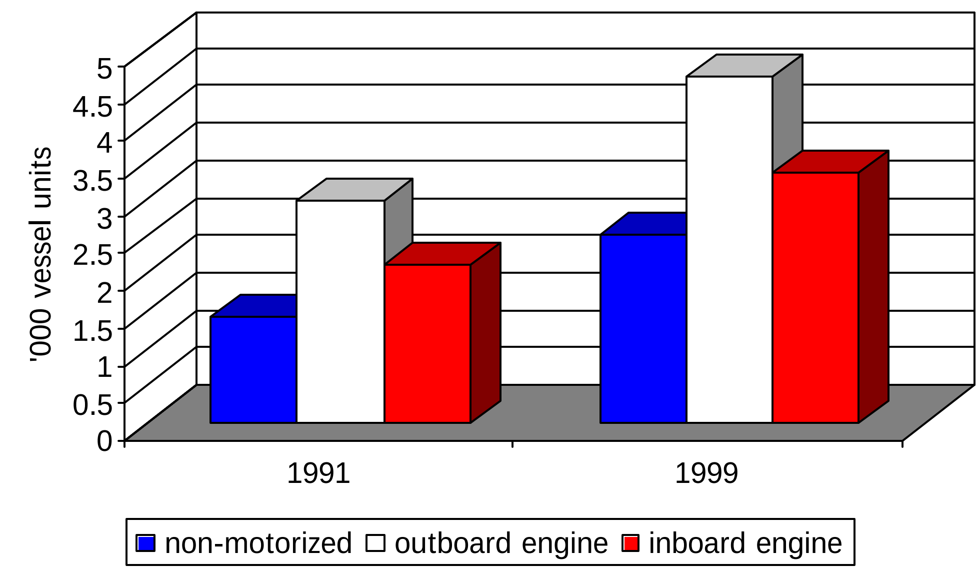


Figure 107. Spatial distribution of vessels by GRT in Sabah during the 1991 period (inboard engine - 2,136 units)

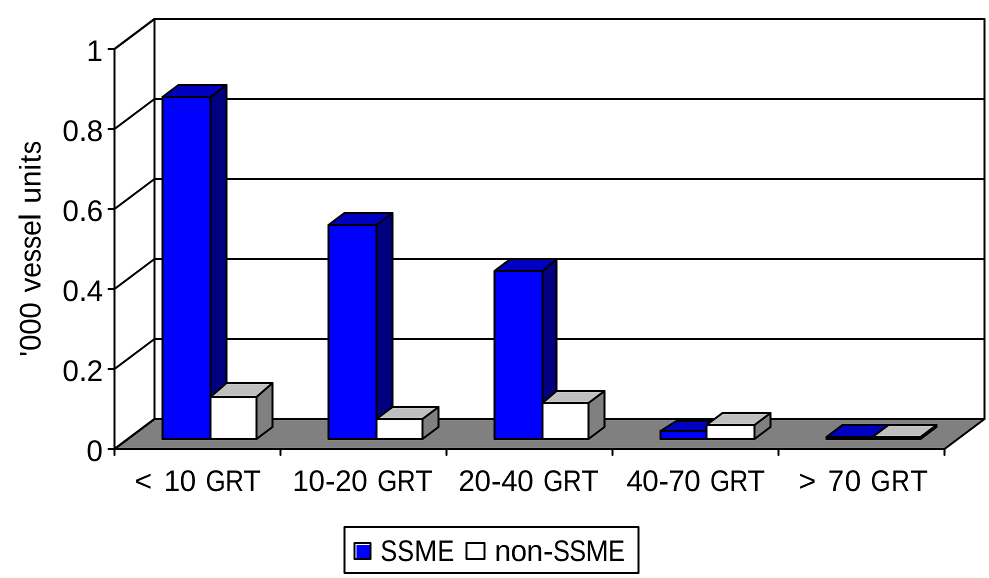


Figure 108. Spatial distribution of vessels by GRT in Sabah during the 1999 period (inboard engine - 3,279 units)

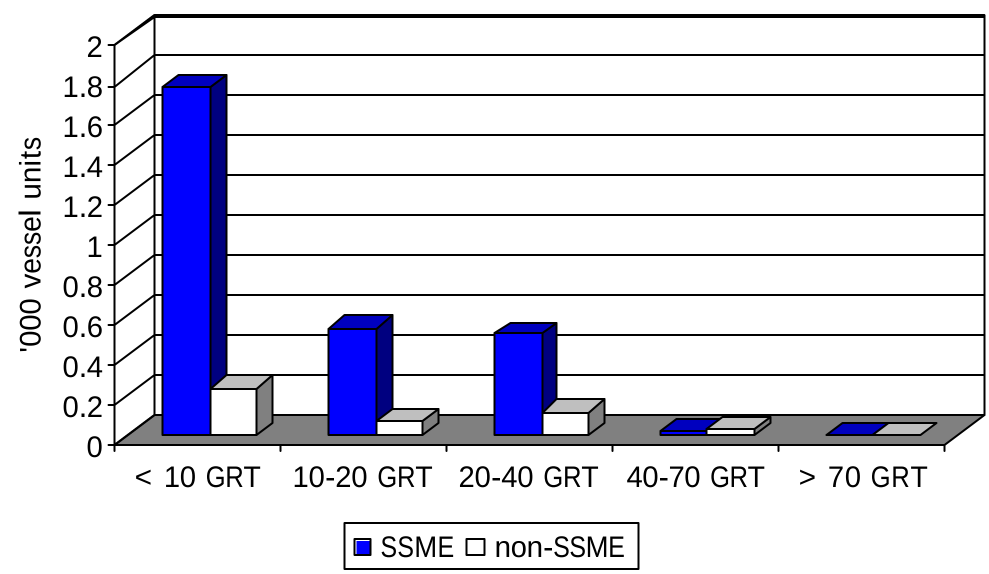


Figure 109. Spatial distribution of vessels by GRT in the SSME area during the 1999 period (inboard engine - 2,818 units)

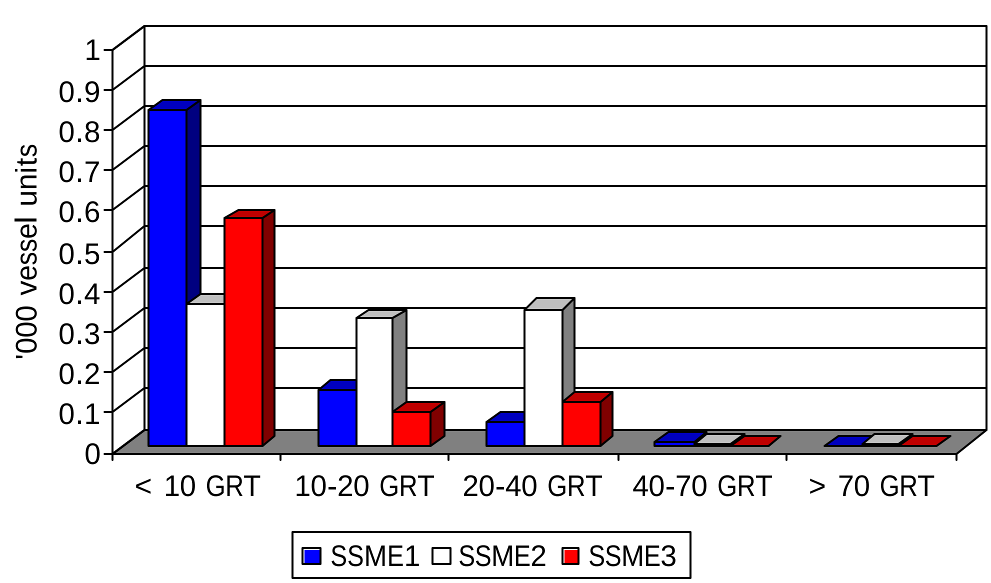


Figure 110a. Temporal distribution of motorized vessels by GRT in the SSME area during the 1991-1999 period

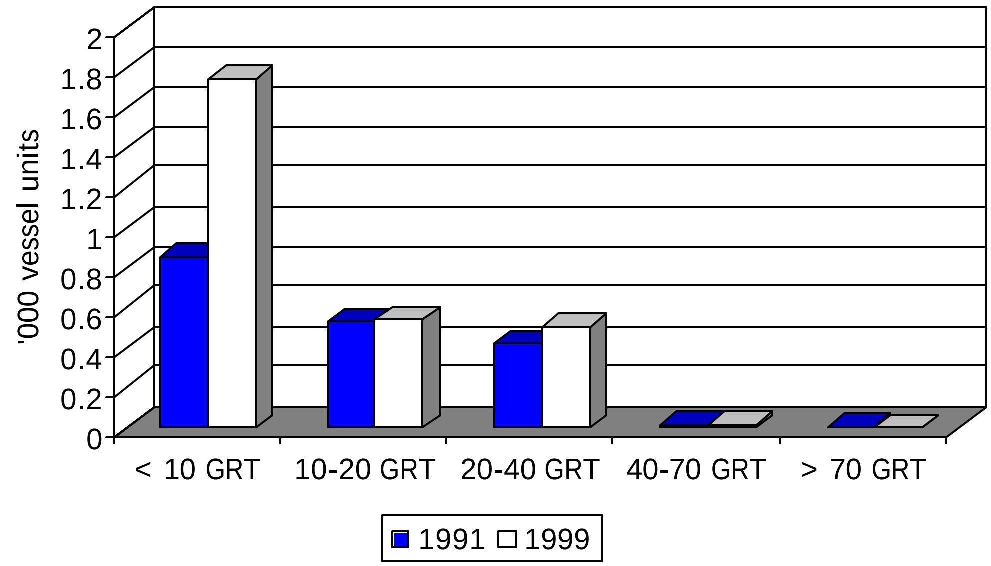
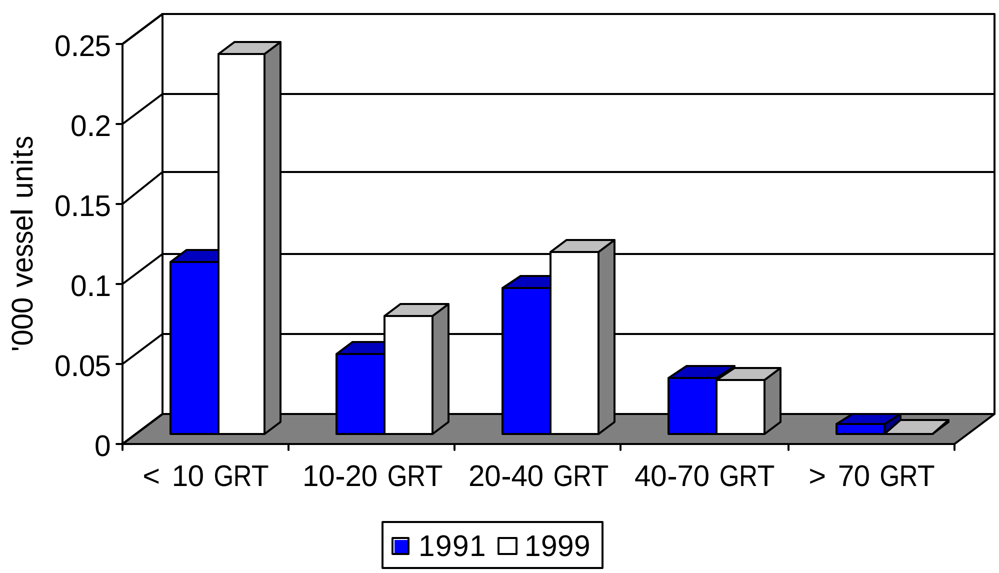


Figure 110b. Temporal distribution of motorized vessels by GRT in the non-SSME area during the 1991-1999 period



Marine Fish Landings

The DOF Sabah annual fisheries statistics for 1991-1999 are used in this report. Since 1991, the estimation of fish landings had been implemented under the national SMPP[127] (*Sistem Maklumat Pengurusan Perikanan*) Program. Landing statistics were estimated by stratified random sampling of selected fishing gears in the major landing sites of the 16 coastal districts. Gear type landings are estimated by species according to ISSCAAP (*International Standard Statistical Classification of Aquatic Animals and Plants*). Before 1991, landing statistics were estimated from a number of sources: fish market observations, fishing operation logbooks (in the case for trawlers), reports from fish processing plants and export data. Fish landing statistics reported before 1991 were not used in this report to ensure a common data source representation.

In 1999, marine fish landings in Sabah totaled 207,211 metric tons, with an increase of 91% over the 1991 period (108,437 metric ton) (**Figures 120-121**). The non-SSME and SSME areas respectively contributed 33% (range: 25-44%) and 67% (range: 56-75%) to the annual marine fish landings during the 9-year (**Figures 122-124**). The non-SSME contribution to the state annual fish landings had decreased by 24%, from 44% in 1991 to 33% in 1999. On the other hand, the SSME contribution to the annual fish landings had increased by 19%, from 56% in 1991 to 67% in 1999.

The temporal and spatial distribution of marine fish landing by fishing gear and resource group during the 1991-1999 period are given in **Tables A42-A71** and **Figures 111-355**. It is clearly shown that the SSME area contributed at least 65% to the annual marine fish landings in Sabah. The breakdown of the regional contribution to the annual marine fish landings in Sabah during the 1991-1999, 1997-1999 and 1999 periods is summarized in *Table 103.*

Table 103: *Marine fish landing breakdown by fishing region, Sabah 1991-1999*

% Average Annual Fish Landings	% STATE SHARE					State TOTAL metric ton
	SSME-1	SSME-2	SSME-3	SSME	Non-SSME	
1991-1999	16.31	20.31	30.28	66.89	33.11	164,947
Range:	10.8-21.2	16.3-24.5	20.0-41.2	56.2-75.0	25.0-43.8	108,437-207,211
1997-1999	15.73	17.15	32.65	65.53	34.47	192,579
Range:	14.4-16.9	16.3-18.0	30.5-33.9	64.4-66.7	33.3-35.6	174,265-207,211
1999 Period	16.90	16.27	33.55	66.71	33.29	207,211

Spatial Landings

During the 1991-1999 period, four districts contributed the bulk of the annual landings in Sabah: Sandakan, Kudat and Kunak (SSME) and Kota Kinabalu (non-SSME). In 1999, these districts contributed 68% to the total landings, an increase of 18% from 58% in 1991. The spatial fish landing distribution during the 1991-1999 period are shown in **Figures 115-119**.

In the non-SSME area, Kota Kinabalu contributed 79% to the non-SSME landings in 1999 (68,976 metric tons), followed by Kota Belud (8.0%), Beaufort (4.5%), Kuala Penyu (4.3%), Sipitang (1.9%), Tuaran (1.3%) and Papar (1.2%) (**Figure 112**). During the 1991-1999 period, landings in Kota Kinabalu had increased by 168%, followed by Beaufort (19%), Kota Belud (18%) and Sipitang (13%) (**Figures 131d-131f**). On the other hand, landings in Tuaran, Papar and Kuala

[127] Fisheries Management Information System or FMIS program

Penyu had decreased respectively by 90%, 88% and 13% during the 9-year period. The decline in landings in these 3 districts was mainly due to temporal changes in the fishing effort scenario (**Figures 79-94**) and the fact that fishing vessels operating in these areas tend to land their catches in Kota Kinabalu – the principal fishing port in the non-SSME area. Kota Kinabalu has the highest landings in the state, which represents 79% of the non-SSME contribution or 26% of the total landings (**Figures 113-114**).

During the 9-year period, landings in the non-SSME area had increased by 45%, from 47,478 metric tons in 1991 to 68,976 metric tons in 1999 (**Figures 131a**). During the same period, landings in the SSME area had increased by 127%, from 60,959 metric tons in 1991 to 138,236 metric tons in 1999 (**Figures 132-134**). In the SSME area, significant increase in landings was noted in SSME-1 and SSME-3. SSME-3 has the highest increase in landings (207%), from 22,637 metric tons in 1991 to 69,513 metric tons in 1999. In SSME-1, landings had increased by 198%, from 11,761 metric tons in 1991 to 35,014 metric tons in 1999. Landings in SSME-2 had increased only by 27%, from 26,561 metric tons in 1991 to 33,708 metric tons in 1999 because of declining landings in Beluran.

In the SSME area, Kudat contributed 24.7% to the SSME landings of 138,235 metric tons in 1999, followed by Sandakan (21.3%), Kunak (16.8%), Tawau (14.1%), Lahad Datu (10.8%), Semporna (8.7%), Beluran (3.1%), Pitas (0.3%) and Kota Marudu (0.3%). During the 9-year period, significant increases in landings were noted in most districts except for Beluran and Kota Marudu. Lahad Datu has the highest increase in landings (420%), followed by Tawau (313%), Kudat (208%), Pitas (123%), Kunak (113%) and Sandakan (45%). On the other hand, landings in Beluran and Kota Marudu had respectively declined by 32% and 19% during the 1991-1999 period.

Kudat contributed more than 95% to SSME-1 annual landings. Kudat contribution to the SSME-1 annual landings had increased by 3% during the 9-year, from 95% in 1991 to 98% in 1999. Landings in other districts had decreased during the same period. Pitas share of the SSME-1 annual landings had decreased by 25%, from 2% in 1991 to 1% in 1999. While Kota Marudu share had decreased by 73%, from 4% in 1991 to 1% in 1999. The significant decrease in Kota Marudu share of the SSME-1 annual landings was due to declining jellyfish landings that had make up the bulk of the annual landings in the early 90s. Most of the annual landings in Kudat were contributed from trawl net landings. The temporal trend in the landings in SSME-1 during the 1991-1999 period is shown in **Figure 116b**. The characteristics of the marine fisheries sector in SSME-1 are given in **Figures 156-173**.

In SSME-1, the high monthly landings between 1992 and 1995 (4,000-6,700 metric tons) were attributed by trawl net landings from Kudat and jellyfish landings in Kota Marudu. During that period, jellyfish landings peaked during the months of February and May. However, for some unknown reasons the annual jellyfish landings had declined to less than 100 metric tons since 1997. The increasing but erratic trend in the temporal landings in SSME-1 was due to the high variation of monthly trawl net landings. At present, SSME-1 is major contributor of trawl net landings in Sabah.

Sandakan is the main contributor of landings in the SSME-2 area. No fish landing records were available for Kinabatangan, where catches in the Kinabatangan fishing grounds are landed in Sandakan. Sandakan contribution to the SSME-2 annual landings had increased by 14%, from 76% in 1991 to 87% in 1999. On the other hand, Beluran contribution to the SSME-2 annual landings had decreased by 46%, from 24% in 1991 to 13% in 1999. The SSME-2 monthly landing trend during the 1991-1999 period is given in **Figure 116c**. The characteristics of the marine fisheries sector in SSME-2 are given in **Figures 174-192**.

In SSME-2, the monthly landings seem to have saturated around 2,500-3,500 metric tons. It is highly probable that the trawler fishery that contributed the bulk of the annual landings in the early 90s is already stagnated with exploitation levels within limits of sustainable production. Despite having the largest trawler fleet in Sabah, SSME-2 contribution to the trawl net landings had significantly decreased throughout the years. SSME-2 used to be the major source of trawl net landings in the state since the 60s, where its position had now been taken over by SSME-1. There is no further development of the trawler fishery in SSME-2 because of the limited fishing grounds, which is in close proximity with the Philippines. With the decline of the trawler fishery, the future of marine fisheries in SSME-2 depends on the further development of the pelagic and non-trawler demersal fisheries in reef and non-reef areas. However, the offshore fishing grounds could not be fully tapped at this present time being constrained by security problems, where there were a number of fishing vessels operating near the SSME-2 boundary being hijacked for ransom by pirates in the past. The development of reef fisheries is also not feasible because most of the reef areas in the SSME-2 area had been severely damaged by destructive fishing practices, including blast fishing in particular, that may have also attributed to the decline in hook & line landings throughout the years.

Kunak is the major contributor of landings in the SSME-3 area. However, Kunak contribution to the SSME-3 annual landings had decreased by 31%, from 48% in 1991 to 33% in 1999. Tawau is the second major contributor to the SSME-3 annual landings, where its contribution had increased by 35%, from 21% in 1991 to 28% in 1999. Lahad Datu is a major contributor to the SSME-3 annual landings, where its contribution had increased by 69%, from 13% in 1991 to 21% in 1999. On the other hand, Semporna is the smallest contributor of landings in the SSME-3, where its contribution had decreased by 6%, from 18% in 1991 to 17% in 1999. The monthly landing trend in the SSME-2 area during the 1991-1999 period is shown in **Figure 116c**. The characteristics of the marine fisheries sector in SSME-3 are given in **Figures 193-211**.

In SSME-3, the temporal trend of the monthly landings seems to be erratic and in recent years had fluctuated around the 4,000-7,000 metric tons. It is very difficult to ascertain the status of resource exploitation in SSME-3. The marine fisheries sector in SSME-3 is more diverse in terms of gear deployment and scale of operations. Traditional gear landings (*bagang* lift net, hook & line and miscellaneous gears) make up a significant portion of the SSME-3 annual landings, and in recent years contributed a high portion of the state traditional gear landings. SSME-3 is also the largest contributor of pelagic and reef-fish landings in the state. Most of the state tuna and anchovy landings come from the SSME-3 area.

In summary, the SSME contributed about 65% to the annual landings, with SSME-3 making up 50% of the SSME share, followed by SSME-1 (26%) and SSME-2 (24%). During the 9-year period, SSME contribution had increased by 19%, from 56% in 1991 to 67% in 1999 (peaking at 75% in 1996), where SSME-1 and SSME-3 share of the annual landings had respectively increased by 56% and 61%. SSME-1 share had increased from 11% in 1991 to 17% in 1999 (peaking at 21% in 1993 – due to jellyfish landings). While SSME-3 share had increased from 21% in 1991 to 34% in 1999 (peaking at 41% in 1996 – due to seine net landing). On the other hand, SSME-2 share had decreased by 34%, from 24% in 1991 to 16% in 1999. The non-SSME contribution to the annual landings had decreased by 24%, from 44% in 1991 to 33% in 1999 (minimum of 25% in 1996). Overall, the non-SSME area had contributed less than 35% to the annual landings in Sabah.

During the 1997-1999 period, commercial gears contributed respectively 86% and 68% to the non-SSME and SSME annual landings. In the SSME area, commercial gears contributed 82%, 70% and 60% respectively to the annual landings in SSME-1, SSME-2 and SSME-3. Overall, commercial gears contributed 74% to the annual landings in Sabah.

Gear Landings

During the 1991-1999 period, trawl net contributed 33.1% to the annual landings in Sabah, followed by seine net (20.0%), gill net (17.6%), hook & line (13.1%), lift net (10.2%) and miscellaneous gears (5.9%) (**Figure 248**). The principal contributing fishing gears throughout the 9-year period are trawl net, seine net, and hook & line (**Figure 140a**). The fishing gear contribution to the annual landings during the 1991-1999 period is summarized in *Table 104.* The non-SSME and SSME contribution to the annual gear landings in Sabah for the 1991-1999 period is summarized in *Tables 105-106.*

Table 104: *Fishing gear breakdown of annual landings in Sabah, 1991-1999*

Year	% GEAR CONTRIBUTION							
	TN	SN	GN	LN	HL	OT	COM	TRA
1991	28.5	18.5	22.9	11.6	13.6	4.9	70.0	30.0
1992	25.4	16.3	24.3	12.9	13.6	7.5	65.9	34.1
1993	25.4	19.6	20.5	9.1	13.9	11.5	65.5	34.5
1994	33.1	19.2	20.9	10.9	10.4	5.5	73.2	26.8
1995	29.5	21.8	17.5	12.5	13.7	5.0	68.8	31.2
1996	30.4	24.7	15.6	13.6	11.6	4.1	70.7	29.3
1997	39.0	18.7	12.7	11.0	13.6	5.1	70.3	29.7
1998	42.1	19.8	12.8	6.5	14.3	4.5	74.7	25.3
1999	44.1	21.3	11.1	4.9	13.6	5.0	76.5	23.5

Commercial gear landings make up a significant portion of the annual landings. In 1991, trawl net contributed 28.6% to the total landings, followed by gill net (22.9%), seine net (18.5%), hook & line (13.6%), lift net 11.6%) and miscellaneous gears (4.9%). In 1999, trawl net contributed 44.1% to the total landings, followed by seine net (21.3%), hook & line (13.6%), gill net (11.1%), lift net (4.9%) and miscellaneous gears (5.0%). During the 1997-1999 period, trawl net contributed 41.8% to the annual landings, followed by seine net (20.0%), hook & line (13.4%), gill net (12.2%), lift net (7.3%) and miscellaneous gears (4.9%).

In 1999, commercial gear landings amounted to 158,427 metric tons, with an increase of 109% over the 1991 period (75,875 metric tons). Commercial gear contribution to the annual landings had increased by 9%, from 70% in 1991 to 77% in 1999 (**Figures 125-127**). During the 1991-1999 period, commercial gears contributed between 65-76% to the annual landings, with trawl net landings making up 46.5% of the annual commercial gear landings, followed by seine net (28.3%) and gill net (25.2%). The non-SSME and SSME areas contributed respectively 33% (range: 26-42%) and 67% (range: 58-74%) to the annual commercial gear landings in the state. SSME contribution to the annual commercial gear landings had increased by 5%, from 59% in 1991 to 63% in 1999 (**Figures 144-146**). On the other hand, the non-SSME contribution to the annual commercial gear landings decreased by 8%, from 41% in 1991 to 37% in 1999.

Table 105: *Non-SSME contribution to the annual gear landings in Sabah (% total)*

Year	% Non-SSME CONTRIBUTION								
	TN	SN	GN	LN	HL	OT	TOTAL	COM	TRA
1991	43.2	30.6	45.5	54.8	60.6	16.0	43.8	40.6	43.8
1992	32.0	18.5	42.2	49.8	63.4	16.1	37.7	32.5	37.7
1993	29.1	14.6	34.9	46.8	59.3	9.7	31.0	26.6	31.0
1994	29.0	21.6	29.3	35.1	38.7	25.3	29.1	27.1	29.1
1995	33.6	23.7	23.4	31.8	25.5	25.5	27.9	27.9	27.9
1996	37.3	13.9	21.6	21.0	23.9	31.2	25.0	25.7	25.0
1997	53.5	26.6	23.1	17.1	18.0	27.9	34.5	40.9	34.5
1998	55.1	28.3	18.1	19.8	14.7	25.8	35.6	41.6	35.6
1999	49.9	19.9	21.5	21.5	13.6	35.4	33.3	37.4	33.3

Table 106: *SSME contribution to the annual gear landings in Sabah (% total)*

Year	% SSME CONTRIBUTION								
	TN	SN	GN	LN	HL	OT	TOTAL	COM	TRA
1991	56.8	69.4	54.5	45.2	39.4	84.0	56.2	59.4	56.2
1992	68.0	81.5	57.8	50.2	36.6	83.9	62.3	67.5	62.3
1993	70.9	85.4	65.1	53.2	40.7	90.3	69.0	73.4	69.0
1994	71.0	78.4	70.7	64.9	61.3	74.7	70.9	72.9	70.9
1995	66.4	76.3	76.6	68.2	74.5	74.5	72.1	72.1	72.1
1996	62.7	86.1	78.4	79.0	76.1	68.8	75.0	74.3	75.0
1997	46.5	73.4	76.9	82.9	82.0	72.1	65.5	59.1	65.5
1998	44.9	71.7	81.9	80.2	85.3	74.2	64.4	58.4	64.4
1999	50.1	80.1	78.5	78.5	86.4	64.6	66.7	62.6	66.7

In 1999, Kota Kinabalu contributed 32.6% to the annual commercial gear landings (158,427 metric tons), followed by Kudat (17.5%), Sandakan (12.8%), Kunak (12.1%), Tawau (8.7%), Semporna (6.1%), Lahad Datu (2.5%), Beluran (2.5%), Kuala Penyu (1.8%) and Beaufort (1.1%). Other districts only contributed less than 1% to the annual commercial gear landings. During the 1991-1999 period, Lahad Datu has the highest commercial gear landing increase (356%), followed by Tawau (292%), Kota Kinabalu (202%), Kudat (182%), Semporna (181%), Kunak (181%), Pitas (109%), Sipitang (29%) and Sandakan (28%). On the other hand, Tuaran has the highest decrease in commercial gear landings (96%), followed by Papar (88%), Kota Belud (23%), Beaufort (19%), Kuala Penyu (14%), Kota Marudu (9%) and Beluran (6%).

In 1999, Lahad Datu contributed 22.2% to the annual traditional gear landings, followed by Sandakan (18.7%), Kudat (13.2%), Tawau (11.7%), Kota Belud (8.4%), Kunak (8.1%), Kota Kinabalu (5.6%), Semporna (4.6%), Beaufort (2.9%) and Tuaran (1.7%). Other districts contributed less than 1% to the annual traditional gear landings. During the 1991-1999 period, Lahad Datu has the highest increase in traditional gear landings (448%), followed by Kudat (410%), Tawau (377%), Semporna (224%), Beaufort (169%), Pitas (129%), Sandakan (109%), Kota Belud (46%) and Kuala Penyu (26%). On the other hand, Papar has the highest decrease in traditional gear landings (88%), followed by Beluran (81%), Kota Marudu (65%), Tuaran (40%), Sipitang (40%), Kota Kinabalu (12%) and Kunak (3%).

During the 1991-1999 period, traditional gear landings make up the bulk of the annual landings in Tuaran, Kota Belud, Lahad Datu and Pitas (**Figures 111-112**). In the remaining districts, commercial gear landings make up more than 50% of the annual landings.

In 1991, districts with commercial gear landings making up more than 50% of the total landings include Kuala Penyu (97% contribution to the total landings), Kudat (89%), Kota Kinabalu (85%), Semporna (83%), Kota Marudu (81%), Beaufort (80%), Sandakan (79%), Sipitang (76%), Tawau (75%), Beluran (66%), Kunak (62.7%) and Papar (52.3%). On the other hand, districts with traditional gear landings making up more than 50% of the total landings (**Figure 113**). include Tuaran (76%), Lahad Datu (69%), Pitas (69%) and Kota Belud (60%). In 1999, districts with dominant commercial gear landings include Kuala Penyu (97%), Kota Kinabalu (95%), Kota Marudu (92%), Beluran (91%), Sipitang (87%), Kunak (83%), Kudat (81%), Semporna (81%), Tawau (71%), Sandakan (69%), Beaufort (55%) and Papar (52%). Other districts with significant traditional gear landings include Tuaran (91%), Kota Belud (74%), Lahad Datu (73%) and Pitas (71%) (**Figure 114**).

In 1999, trawl net landings contributed 91,289 metric tons, with an increase of 195% over the 1991 period (30,955 metric tons) (**Figure 215**). During the 1991-1999 period, trawl net landings make up 46.5% of the annual commercial gear landings (**Figure 217a**). Trawl net contribution had increased by 41%, from 41% in 1991 to 58% in 1999. During the 9-year period, the SSME and non-SSME areas respectively contributed 60% and 40% to the annual commercial gear landings (**Figure 216**). The SSME contribution to the annual trawl net landings had decreased by 7%, from 57% in 1991 to 50% in 1999. On the other hand, the non-SSME contribution had increased by 16%, from 43% in 1991 to 50% in 1999. During the 1997-1999 period, demersal fishes make up 77% of the annual trawl net landings, with finish representing 73% of the annual demersal landings, followed by shrimp (11%) and invertebrates (16%). Pelagic fishes make up 23% of the annual trawl net landings, with mackerels making up 20% of the annual pelagic portion, followed by round scad (15%) and other pelagic species (65%).

In 1999, seine net landings contributed 44,162 metric tons, with an increase of 120% over the 1991 period (20,061 metric tons) (**Figure 221**). During the 1991-1999 period, seine net make up 28.3% of the annual commercial gear landings. Contribution from seine net to the annual commercial gear landings had increased by 5%, from 26% in 1991 to 28% in 1999 (**Figure 223a**). The non-SSME and SSME areas contributed respectively 22% and 78% to the annual seine net landings during the 1991-1999 period (**Figure 222**). The SSME contribution to the annual seine net landings had increased by 16% during the 9-year period, from 69% in 1991 to 80% in 1999. On the other hand, contribution from the non-SSME area had decreased by 35%, from 31% in 1991 to 20% in 1999. During the 1997-1999 period, pelagic fishes represents 93% of the annual seine net landings, with sardine making up 34% of the pelagic landings, followed by tuna (23%), round scad (21%) and other pelagic species (22%). Demersal fishes only make up 7% of the annual seine net landings, with finfish contributing 88% to the annual demersal landings, followed by invertebrates (10%) and shrimp (2%).

In 1999, gill net landings contributed 22,976 metric tons, with a decrease of 7.6% over the 1991 period (24,859 metric tons) (**Figure 227**). During the 1991-1999 period, gill net contributed 25.2% to the annual commercial gear landings. Gill net contribution to the annual commercial gear landings had declined by 56%, from 33% in 1991 to 15% in 1999 (**Figure 229a**). The non-SSME and SSME areas contributed respectively 29% and 71% to the annual gill net landings during the 1991-1999 period (**Figure 228**). The SSME contribution to the annual gill net landings had increased by 44%, from 55% in 1991 to 79% in 1999. On the other hand, the non-SSME contribution had decreased by 53%, from 46% in 1991 to 22% in 1999. During the 1997-1999 period, pelagic fishes represents 53% of the annual gill net landings, which comprised of 17% tuna and 83% other pelagic species. On the other hand, demersal fishes represents 47% of the annual gill net landings, with finfish making up 78% of the annual demersal portion, followed by shrimp (18%) and invertebrates (4%).

Overall, demersal fishes make up 52% of the annual commercial gear landings in Sabah, with finfish representing 74% of the annual demersal landings, followed by invertebrates (14%) and shrimps (12%). On the other hand, sardine makes up 19% of the annual pelagic landings, followed by tuna (16%), round scad (16%), mackerel and other pelagic species (39%).

In 1999, traditional gears contributed 48,785 metric tons to the total landings, with an increase of 49.8% over the 1991 period (32,562 metric tons). Contribution from traditional gears to the annual landings had decreased by 22%, from 30% in 1991 to 24% in 1999 (**Figures 125-127**). Traditional gears contributed 29.4% to the annual total landings during the 1991-1999 period, with hook & line making up 45.3% of the annual traditional gear landings, followed by lift nets (34.8%) and miscellaneous gears (19.9%). Both non-SSME and SSME areas respectively contributed 35% and 65% to the annual traditional gear landings. The SSME contribution to the annual traditional gear landings had increased by 64% during the 9-year period, from 49% in 1991 to 81% in 1999 (**Figures 128-129**). On the other hand, the non-SSME area contribution to the annual traditional gear landings had decreased by 61%, from 51% in 1991 to 20% in 1999.

In 1999, lift net landings contributed 10,155 metric tons, with a decrease of 19% over the 1991 period (12,530 metric tons) (**Figure 233**). During the 1991-1999 period, lift net contributed 34.8% to the annual traditional gear landings. Lift net contribution to the annual traditional gear landings had declined by 46% during the 9-year period, from 39% in 1991 to 21% in 1991 (**Figure 235a**).

The non-SSME and SSME areas contributed respectively 33% and 67% to the annual lift net landings (**Figure 234**). The SSME contribution to the annual lift net landings had increased by 33% during the 9-year period, from 45% in 1991 to 79% in 1999. On the other hand, the non-SSME contribution to the annual lift net landings had decreased by 61%, from 55% in 1991 to 22% in 1999. During the 1997-1999 period, pelagic fishes represents 89% of the annual lift net landings, with anchovy making up 23% of the annual pelagic portion, followed by round scad (22%), sardine (21%) and other pelagic species (33%). Demersal fish only make up 11% of the annual lift landings, comprising of 32% finfish, 7% shrimp and 61% invertebrates.

In 1999, hook & line landings contributed 28,261 metric tons, with an increase of 92% over the 1991 period (14,742 metric tons) (**Figure 239**). During the 1991-1999 period, hook & line gears contributed 45.3% to the annual traditional gear landings. Hook & line contribution to the annual traditional gear landings had increased by 28.0% during the 9-year period, from 45% in 1991 to 58% in 1999 (**Figure 241a**).

The non-SSME and SSME areas contributed respectively 35% and 65% to the annual hook & line landings (**Figure 240**). The SSME contribution to the annual hook & line landings had increased by 119% during the 9-year period, from 39% in 1991 to 86% in 1999. On the other hand, the non-SSME contribution to the annual hook & line landings had decreased by 78%, from 61% in 1991 to 14% in 1991. During the 1997-1999 period, demersal fishes represents 63% of the annual hook & line landings (97% finfish and 3% invertebrates). While pelagic fishes make up 37% of the annual hook & line landings, comprising of 11% tuna, 5% mackerel and 84% other pelagic species.

In 1999, miscellaneous gear landings contributed 10,369 metric tons, with an increase of 96% over the 1991 period (5,290 metric tons) (**Figure 245**). Miscellaneous gears contributed 20% to the annual traditional gear landings. Miscellaneous gear contribution to the annual traditional gear landings had increased by 31%, from 16% in 1991 to 21% in 1999 (**Figure 247a**).

During the 1991-1999 period, the non-SSME and SSME areas respectively contributed 24% and 76% to the annual miscellaneous gear landings (**Figure 246**). The SSME contribution to the annual miscellaneous gear landings had decreased by 23% during the 9-year period, from 84% in 1991 to 65% in 1999. Consequently, the non-SSME contribution to the annual miscellaneous gear landings increased by 121%, from 16% in 1991 to 35% in 1999.

During the 1997-1999 period, demersal fishes make up 84% of the annual miscellaneous gear landings, comprising of 42% finfish, 10% shrimps and 48% invertebrates. Pelagic fishes make up only 16% of the annual miscellaneous gear landings, with mackerels contributing 8% to the annual pelagic catch, followed by anchovy (5%), sardine (5%) and other pelagic species (82%).

Overall, demersal fishes make up 52% of the annual marine fish landings in Sabah during the 1991-1999 period. Finfish represents 75% of the annual demersal fish landings, followed by invertebrates (15%) and shrimps (10%). Pelagic fishes make up 48% of the annual marine fish landings, with sardine representing 17% of the annual pelagic fish landings, followed by round scad (15%), tuna (13%), mackerel (9%), anchovy (3%) and other pelagic species (43%).

Non-SSME Area

In 1999, landings in the non-SSME area amounted to 68,976 metric tons, with an increase of 45.3% over the 1991 period (47,478 metric tons) (**Figures 150-152**). During the 1991-1999 period, trawl net contributed 44.5% to the non-SSME annual landings, followed by gill net (15.2%), seine net (13.3%), hook & line (13.0%), lift net (9.9%) and other miscellaneous gears (4.0%) (**Figure 249**). Commercial gear contribution to the non-SSME annual landings had significant increased during the 9-year period, particularly from trawl net landings. The fishing gear contribution to the non-SSME annual landings during the 1991-1999 period is summarized in *Table 107.*

Table 107a: *Fishing gear breakdown of annual landings in the non-SSME, 1991-1999*

Year	% GEAR CONTRIBUTION							
	TN	SN	GN	LN	HL	OT	COM	TRA
1991	28.2	12.9	23.8	14.5	18.8	1.8	64.9	35.1
1992	21.6	8.0	27.2	17.1	22.9	3.2	56.8	43.2
1993	23.9	9.2	23.0	13.8	26.5	3.6	56.1	43.9
1994	32.9	14.3	21.1	13.1	13.8	4.8	68.3	31.7
1995	35.5	18.5	14.7	14.3	12.5	4.6	68.6	31.4
1996	45.3	13.7	13.4	11.4	11.1	5.1	72.4	27.6
1997	60.4	14.4	8.5	5.5	7.1	4.1	83.3	16.7
1998	65.0	15.7	6.5	3.6	5.9	3.3	87.2	12.8
1999	66.1	12.7	7.2	3.2	5.6	5.3	85.9	14.1

Table 107b: *Gear landing composition in the non-SSME area, 1997-1999*

Resource Group	% RESOURCE GROUP SHARE								
	TN	SN	GN	LN	HL	OT	Total	COM	TRA
Pelagic	31.6	95.3	61.3	95.5	40.5	24.7	45.7	44.8	51.2
Demersal	68.4	4.7	38.7	4.5	59.5	75.3	54.3	55.2	48.8
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Pelagic Portion									
sardine	0.0	16.2	0.1	7.5	0.0	0.0	5.5	5.8	3.9
round scad	16.1	23.0	0.0	71.8	0.4	0.0	20.0	16.7	37.5
mackerel	16.9	15.5	1.6	5.3	0.4	7.1	12.9	14.6	3.9
anchovy	0.0	0.4	0.0	0.3	0.0	3.1	0.2	0.1	0.6
tuna	0.0	27.8	45.6	0.0	22.4	0.0	14.0	15.2	7.6
others	66.9	17.1	52.7	15.1	76.8	89.8	47.4	47.6	46.5
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
DEMERSAL PORTION									
finfish	77.6	86.4	54.4	0.0	83.8	51.6	75.1	76.4	67.0
shrimp	3.1	0.8	45.5	100.0	0.0	23.7	6.6	5.6	13.3
other invertebrate	19.3	12.8	0.1	0.0	16.2	24.7	18.3	18.1	19.7
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

In 1991, trawl net contributed 66.1% to the total landings, followed by seine net (12.7%), gill net (7.2%), hook & line (5.6%), miscellaneous gears (5.3%) and lift net (3.2%). During the 1997-1999 period, trawl net contributed 64.0% to the total landings, followed by seine net (14.3%), gill net (7.3%), hook & line (6.1%), miscellaneous gears (4.2%) and lift net (4.0%). The principal contributing gears throughout the 9-year period in the non-SSME area are trawl net, seine net and miscellaneous gears (**Figure 140b**).

The West Coast North (WC-North) and West Coast South (WC-South) contributed respectively 88.6% and 11.4% to the non-SSME annual landings during the 1991-1999 period. Landings in the WC-North area had increased by 80%, from 33,740 metric tons in 1991 to 60,810 metric tons in 1999. Its share of the non-SSME annual landings had increased by 24%, from 71% in 1991 to 88% in 1999. In the WC South area, landings had decreased by 41%, from 13,738 metric tons in 1991 to 8,166 metric tons in 1999. Its share of the non-SSME annual landings had decreased by 59%, from 29% in 1991 to 12% in 1999.

Table 107c: *Gear landing composition in Kota Kinabalu, 1997-1999*

Resource Group	% RESOURCE GROUP SHARE								
	TN	SN	GN	LN	HL	OT	Total	COM	TRA
Pelagic	31.9	94.0	67.1	100.0	19.3	16.0	41.3	40.9	49.1
Demersal	68.1	6.0	32.9	0.0	80.7	84.0	58.7	59.1	50.9
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Pelagic Portion									
sardine	0.0	10.0	0.0	10.1	0.0	0.0	3.5	3.2	7.7
round scad	16.1	26.3	0.0	73.3	0.0	0.0	21.5	19.1	56.1
mackerel	16.9	16.4	1.9	8.5	0.0	11.5	15.8	16.5	7.1
anchovy	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
tuna	0.0	33.8	63.6	0.0	4.0	0.0	11.2	11.9	0.7
others	66.9	13.5	34.4	8.1	96.0	88.5	48.0	49.4	28.3
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
DEMERSAL PORTION									
finfish	78.6	87.9	73.4		98.5	65.7	79.2	78.7	89.5
shrimp	1.8	0.0	26.6		0.0	20.7	2.1	2.0	5.7
other invertebrate	19.5	12.1	0.0		1.5	13.6	18.6	19.3	4.8
TOTAL	100.0	100.0	100.0		100.0	100.0	100.0	100.0	100.0

Table 107d: *Gear landing composition in non-SSME area, 1997-1999 (West Coast North)*

Resource Group	% RESOURCE GROUP SHARE								
	TN	SN	GN	LN	HL	OT	Total	COM	TRA
Pelagic	31.9	94.0	78.8	94.9	37.3	32.8	43.7	42.2	53.5
Demersal	68.1	6.0	21.2	5.1	62.7	67.2	56.3	57.8	46.5
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Pelagic Portion									
sardine	0.0	10.0	0.0	6.5	0.0	0.0	3.1	3.0	3.5
round scad	16.1	26.2	0.0	76.1	0.5	0.0	21.6	17.9	41.1
mackerel	16.9	16.3	1.4	4.4	0.3	7.1	13.6	15.5	3.6
anchovy	0.0	0.0	0.0	0.4	0.0	3.1	0.1	0.0	0.7
tuna	0.0	34.2	55.3	0.0	25.1	0.0	13.4	14.5	7.4
others	66.9	13.4	43.3	12.7	74.0	89.8	48.2	49.1	43.7
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
DEMERSAL PORTION									
finfish	78.6	87.9	62.1	0.0	81.9	76.5	78.3	78.5	77.1
shrimp	1.8	0.0	37.9	100.0	0.0	6.1	2.7	2.4	5.7
other invertebrate	19.5	12.1	0.0	0.0	18.1	17.4	18.9	19.1	17.2
TOTAL	100.0	100.0	100.0		100.0	100.0	100.0	100.0	100.0

During the 1997-1999-year period, Kota Kinabalu contributed 89.4% to the WC-North annual landings, followed by Kota Belud (8.8%) and Tuaran (2.2%). Fish landings in Kota Kinabalu had increased by 169%, from 20,239 metric tons in 1991 to 54,369 metric tons in 1999 (**Figure 131d**). Kota Kinabalu share of the WC-North annual landings had increased by 49%, from 60% in 1991 to 89% in 1999. Its share of the non-SSME annual landings had also increased by 85%, from 43% in 1991 to 79% in 1999 (**Figures 131e-131f**). Landings in Kota Belud had increased by 18%, from 4,678 metric tons in 1991 to 5,525 metric tons in 1999. However, its share of the WC-North annual landings had decreased by 34%, from 14% in 1991 to 9% in 1999. On the other hand, landings in Tuaran had decreased by 90%, from 8,823 metric tons in 1991 to only 915 metric tons in 1999. Consequently, its share of the WC-North annual landings had declined by 94%, from 26% in 1991 to only 1.5% in 1999.

Table 107e: *Gear landing composition in non-SSME area, 1997-1999 (West Coast South)*

Resource Group	% RESOURCE GROUP SHARE								
	TN	SN	GN	LN	HL	OT	Total	COM	TRA
Pelagic	0.5	98.8	47.8	100.0	53.5	0.0	61.4	67.8	41.3
Demersal	99.5	1.2	52.2	0.0	46.5	100.0	38.6	32.2	58.7
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Pelagic Portion									
sardine	0.0	31.8	0.3	14.0	0.0		18.7	21.2	5.9
round scad	0.0	15.0	0.0	41.9	0.0		11.2	9.9	17.7
mackerel	0.0	13.5	1.9	12.1	0.6		8.9	9.6	5.5
anchovy	0.0	1.4	0.0	0.0	0.0		0.8	0.9	0.0
tuna	0.0	11.7	33.3	0.0	14.9		17.3	19.0	8.6
others	100.0	26.5	64.5	32.0	84.4		43.1	39.4	62.3
TOTAL	100.0	100.0	100.0	100.0	100.0		100.0	100.0	100.0
DEMERSAL PORTION									
finfish	3.8	66.6	52.0		93.7	0.0	38.9	42.2	33.2
shrimp	94.0	10.8	47.9		0.0	60.1	50.3	56.8	38.9
other invertebrate	2.3	22.6	0.1		6.3	39.9	10.8	0.9	28.0
TOTAL	100.0	100.0	100.0		100.0	100.0	100.0	100.0	100.0

** note: high shrimp portion of trawl net landings due to finfish by-catch being discarded at sea

During the 1997-1999 period, Kuala Penyu contributed 36.0% to the WC-South annual landings, followed by Beaufort (32.3%), Sipitang (15.5%) and Papar (16.2%). Landings in Kuala Penyu had decreased by 13%, from 3,418 metric tons in 1991 to 2,968 metric tons in 1999. However, its share of the WC-South annual landings had increased by 46%, from 25% in 1991 to 36% in 1999. In Beaufort, landings had increased by 19%, from 2,604 metric tons in 1991 to 3,090 metric tons in 1999. Consequently, its share of the WC-South landings had increased by 100%, from 19% in 1991 to 38% in 1999. Landings in Sipitang had increased by 13%, from 1,150 metric tons in 1991 to 1,301 metric tons in 1999. Its share of the WC-South landings had increased by 90%, from 8% in 1991 to 16% in 1999. Landings in Papar had decreased by 88%, from 6,566 metric tons in 1991 to 807 metric tons in 1999. Its share of the WC-South annual landings had decreased by 79%, from 48% in 1991 to only 10% in 1999.

In 1999, commercial gear landings in the non-SSME area amounted to 59,284 metric tons, with an increase of 92% over the 1991 period (30,836 metric tons) (**Figure 130-131**). During the 1991-1999 period, the WC-North and WC-South areas contributed respectively 73% and 27% to the non-SSME annual commercial gear landings.

During the 1991-1999 period, commercial gears contributed between 56-87% (mean 72%) to the annual landings in the non-SSME area (**Figures 150-152**), with trawl net contributing 56.7%, followed by gill net (24.7%) and seine net (18.6%). During the same period, the non-SSME area contributed 33% to the annual commercial gear landings (**Figure 144-146**). The non-SSME contribution to the annual commercial gear landings had decreased by 8%, from 41% in 1991 to 37% in 1999. Commercial gear landings contributed 72% to the non-SSME annual landings. Contribution from commercial gears to the non-SSME annual landings had increased by 32%, from 65% in 1991 to 86% in 1999. During the 1997-1999 period, commercial gear contributed 85.6% to the non-SSME annual landings.

During the 1997-1999-year period, Kota Kinabalu contributed 96.8% to the WC-North annual commercial gear landings, followed by Kota Belud (2.9%) and Tuaran (0.3%). In Kota Kinabalu, commercial gear landings had increased by 202%, from 17,123 metric tons in 1991 to 51,632 metric tons in 1999 (**Figure 146d**). Kota Kinabalu share of the WC-North annual commercial gear landings had increased by 20%, from 81% in 1991 to 97% in 1999. Its share of the non-SSME annual commercial gear landings had also increased by 57%, from 55% in 1991 to 87% in 1999 (**Figures 146c-146d**). Commercial gear landings in Kota Belud had decreased by 23%, from 1,893 metric tons in 1991 to 1,450 metric tons in 1999. Its share of the WC-North annual commercial gear landings had decreased by 69%, from 9% in 1991 to 3% in 1999. In Tuaran, commercial gear landings had decreased by 96%, from 2,079 metric tons in 1991 to only 82 metric tons in 1999. Consequently, its share of the WC-North annual commercial gear landings had decreased by 98%, from 10% in 1991 to only 0.15% in 1999.

Commercial gears contributed between 47-88% (mean 69%) to the WC-North annual landings during the 1991-1999 period. During the 1991-1999 period, the commercial gear contribution to the annual landings had increased by 40%, from 63% in 1991 to 87% in 1999. On the other hand, traditional gears contributed between 12-53% (mean 31%) to the WC-North annual landings. Its share of the WC-North annual landings had decreased by 66% during the 9-year period, from 37% in 1991 to 13% in 1999.

In Kota Kinabalu, commercial gears contributed between 83-95% (mean 88%) to the annual landings during the 1991-1999 period. The commercial gear contribution to the annual landings had increased by 12%, from 85% in 1991 to 95% in 1999. On the other hand, traditional gears contributed between 5-17% (mean 12%) to the annual landings in Kota Kinabalu. Its share of the annual landings had decreased by 67%, from 15% in 1991 to 5% in 1999. During the 1997-1999 period, Kota Kinabalu contributed 79% to the non-SSME annual landings. During the 3-year period, trawl net contributed 80% to the annual landings, followed by seine net (13.0%), hook & line (2.5%), lift net (2.1%), gill net (1.1%) and miscellaneous gears (0.9%). Overall, Kota Kinabalu contributed respectively 87% and 30% to the annual commercial and traditional gear landings in the non-SSME area. Overall, Kota Kinabalu contributed between 31.6-80.2% (mean 56.0%) to the non-SSME annual landings during the 1991-1999 period. Kota Kinabalu share of the non-SSME annual landings had increased by 85%, from 43% in 1991 to 79% in 1999. Kota Kinabalu is the among the principal fish landing contributor in Sabah. During the 1991-1999 period, Kota Kinabalu contributed between 10.7-28.6% (mean 18.4%) to the total annual fish landings in Sabah (**Figures 123a-123f**). Kota Kinabalu does not contribute much to the annual traditional gear landings (range: 4.8-9.5%, mean 6.5%). However, its contribution to the annual commercial gears is significant (range: 13.8-36.3%, mean 23.1%), and probably had reached its peak of 32.6-36.3% during the last 3 years.

In Kota Belud, commercial gears contributed 7-40% (mean 24%) to the annual landings during the 1991-1999 period. The annual commercial gear share decreased by 35%, from 40% in 1991 to 26% in 1999. On the other hand, traditional gears contributed between 60-93% (mean 76%) to the annual landings. The annual traditional gear increased by 24%, from 59% in 1991 to 74%

in 1999. Kota Belud contributed 0.6-6.1% (mean 3.5%) to the non-SSME annual commercial gear landings during the 9-year period. Kota Belud share of the non-SSME annual commercial gear landings had decreased by 60%, from 6.1% in 1991 to 2.4% in 1999. Kota Belud contributed 15.5-42.1% (mean 28.4%) to the non-SSME annual traditional gear landings during the 1991-1999 period. Its share of the non-SSME traditional gear landings increased by 151%, from 17% in 1991 to 42% in 1999. During the 1997-1999 period, hook & line contributed 33.2% to the annual landings, followed by miscellaneous gears (31.4%), gill net (27.5%), lift net (7.1%), seine net (0.8%) and trawl net (0.1%). Overall, Kota Belud contributed between 5.3-16.8% (mean 9.9%) to the non-SSME annual landings during the 1991-1999 period. Its share of the non-SSME annual landings had decreased by 19%, from 10% in 1991 to 8% in 1999.

In Tuaran, commercial gears only contributed 5-24% (mean 11%) to the annual landings during the 1991-1999 period. The commercial gear share of the annual landings had decreased by 57%, from 19% in 1991 to 8% in 1999. On the other hand, traditional gears contributed 76-95% (mean 89%) to the annual landings in Tuaran. The traditional gear share of the annual landings had increased by 13%, from 81% in 1991 to 92% in 1999. Overall, Tuaran contributed 0.1-6.7% (mean 1.8%) to the non-SSME annual commercial gear landings. Its share of the non-SSME annual commercial gear landings had decreased by 98%, from 6.7% in 1991 to only 0.1% in 1999. During the 1991-1999 period, Tuaran contributed between 8.6-40.8% (mean 26.5%) to the non-SSME annual traditional gear landings. Its share of the non-SSME annual traditional gear landings had decreased by 79%, from 40.5% in 1991 to only 8,6% in 1998. During the 1997-1999 period, lift net contributed 70.2% to the annual landings, followed by hook & line (17.4%), gill net (10.1%) and miscellaneous gears (2.2%). Tuaran contributed between 1.3-19.3% (mean 9.7%) to the non-SSME annual landings during the 1991-1999 period. Tuaran share of the non-SSME annual landings had decreased by 93%, from 18.6% in 1991 to 1.3% in 1999.

During the 1997-1999-year period, Kuala Penyu contributed 45.9% to the WC-South annual commercial gear landings, followed by Beaufort (28.8%), Sipitang (16.9%) and Papar (8.4%). In Kuala Penyu, commercial gear landings had decreased by 14%, from 3,346 metric tons in 1991 to 2,878 metric tons in 1999 (Figure 146d). Kuala Penyu share of the WC-South annual commercial gear landings had increased by 106%, from 34% in 1991 to 47% in 1999. On the other hand, commercial gear landings in Beaufort had decreased by 19%, from 2,082 metric tons in 1991 to 1,685 metric tons in 1999. Beaufort share of the WC-South annual commercial gear landings had increased by 29%, from 21% in 1991 to 28% in 1999. In Sipitang, commercial gear landings had increased by 29%, from 879 metric tons in 1991 to 1,137 metric tons in 1999. Consequently, its share of the WC-South annual commercial gear landings had decreased by 106%, from 9% in 1991 to 19% in 1999. Commercial gear landings in Papar had decreased by 88%, from 3,434 metric tons in 1991 to only 421 metric tons in 1999. Consequently, Papar share of the WC-South annual commercial gear landings had also decreased by 81%, from 35% in 1991 to only 7% in 1999.

Commercial gears contributed 65-82% (mean 74%) to the WC-South annual landings during the 1991-1999 period. During the 1991-1999 period, the commercial gear contribution to the annual fish landings had increased by 6%, from 71% in 1991 to 75% in 1999. On the other hand, the traditional gear share of the annual fish landings had decreased by 14%, from 29% in 1991 to 25% in 1999.

In Kuala Penyu, commercial gears contributed between 96-99% (mean 97.5%) to the annual landings during the 1991-1999 period. The commercial gear share of the annual landings had only decreased by 1%, from 97.9% in 1991 to 96.9% in 1999. On the other hand, traditional gears contributed between 1.5-3.6% (mean 2.5%) to the annual landings in Kuala Penyu. The traditional gear share of the annual landings had increased by 45%, from 2.1% in 1991 to 3.1% in 1999. Kuala Penyu contributed between 4.2-18.2% (mean 9.1%) to the non-SSME annual commercial gear landings during the 1991-1999 period. Kuala Penyu share of the non-SSME annual commercial gear landings had decreased by 55%, from 11% in 1991 to only 5% in 1999. Kuala Penyu contributed between 0.4-1.0% (mean 0.6%) to the non-SSME annual traditional gear landings during the 1991-1999 period. Its share of the non-SSME annual traditional gear landings had increased by 116%, from 0.43% in 1991 to 0.94% in 1998. During the 1997-1999 period, gill net contributed 49.4% to the annual landings in Kuala Penyu, followed by seine net (47.0%), miscellaneous gears (2.1%), hook & line (0.9%) and trawl net (0.7%). Overall, Kuala Penyu contributed between 3.8-12.6% (mean 6.4%) to the non-SSME annual landings during the 1991-1999 period. Its share of the non-SSME annual landings had decreased by 40%, from 7.2% in 1991 to 4.3% in 1999.

In Beaufort, commercial gears contributed between 55-85% (mean 75%) to the annual landings during the 1991-1999 period. The commercial gear share of the annual landings had decreased by 32%, from 80% in 1991 to 75% in 1999. On the other hand, traditional gears contributed between 15-45% (mean 25%) to the annual landings in Beaufort. The traditional gear share of the annual landings had increased by 127%, from 20% in 1991 to 25% in 1999. Beaufort had contributed between 2.8-14.5% (mean 7.7%) to the non-SSME annual commercial gear landings during the 1991-1999 period. Beaufort share of the non-SSME annual commercial gear landings had decreased by 58%, from 6.8% in 1991 to only 2.8% in 1999. During the 1991-1999 period, Beaufort contributed between 2.2-15.5% (mean 6.8%) to the non-SSME annual traditional gear landings. Beaufort share of the non-SSME annual traditional gear landings had increased by 362%, from 3.1% in 1991 to 14.5% in 1999. During the 1997-1999 period, gill net contributed 31.1% to the annual landings in Beaufort, followed by seine net (27.9%), miscellaneous gears (22.9%), hook & line (9.8%) and trawl net (8.3%). Overall, Beaufort contributed between 3.3-13.3% (mean 6.9%) to the non-SSME annual landings during the 1991-1999 period. Its share of the non-SSME annual landings had decreased by 18%, from 5.5% in 1991 to 4.5% in 1999.

In Sipitang, commercial gears contributed 78.2% to the annual landings during the 1991-1999 period. The commercial gear share of the annual landings had increased by 14%, from 76% in 1991 to 87% in 1999. On the other hand, the traditional gear share of the annual landings had decreased by 47%, from 24% in 1991 to 13% in 1999. Overall, Sipitang contributed 2.5% to the non-SSME annual commercial gear landings. Its share of the non-SSME annual commercial gear landings had decreased by 33%, from 2.9% in 1991 to 1.9% in 1999. Sipitang contributed 1.8% to the non-SSME annual traditional gear landings during the 1991-1999 period. Its share of the non-SSME annual traditional gear landings had increased by 3.7%, from 1.6% in 1991 to 1.7% in 1998. During the 1997-1999 period, seine net contributed 54.4% to the annual landings in Sipitang, followed by hook & line (18.2%), trawl net (13.8%), gill net (13.5%) and miscellaneous gears (0.1%). Overall, Sipitang contributed between 1.2-3.3% (mean 2.2%) to the non-SSME annual landings during the 1991-1999 period. Its share of the non-SSME annual landings had decreased by 22%, from 2.4% in 1991 to 1.9% in 1999.

In Papar, commercial gears contributed 47.8% to the annual landings during the 1991-1999 period. The commercial gear share of the annual landings had decreased by 0.4%, from 52.3% in 1991 to 52.1% in 1999. On the other hand, the traditional gear share of the annual landings had increased by 0.4%, from 47.7% in 1991 to 47.9% in 1999. Papar contributed 7.6% to the non-SSME annual commercial gear landings during the 1991-1999 period. Its share of the non-SSME annual commercial gear landings had decreased by 94%, from 11.1% in 1991 to only 0.7% in 1999. Papar contributed 12.8% to the non-SSME annual traditional gear landings during the 1991-1999 period. Its share of the non-SSME annual traditional gear landings had decreased by 79%, from 18.8% in 1991 to 4.0% in 1998. During the 1997-1999 period, gill net contributed 40.4% to the annual landings in Papar, followed by hook & line (27.6%), lift net (26.5%) and miscellaneous gears (5.5%). Overall, Papar contributed between 1.2-20.5% (mean 8.9%) to the non-SSME annual landings during the 1991-1999 period. Papar share of the non-SSME annual landings had decreased by 92%, from 13.8% in 1991 to 1.2% in 1999.

In 1999, trawl net landings in the non-SSME area totaled 45,564 metric tons, with an increase of 241% over the 1991 period (13,374 metric tons) (**Figure 215**). Trawl net contributed 38.0-76.9% (mean 56.7%) to the non-SSME commercial gear landings during the 1991-1999 period (**Figure 217b**). Trawl net contribution to the non-SSME annual commercial gear landings had increased by 77% during the 9-year period, from 43% in 1991 to 77% in 1999. The non-SSME area contributed 32.0-55.1% (mean 40.3%) to the annual trawl net landings. During the 9-year period, the non-SSME contribution to the annual trawl net landings had increased by 16%, from 43% in 1991 to 50% in 1999 (**Figure 216**). During the 1997-1999 period, demersal fish make up 68% of the non-SSME annual trawl net landings, with finfish representing 78% of the annual demersal catch, followed by shrimps (3%) and invertebrates (19%). Pelagic fish make up 32% of the annual trawl net landings, with mackerels making up 17% of the pelagic catch, followed by round scad (16%) and other pelagic species (67%).

Kota Kinabalu contributed 98.9-99.3% (mean 99.1%) to the non-SSME annual trawl net landings during the 1997-1999 period, followed by Beaufort (range: 0.4-0.5%, mean 0.5%) and Sipitang (range: 0.3-0.5%, mean 0.4%). Overall, Kota Kinabalu contributed 49.4-58.8% (mean 53.7%) to the annual trawl net landings in the state. Pelagic and demersal fish make up respectively 32% and 68% of the annual trawl net landing in Kota Kinabalu. The demersal portion comprised of 79% finfish, 2% shrimps and 19% invertebrates. On the other hand, the pelagic portion of the trawl net annual landings comprised of 17% mackerels, 16% round scad and 67% other pelagic species.

A considerable portion of the trawl net landings in Kota Kinabalu comprised of trash fish targeted as raw materials for fish meal production. In recent years, most of the trawler by-catch that had previously been discarded at sea had been brought back to shore to meet the increasing demand from fish meal plants and fish processing establishments. The demand from both local and foreign markets for raw materials for *surimi* products had also attributed to the increasing landing trend in recent years. Most of the raw materials used in *surimi* production comprised of threadfin bream (*Nemipterus* spp) and lizard fish (*Saurida* spp). These fishes are used in Kota Kinabalu and surrounding areas in the production of fish ball and fish cake. Exports of frozen and chilled fish to Peninsular Malaysia also include a considerable proportion of the trawl net landings. In recent years, exports of fish to Peninsular Malaysia had increased to meet the increasing demand caused by declining fish landings. New markets in China and Taiwan in recent years for cheap frozen fish in whole or fillet forms had also been an attributing factor. Some of the round scad landings in Kota Kinabalu are also exported as raw materials for animal pet food in Australia.

In 1999, seine net landings in the non-SSME area totaled 8,776 metric tons, with an increase of 44% over the 1991 period (6,148 metric tons) (**Figure 221**). Seine net contributed 14.1-27.0% (mean 18.6%) to the non-SSME annual commercial gear landings during the 1991-1999 period (**Figure 223b**). Seine net contribution to the non-SSME commercial gear landings had declined by 26%, from 20% in 1991 to 15% in 1999. The non-SSME area contributed 13.9-30.6% (mean 22.0%) to the annual seine net landings. During the 9-year period, the non-SSME contribution to the annual seine net landings had decreased by 35%, from 31% in 1991 to 20% in 1999 (**Figure 222**). During the 1997-1999 period, pelagic fish represents 95% of the non-SSME annual seine net landings, with tuna making 28% of the pelagic catch, followed by round scad (23%), sardine (16%), mackerel (16%) and other pelagic species (16%). Demersal fish only make up 5% of the annual landings, where finfish make up 86% of the demersal catch, followed by shrimp (1%) and invertebrates (13%).

During the 1997-1999 period, Kota Kinabalu contributed 66.8-81.5% (mean 72.1%) to the non-SSME annual seine net landings, followed by Kuala Penyu (range: 11.8-15.2%, mean 13.6%), Beaufort (range: 3.3-10.2%, mean 6.9%), Sipitang (range: 1.3-9.3%, mean 6.6%), Tuaran (range: 0.5-0.7%, mean 0.6%) and Kota Belud (range: 0.01-0.70%, mean 0.41%).

Kota Kinabalu contributed 13.4-21.7% (mean 17.3%) to the state annual seine net landings during the same period. Pelagic fishes make up 94% of the annual seine net landings in Kota Kinabalu. Tuna represents 34% of the pelagic catch, followed by round scad (26%), mackerel (16%), sardine (10%) and other pelagic species (14%). Demersal fishes make up 6% of the annual seine net landings, with finfish and invertebrates respectively making up 88% and 12% of the annual demersal catch. In Kuala Penyu, pelagic fishes make up 98% of the annual seine net landings, comprising of round scad (31%), sardine (23%), mackerel (16%) and other pelagic species (30%). In Sipitang, pelagic fishes make up 99% of the seine net landings, comprising of sardines (83%), anchovy (6%), tuna (5%), mackerel (4%) and other pelagic species (58%). In the WC-North, pelagic fishes make up 94% of the annual seine net landings. Tuna represents 34% of the annual pelagic catch, followed by round scad (26%), mackerel (16%), sardine (10%) and other pelagic species (13%). On the other hand, pelagic fishes make up 99% of the annual seine net landings in the WC-South, with sardine making up 32% of the annual pelagic catch, followed by round scad (15%), mackerel (13%), tuna (12%) and other pelagic species (27%).

In 1999, gill net landings in the non-SSME area totaled 4,945 metric tons, an increase of 56% over the 1991 period (11,314 metric tons) (**Figure 227**). Gill net contributed 7.5-47.9% (mean 24.7%) to the non-SSME commercial gear landings (**Figure 229b**). Gill net contribution to the non-SSME commercial gear landings had declined by 77% during the 9-year period, from 37% in 1991 to 8% in 1999. The non-SSME area contributed 21.5-45.5% (mean 28.8%) to the annual gill net landings. During the 9-year period, non-SSME contribution to the annual gill net landings had decreased by 53%, from 46% in 1991 to 22% in 1999 (**Figure 228**). During the 1997-1999 period, pelagic and demersal fishes make up respectively 61% and 39% of the non-SSME annual gill net landings. The demersal portion comprised of 54% finfish and 46% shrimps. On the other hand, the pelagic portion comprised of 46% tuna and 54% other pelagic species.

Kota Belud contributed 29.3% (range: 28.1-30.5% to the non-SSME gill net landings during the 1997-1999 period, followed by Kuala Penyu (range: 25.7-30.5, mean 27.7%), Beaufort (range: 12.6-18.3%, mean 15.7%), Kota Kinabalu (range: 8.7-13.7%, mean 11.5%), Papar (range: 8.5-10.9%, mean 10.0%), Sipitang (range: 1.5-4.4%, mean 3.3%) and Tuaran (range: 1.6-3.3%, mean 2.7%).

In Kota Belud, pelagic fishes make up 85% of the annual gill net landings, with tuna and other pelagic species respectively making up 55% and 45% of the pelagic catch. Demersal fishes make up 15% of the landings, with finfish and shrimps respectively making up 51% and 49% of the demersal catch.

In Kuala Penyu, pelagic fishes make up 65% of the annual gill net landings, with tuna and other pelagic fishes respectively making up 41% and 59% of the pelagic catch. Demersal fishes make up 35% of the landings, comprising of finfish representing 98.9% of the demersal catch, followed by shrimps (1.1%) and invertebrates (0.1%).

In Kota Kinabalu, pelagic fishes make up 67% of the annual gill net landings, with tuna and other pelagic fishes respectively making up 64% and 36% of the pelagic catch. Demersal fishes make up 33% of the landings, with finfish and shrimps respectively making up 73% and 27% of the demersal catch.

In Papar, demersal fishes make up 53% of the annual gill net landings, with finfish and shrimps respectively making up 83% and 17% of the demersal catch. Pelagic fishes make up 47% of the landings, with tuna representing 12% of the pelagic catch, followed by mackerel (7%) and other pelagic species (81%).

In Sipitang, demersal fishes make up 83% of the annual gill net landings, with shrimp making up 87% of the demersal catch, followed by fishfish (12%) and invertebrates (1%). Pelagic fishes make up 17% of the landings, with sardine representing 15% of the pelagic catch, followed by mackerel (12%) and other pelagic species (73%).

In Tuaran, pelagic fishes make up 66% of the annual gill net landings, with tuna making up 29% of the pelagic catch, followed by mackerel (18%) and other pelagic fishes (53%). Demersal species make up 34% of the annual gill net landings, with finfish and shrimps respectively making up 71% and 29% of the demersal catch.

In 1999, traditional gear landings in the non-SSME area amounted to 9,691 metric tons, with a decrease of 42% over the 1991 period (16,642 metric tons). During the 1991-1999 period, traditional gears contributed between 13-44% (mean 28%) to the annual landings in the non-SSME area (**Figures 138-139**), with hook & line contributing 48.3%, followed by lift net (36.9%) and miscellaneous gears (14.8%). During the same period, the non-SSME area contributed 18-51% (mean 31.3%) to the annual traditional gear landings (**Figure 138**). The non-SSME contribution to the annual traditional gear landings had decreased by 61%, from 51% in 1991 to 20% in 1999. Traditional gear contributed 13-44% (mean 28.5%) to the non-SSME annual landings, and during the 9-year period had decreased by 60%, from 35% in 1991 to 14% in 1999. During the 1997-1999 period, traditional gear contributed 14.5% to the non-SSME annual landings.

During the 1991-1999 period, WC-North and WC-South contributed respectively 71-84% (mean 78%) and 16-29% (mean 22%) to the non-SSME annual traditional gear landings. Kota Belud contributed 20-53% (mean 36.2%) to the annual WC-North traditional gear landings, followed by Tuaran (range: 11-53%, mean 34.2%) and Kota Kinabalu (range: 14-39%, mean 29.6%). Papar contributed 19-84% (mean 57.0%) to the annual WC-South traditional gear landings, followed by Beaufort (range: 9-69%, mean 31.7%), Sipitang (range: 4-19%, mean 8.6%) and Kuala Penyu (range: 1-5%, mean 2.7%).

During the 1997-1999 period, WC-North and WC-South respectively contributed 80-84% (mean 81%) and 16-20% (mean 19%) to the non-SSME annual traditional gear landings. During the 3-year period, Kota Belud contributed 45-53% (mean 48.0%) to the WC-North annual traditional gear landings, followed by Kota Kinabalu (range: 36-39%, mean 37.3%) and Tuaran (range: 11-18%, mean 14.7%). During the 1997-1999 period, Beaufort contributed 27-69% (mean 43.1%) to the WC-South annual traditional gear landings, followed by Papar (range: 19-57%, mean 39.7%), Sipitang (range: 8-19%, mean 12.8%), and Kuala Penyu (range: 4-5%, mean 4.4%).

During the 9-year period, WC-North annual traditional gear landings had decreased by 39.5%, from 12,645 metric tons in 1991 to 7,645 metric tons in 1999. Landings peaked at 18,369 metric tons in 1992 and since then had declined by 58.9% to its minimum of 7,549 metric tons in 1998. In 1999, landings had slightly increased by 1.3% to 7,645 metric tons in 1999. During the 9-year period, WC-North contribution to the non-SSME annual traditional gear landings had increased by 11%, from 76.0% in 1991 to 84.4% in 1998, and declined to 78.9% in 1999. Traditional gears contributed 12-53% (mean 30.8%) to the WC-North annual landings during the 1991-1999 period. Traditional gear contribution to the WC-North annual landings had declined by 76%, from its peak of 53.0% in 1992 to 12.6% in 1999.

In Kota Belud, traditional gear landings in 1999 amounted to 4,075 metric tons, with an increase of 46.3% over the 1991 period (2,785 metric tons). Traditional gears contributed 59.5-92.5% (mean 75.9%) to the annual landings in Kota Belud. During the 9-year period, traditional gear contribution to the annual landings in Kota Belud had increased by 23.9%, from 59.3% in 1991 to 73.8% in 1999. In 1995, traditional gears contributed 92.5% to the annual landings, which then declined by 24% to 70.2% in 1998, and increased by 5.0% to 73.8% in 1999. Kota Belud contribution to the non-SSME annual traditional gear landings fluctuated between 15.5-42.0% (mean 28.4%) during the 1991-1999 period. Kota Belud annual contribution had increased by 151%, from 16.7% in 1991 to 42.0% in 1999. On the other hand, Kota Belud contribution to the WC-North annual traditional gear landings had increased by 142.0%, from 22.0% in 1991 to 53.3% in 1999. Kota Belud annual contribution during the 9-year period fluctuated between 20.4-53.3% (mean 36.2%). During the 1997-1999 period, the annual traditional gear landings fluctuated around 3,421-4,075 metric tons, contributing 70.2-73.8% (mean 71.2%) to the annual landings in Kota Belud. During the 3-year period, Kota Belud contributed 45.2-53.3% (mean 48.0%) and 36.1-42.0% (mean 38.8%) respectively to the WC-North and non-SSME annual traditional gear landings.

In Tuaran, traditional gear landings in 1999 amounted to 833 metric tons, with a decrease of 87.6% from 6,744 metric tons in 1991. Traditional gears contributed 76.4-94.6% (mean 89.2%) to the annual landings in Tuaran. During the 9-year period, traditional gear contribution had increased by 19.1%, from 76.4% in 1991 to 91.0% in 1999. However, Tuaran contribution to the WC-North annual traditional gear landings had declined by 79.6%, from 53.3% in 1991 to only 10.9% in 1999. Overall, Tuaran contribution to the non-SSME annual traditional gear landings had decreased by 78.8%, from 40.5% in 1991 to 9.7% in 1999. During the 1997-1999 period, the annual traditional gear landings fluctuated around 833-1,408 metric tons, contributing 89.4-91.0% (mean 90.0%) to the annual landings in Tuaran. During the 3-year period, Tuaran contributed 10.9-17.6% (mean 14.7%) and 8.6-14.0% (mean 12.0%) respectively to the WC-North and non-SSME annual traditional gear landings.

In Kota Kinabalu, traditional gear landings in 1999 amounted to 2,737 metric tons, with an decrease of 50.9% over the 1991 period (3,116 metric tons). Traditional gear contributed 5.0-16.7% (mean 11.9%) to the annual landings in Kota Kinabalu. During the 9-year period, traditional gear contribution had increased by 8.4%, from 15.4% in 1991 to 16.7% in 1994, and since then had declined by 69.8% to only 5.0% in 1999. Kota Kinabalu contribution to the WC-North annual traditional gear landings had increased by 45.3%, from 24.6% in 1991 to 35.8% in 1999. Overall, Kota Kinabalu contribution to the non-SSME annual traditional gear landings had increased by 50.9%, from 18.7% in 1991 to 28.2% in 1999. During the 1997-1999 period, the annual traditional gear landings fluctuated around 2,737-2,971 metric tons, contributing 5.0-6.4% (mean 5.6%) to the annual landings in Kota Kinabalu. During the 3-year period, Kota Kinabalu contributed 35.8-39.0% (mean 37.3%) and 28.2-32.9% (mean 30.3%) respectively to the WC-North and non-SSME annual traditional gear landings.

During the 9-year period, WC-South annual traditional gear landings had decreased by 48.9%, from 3,997 metric tons in 1991 to 2,046 metric tons in 1999. Landings peaked at 6,109 metric tons in 1993, and since then had declined by 77.2% to its minimum of 1,395 metric tons in 1998. In 1999, landings had increased by 46.6% to 2,046 metric tons in 1999. During the 9-year period, WC-North contribution to the non-SSME annual traditional gear landings had decreased by 12%, from 24.0% in 1991 to 21.1% in 1999. Traditional gears contribution to the WC-South annual landings had declined by 37.2%, from 29.1% in 1991 to its minimum of 18.3% in 1998, and then increased by 37.2% to 25.1% in 1999. During the 3-year period, the annual traditional gear landings fluctuated around 1,395-2,046 metric tons, contributing 18.3-29.4% (mean 24.1%) to the WC-South annual landings. During the 1997-1999 year period, WC-South contributed 15.6-21.1% (mean 19.0%) to the non-SSME annual traditional gear landings.

In Beaufort, traditional gear landings in 1999 amounted to 1,405 metric tons, with an increase of 169.2% over the 1991 period (522 metric tons). Traditional gear contributed 14.9-45.5% (mean 25.1%) to the annual landings in Beaufort. Traditional gear contribution to the annual landings in Beaufort had increased by 126.9% during the 9-year period, from 20.0% in 1991 to 45.5% in 1999. During the 9-year period, Beaufort contribution to the WC-South annual traditional gear landings had increased by 425.9%, from 13.1% in 1991 to 68.7% in 1999. Overall, Beaufort contribution to the non-SSME area had increased by 362.3%, from 3.1% in 1991 to 14.5% in 1999. During the 1997-1999 period, the annual traditional gear landings fluctuated around 464-1,405 metric tons, contributing 19.8-45.5% (mean 31.2%) to the annual landings in Beaufort. During the 3-year period, Beaufort contributed 27.4-68.7% (mean 43.1%) and 5.2-14.5% (mean 8.4%) respectively to the WC-South and non-SSME annual traditional gear landings.

In Papar, traditional gear landings in 1991 amounted to 386 metric tons, with a decrease of 87.7% over the 1991 period (3,132 metric tons). Traditional gear contributed 31.2-68.3% (mean 52.2%) to the annual landings in Papar. Traditional gear contribution to the annual landings in Papar had increased by 43.1%, from 47.7% in 1991 to 68.3% in 1997, and then declined by 29.9% to 47.9% in 1999. During the 9-year period, Papar contribution to the WC-South annual traditional gear landings had declined by 75.9%, from 78.4% in 1991 to 18.9% in 1999. Papar contribution had increased by 7.1% to 83.9% in 1993, and then declined by 77.5% to 18.9% in 1999. Overall, Papar contribution to the non-SSME annual traditional gear landings had declined by 78.8%, from 18.8% in 1991 to only 4.0% in 1999. Papar contribution to the non-SSME annual traditional gear landings had initially increased by 28.9% to its peak of 24.3% in 1993, which then gradually declined by 83.6% to 4.0% in 1999. During the 1997-1999 period, the annual traditional gear landings fluctuated around 386-1,147 metric tons, contributing 47.9-68.3% (mean 57.0%) to the annual landings in Papar. During the 3-year period, Papar contributed 18.9-56.7% (mean 39.7%) and 4.0-11.4% (mean 7.4%) respectively to the WC-South and non-SSME annual traditional gear landings.

In Sipitang, traditional gear landings in 1999 amounted to 164 metric tons, with decrease of 39.6% over the 1991 period (271 metric tons). Traditional gear contributed 12.6-32.9% (mean 21.8%) to the annual landings in Sipitang. During the 9-year period, traditional gear contribution to the annual landings in Sipitang had decreased by 46.9%, from 23.6% in 1991 to 12.6% in 1999. Traditional gear contribution to the annual landings in Sipitang had initially increased by 39.8% to 32.9% in 1997, and then further declined by 61.8% to 12.6% in 1999. Sipitang contribution to the WC-South annual traditional gear landings had increased by 181.9%, from 6.8% in 1991 to 19.1% in 1998, and then declined by 58.2% to only 8.0% in 1999. Overall, Papar contributed 0.9-3.0% (mean 1.8%) to the non-SSME annual traditional gear landings. Papar contribution had decreased by 44.4%, from 1.6% in 1991 to 0.9% in 1995, and then increased by 229.1% to 3.0% in 1998, before declining by 43.4% to 1.7% in 1999. During the 1997-1999 period, the annual traditional gear landings fluctuated around 164-267 metric tons, contributing 12.6-32.9% (mean 20.8%) to the annual landings in Sipitang. During the 3-year period, Sipitang contributed 8.0-19.1% (mean 12.8%) and 1.7-3.0% (mean 2.3%) respectively to the WC-South and non-SSME annual traditional gear landings.

In Kuala Penyu, traditional gear landings in 1999 amounted to 91 metric tons, an increase of 26.0% over the 1991 period (72 metric tons). Traditional gear contribution to the Kuala Penyu annual landings had increased by 45.2%, from 2.1% in 1991 to 3.1% in 1999. During the 1991-1999 period, traditional gears only contributed 1.5-3.6% (mean 2.5%) to the annual landings in Kuala Penyu. Traditional gear do not contribute much to the annual landings in Kuala Penyu. However, Kuala Penyu contribution to the WC-South annual traditional gear landings had increased by 146.3%, from 1.8% in 1991 to 4.4% in 1999. Kuala Penyu contribution to the WC-South annual traditional gear landings fluctuated around 1.3-4.7% (mean 2.7%) during the 9-

year period. Overall, Kuala Penyu only contributed between 0.4-0.9% (mean 0.6%) to the non-SSME annual traditional gear landings during the 1991-1999 period. During the 1997-1999 period, the annual traditional gear landings fluctuated around 58-95 metric tons, contributing 2.2-3.6% (mean 3.0%) to the annual landings in Kuala Penyu. During the 3-year period, Kuala Penyu contributed 4.2-4.7% (mean 4.4%) and 0.7-0.9% (mean 0.8%) respectively to the WC-South and non-SSME annual traditional gear landings.

In 1999, lift net landings in the non-SSME area amounted to 2,187 metric tons, with a decrease of 68% over the 1991 period (6,864 metric tons) (**Figure 233**). Lift net contributed 22.6-45.5% (mean 36.0%) to the non-SSME annual traditional gear landings during the 1991-1999 period. Lift net contribution to the non-SSME annual traditional gear landings had decreased by 45.3%, from 41.2% in 1991 to 22.6% in 1999 (**Figure 235b**). During the 9-year period, the non-SSME contribution to the annual lift net landings had decreased by 60.7%, from 54.8% in 1991 to 21.5% in 1999 (**Figure 234**). During the 1997-1999 period, pelagic fishes represents 95% of the non-SSME annual lift net landings, with round scad making up 72% of the pelagic catch, followed by sardine (8%), mackerel (5%) and other pelagic species (15%). Demersal finfish only make up 5% of the non-SSME annual lift net landings.

In the non-SSME area, lift net landings are only recorded in four districts: Kota Belud, Tuaran, Kota Kinabalu and Papar. During the 1997-1999 period, annual lift net landings in the non-SSME area fluctuated between 2,187–3,276 metric tons (mean 2,661 metric tons). Lift net landings had declined by 33.3% during the 3-year period, from 3,276 metric tons in 1997 to 2,186 metric tons in 1999. In the WC-North, lift net landings had declined by 17.9%, from 2,567 metric tons in 1997 to 2,107 metric tons in 1999. On the other hand, lift net landings in the WC-South had declined by 88.8%, from 710 metric tons in 1997 to only 80 metric tons in 1999. Overall, the WC-North contributed 88.1% to the non-SSME annual lift net landings during the 3-year period. Kota Kinabalu contributed 46.2% to the WC-North annual lift net landings, followed by Tuaran (38.1%) and Kota Belud (15.7%).

In Kota Kinabalu, lift net landings in 1999 amounted to 1,021 metric tons, with a decrease of 6.1% over the 1997 period (1,087 metric tons). Lift net contributed 36.6-38.8% (mean 37.6%) to the annual traditional gear landings. During the 3-year period, lift net contribution to the annual traditional gear landings had increased by 1.9%, from 36.6% in 1997 to 37.3% in 1999. Lift net landings in Kota Kinabalu comprised of 100% pelagic species, with round scad making up 73.3% of the annual pelagic catch, followed by sardine (10.1%), mackerel (8.5%) and other pelagic species (8.1%). Lift net contributed 74.8-78.3% (mean 76.5%) to the pelagic portion of the annual traditional gear landings in Kota Kinabalu.

In Tuaran, lift net landings in 1999 amounted to 543 metric tons, with a decrease of 55.4% over the 1997 period (1,219 metric tons). Lift net contributed 65.2-86.6% (mean 76.3%) to the annual traditional gear landings. During the 3-year period, lift net contribution to the annual traditional gear landings had decreased by 24.7%, from 86.6% in 1997 to 65.2% in 1999. Lift net landings in Tuaran comprised of 100% pelagic species, with round scad making up 76.0% of the annual pelagic catch, followed by sardine (2.7%), mackerel (0.5%) and other pelagic species (20.8%). Lift net contributed 74.5-90.4% (mean 83.4%) to the pelagic portion of the annual traditional gear landings in Tuaran.

In Kota Belud, lift net landings in 1999 amounted to 542 metric tons, an increase of 108.9% over the 1997 period (260 metric tons). Lift net contributed 7.2-13.3% (mean 9.8%) to the annual traditional gear landings. During the 3-year period, lift net contribution to the annual traditional gear landings had increased by 85.5%, from 7.2% in 1997 to 13.3% in 1999. Lift net landings in Kota Kinabalu comprised of 71.7% pelagic and 28.3% demersal fishes. Round scad make up 88.4% of the annual pelagic catch, followed by sardine (4.7%), anchovy (3.4%) and other pelagic species (3.3%). The demersal portion of the lift net landings in Kota Belud comprised of 100% shrimps. Lift net contributed 14.5-15.3% (mean 14.9%) and 93.5-100.0% (mean 97.0%) respectively to the pelagic and demersal portions of the annual traditional gear landings in Kota Belud.

In Papar, lift net landings in 1999 amounted to 80 metric tons, a decrease of 88.8% over the 1999 period (710 metric tons). Lift net contributed 20.6-61.9% (mean 36.5%) to the annual traditional gear landings. During the 3-year period, lift net contribution to the annual traditional gear landings had decreased by 66.6%, from 61.9% in 1997 to 20.6% in 1999. Lift net landings in Papar comprised of 100% pelagic fishes, with round scad making up 41.9% of the annual pelagic catch, followed by sardine (14.0%), mackerel (12.1%) and other pelagic species (32.0%). Lift net contributed 44.9-80.3% (mean 58.6%) to the pelagic portion of the annual traditional gear landings in Papar.

In 1999, hook & line landings in the non-SSME area amounted to 3,835 metric tons, with a decrease of 57% over the 1991 period (8,929 metric tons) (**Figure 239**). Hook & line gears contributed 39.6-60.4% (mean 46.5%) to the non-SSME annual traditional gear landings during the 1991-1999 period. Hook & line contribution to the non-SSME traditional gear landings had decreased by 26.2%, from 53.7% in 1991 to 39.6% in 1999 (**Figure 241b**). During the 9-year period, the non-SSME contribution to the annual hook & line landings had decreased by 77.6%, from 60.6% in 1991 to 13.6% in 1999 (**Figure 240**). Demersal fishes contributed 60% to the non-SSME annual hook & line landings, with finfish and invertebrates respectively making up 84% and 16% of the annual demersal catch. Pelagic fishes represents 40% of the annual hook & line landings, comprising of tuna (4%) and other pelagic species (96%).

During the 1997-1999 period, annual hook & line landings in the non-SSME area fluctuated between 3,835–4,258 metric tons (mean 4,072 metric tons). Hook & line landings had declined by 9.9% during the 3-year period, from 4,258 metric tons in 1997 to 3,835 metric tons in 1999. During the 3-year period, WC-North and WC-South contributed respectively 78.2-82.1% (mean 80.0%) and 17.9-21.8% (mean 20.0%) to the annual non-SSME hook & line landings. In the WC-North, hook & line landings had declined by 5.5%, from 3,330 metric tons in 1997 to 3,147 metric tons in 1999. In the WC-South, hook & line landings had also declined by 25.8%, from 928 metric tons in 1997 to 688 metric tons in 1999. Kota Belud contributed 52.7% to the WC-North annual hook & line landings, followed by Kota Kinabalu (40.5%) and Tuaran (6.8%). On the other hand, Papar contributed 40.6% to the WC-South annual hook & line landings, followed by Beaufort (29.7%), Sipitang (26.8%) and Kuala Penyu (2.9%).

In Kota Belud, hook & line landings in 1999 amounted to 1,636 metric tons, a decrease of 10.9% over the 1997 period (1,835 metric tons). Hook & line contributed 40.1-50.1% (mean 46.6%) to the annual traditional gear landings. During the 3-year period, hook & line contribution to the annual traditional gear landings had decreased by 20.8%, from 50.7% in 1997 to 40.1% in 1999. Hook & line landings in Kota Belud comprised of 53.2% demersal and 46.8% pelagic species. Finfish and invertebrates make up respectively 65.5% and 34.5% of the annual demersal catches landed by hook & line gears in Kota Belud. On the other hand, tuna make up 23.9% of the annual pelagic catches landed by hook & line, followed by round scad (0.8%), mackerel (0.5%) and other pelagic species (74.8%). Hook & line contributed 42.1-53.7% (mean 48.6%) and 38.2-48.7% (mean 45.0%) respectively to the pelagic and demersal portions of the annual traditional gear landings in Kota Belud.

In Kota Kinabalu, hook & line landings in 1999 amounted to 1,321 metric tons, a decrease of 5.5% over the 1997 period (1,329 metric tons). Hook & line contributed 44.7-46.8% (mean 45.8%) to the annual traditional gear landings in Kota Kinabalu. During the 3-year period, hook & line contribution to the annual traditional gear landings had decreased by 2.6%, from 44.7% in

1997 to 45.8% in 1999. Hook & line landings in Kota Kinabalu comprised of 50.4% pelagic and 49.6% demersal species. Tuna and other pelagic species make up respectively 4% and 96% of the annual pelagic catch landed by hook & line gears in Kota Kinabalu. On the other hand, finfish and invertebrates make up respectively 98.5% and 1.5% of the annual demersal catches. Hook & line contributed 15.2-20.3% (mean 18.1%) and 68.6-78.0% (mean 72.6%) respectively to the pelagic and demersal portions of the annual traditional gear landings in Kota Kinabalu.

In Tuaran, hook & line landings in 1999 amounted to 255 metric tons, an increase of 53.1% over the 1997 period (167 metric tons). Hook & line contributed 11.8-30.6% (mean 21.0%) to the annual traditional gear landings in Tuaran. During the 3-year period, hook & line contribution to the annual traditional gear landings had decreased by 158.7%, from 11.8% in 1997 to 30.6% in 1999. Hook & line landings in Tuaran comprised of 72.1% pelagic and 27.9% demersal species. Tuna and other pelagic species make up respectively 65.4% and 34.6% of the annual pelagic catch landed by hook & line gears in Tuaran. On the other hand, finfish and invertebrates make up respectively 39.9% and 60.1% of the annual demersal catches. Hook & line contributed 9.6-25.5% (mean 16.6%) and 62.6-74.6% (mean 68.0%) respectively to the pelagic and demersal portions of the annual traditional gear landings in Tuaran.

In Papar, hook & line landings in 1999 amounted to 331 metric tons, a decrease of 40.3% over the 1997 period (385 metric tons). Hook & line contributed 33.6-62.0% (mean 51.7%) to the annual traditional gear landings in Papar. During the 3-year period, hook & line contribution to the annual traditional gear landings had increased by 77.1%, from 33.6% in 1997 to 59.5% in 1999. Hook & line landings in Papar comprised of 52.5% pelagic and 47.5% demersal species. Tuna and other pelagic species make up respectively 11.9% and 88.1% of the annual pelagic catch landed by hook & line gears in Papar. On the other hand, finfish and invertebrates make up respectively 88.3% and 11.7% of the annual demersal catches. Hook & line contributed 19.7-55.1% (mean 41.4%) and 63.2-80.2% (mean 73.3%) respectively to the pelagic and demersal portions of the annual traditional gear landings in Papar.

In Beaufort, hook & line landings in 1999 amounted to 262 metric tons, a decrease of 6.1% over the 1997 period (270 metric tons). Hook & line contributed 18.7-50.4% (mean 36.2%) to the annual traditional gear landings in Beaufort. During the 3-year period, hook & line contribution to the annual traditional gear landings had decreased by 63.0%, from 50.4% in 1997 to 18.7% in 1999. Hook & line landings in Beaufort comprised of 63.9% pelagic and 36.1% demersal species. Tuna and other pelagic species make up respectively 23.8% and 76.2% of the annual pelagic catch landed by hook & line gears in Beaufort. On the other hand, finfish make up 100% of the annual demersal catches. Hook & line contributed 100% and 10.6-19.4% (mean 15.6%) respectively to the pelagic and demersal portions of the annual traditional gear landings in Beaufort.

In Sipitang, hook & line landings in 1999 amounted to 161 metric tons, a decrease of 29.1% over the 1997 period (227 metric tons). Hook & line contributed 98.3-99.7% (mean 99.1%) to the annual traditional gear landings in Sipitang. During the 3-year period, hook & line contribution to the annual traditional gear landings had decreased by 1.3%, from 99.7% in 1997 to 98.3% in 1999. Hook & line landings in Sipitang comprised of 61.6% pelagic and 38.4% demersal species. Tuna and other pelagic species make up respectively 8.0% and 92.0% of the annual pelagic catch landed by hook & line gears in Sipitang. On the other hand, finfish and invertebrates make up 97.8% and 2.2% respectively to the annual demersal catches. Hook & line contributed 100% and 96.4-99.0% (mean 97.9%) respectively to the pelagic and demersal portions of the annual traditional gear landings in Sipitang.

In Kuala Penyu, hook & line landings in 1999 amounted to 35 metric tons, a decrease of 1.9% over the 1997 period (36 metric tons). In 1998, no hook & line landings were recorded. Hook & line contributed 37.7-38.6% (mean 38.2%) to the annual traditional gear landings in Kuala Penyu. During the 3-year period, hook & line contribution to the annual traditional gear landings had increased by 2.4%, from 37.7% in 1997 to 38.6% in 1999. Hook & line landings in Kuala Penyu comprised of 1.1% pelagic and 98.9% demersal species (100% finfish). Hook & line contributed 100% and 37.4-38.4% (mean 37.9%) respectively to the pelagic and demersal portions of the annual traditional gear landings in Kuala Penyu.

In 1999, miscellaneous gear landings in the non-SSME area totaled 3,670 metric tons, with an increase of 332% over the 1991 period (849 metric tons) (**Figure 245**). Miscellaneous gears contributed 5.1-37.9% (mean 17.5%) to the non-SSME annual traditional gear landings during the 1991-1999 period (**Figure 247b**). Its share of the non-SSME annual traditional gear landings had increased by 642.2%, from 5.1% in 1991 to 37.9% in 1999. During the 9-year period, the non-SSME contribution to the annual miscellaneous traditional gear landings had increased by 120.5%, from 16.0% in 1991 to 35.4% in 1999 (**Figure 246**). During the 1997-1999 period, pelagic and demersal fish respectively make up 25% and 75% of the annual miscellaneous traditional gear landings in the non-SSME area. The demersal portion of the landings comprised of 52% finfish, 23% shrimps and 25% invertebrates. The pelagic portion of the landings comprised of 7% mackerel, 3% anchovy and 90% other pelagic species.

During the 1997-1999 period, miscellaneous gear landings in the non-SSME area fluctuated between 2,301–3,670 metric tons (mean 2,820 metric tons). Miscellaneous gear landings had increased by 47.6% during the 3-year period, from 2,487 metric tons in 1997 to 3,670 metric tons in 1999. During the 3-year period, WC-North and WC-South contributed respectively 65.2-84.4% (mean 75.5%) and 15.6-34.8% (mean 24.5%) to the annual non-SSME miscellaneous gear landings. In the WC-North, miscellaneous gear landings had increased by 13.9%, from 2,100 metric tons in 1997 to 2,391 metric tons in 1999. In the WC-South, miscellaneous gear landing had increased by 230.4%, from 387 metric tons in 1997 to 1,278 metric tons in 1999. Kota Belud contributed 76.2% to the WC-North annual miscellaneous gear landings, followed by Kota Kinabalu (22.5%) and Tuaran (1.3%). On the other hand, Beaufort contributed 82.0% to the WC-South annual miscellaneous gear landings, followed by Papar (9.4%), Kuala Penyu (8.3%) and Sipitang (0.2%).

In Kota Belud, miscellaneous gear landings in 1999 amounted to 1,897 metric tons, with an increase of 24.5% over the 1997 period (1,524 metric tons). Miscellaneous gears contributed 42.1-46.6% (mean 43.6%) to the annual traditional gear landings in Kota Belud. During the 3-year period, miscellaneous gears contribution to the annual traditional gear landings had increased by 10.5%, from 42.1% in 1997 to 46.6% in 1999. Miscellaneous gear landings in Kota Belud comprised of 37.7% pelagic and 62.3% demersal species. Mackerel contributed 6.6% to the pelagic portion of the annual miscellaneous gear landings in Kota Belud, followed by anchovy (3.5%) and other pelagic species (90.0%). On the other hand, finfish contributed 83.0% to the demersal portion of the annual miscellaneous gears, followed by invertebrates (16.6%) and shrimp (0.4%). Miscellaneous gears contributed 31.8-43.0% (mean 36.5%) and 48.4-50.0% (mean 49.2%) respectively to the pelagic and demersal portions of the annual traditional gear landings in Kota Belud.

In Kota Kinabalu, miscellaneous gear landings in 1999 amounted to 460 metric tons, with a decrease of 17.0% over the 1997 period (554 metric tons). Miscellaneous gears contributed 14.3-18.7% (mean 16.6%) to the annual traditional gear landings in Kota Kinabalu. During the 3-year period, miscellaneous gear contribution to the annual traditional gear landings had decreased by 9.9%, from 18.7% in 1997 to 16.8% in 1999. Miscellaneous gear landings in Kota Kinabalu comprised of 16.4% pelagic and 83.6% demersal species. Mackerel and tuna make up

11.5% and 88.5% respectively of the pelagic portion of the annual miscellaneous gear landings in Kota Kinabalu. On the other hand, finfish make up 65.7% of the demersal portion of the annual miscellaneous gear landings, followed by shrimp (20.7%) and invertebrates (13.5%). Miscellaneous gears contributed 4.8-6.5% (mean 5.4%) and 22.0-31.4% (mean 27.4%) respectively to the pelagic and demersal portions of the annual traditional gear landings in Kota Kinabalu.

In Tuaran, miscellaneous gear landings in 1999 amounted to 34.5 metric tons, with an increase of 58.7% over the 1997 period (21.8 metric tons). Miscellaneous gears contributed 1.5-4.1% (mean 2.7%) to the annual traditional gear landings in Tuaran. During the 3-year period, miscellaneous gears contribution to the annual traditional gear landings had increased by 168.1%, from 1.5% in 1997 to 4.1% in 1999. Invertebrates, mainly cephalopods and mangrove crabs, make up 100% of the annual miscellaneous gear landings in Tuaran. Miscellaneous gears contributed 25.4-37.4% (mean 32.0%) to the demersal portion of the annual traditional gear landings in Tuaran.

In Beaufort, miscellaneous gear landings in 1999 amounted to 1,143 metric tons, with an increase of 315.5% over the 1997 period (275 metric tons). Miscellaneous gears contributed 49.6-81.3% (mean 63.8%) to the annual traditional gear landings in Beaufort. During the 3-year period, miscellaneous gear contribution to the annual traditional gear landings had increased by 63.9%, from 49.6% in 1997 to 81.3% in 1999. The annual miscellaneous gear landings in Beaufort comprised of 100% demersal species. Shrimp and invertebrates make up respectively make up 69.9% and 30.1% to the annual miscellaneous gear landings. Overall, miscellaneous gears contributed 80.6-89.4% (mean 84.4%) to the demersal portion of the annual traditional gear landings in Beaufort.

In Papar, miscellaneous gear landings in 1999 amounted to 76.7 metric tons, with an increase of 47.7% over the 1997 period (51.9 metric tons). Miscellaneous gears contributed 4.5-19.8% (mean 11.8%) to the annual traditional gear landings in Papar. During the 3-year period, miscellaneous gear contribution to the annual traditional gear landings had increased by 338.4%, from 4.5% in 1997 to 19.8% in 1999. Annual miscellaneous gear landings in Papar comprised of 100% demersal species. Shrimp and invertebrates make up respectively make up 29.8% and 70.2% to the annual miscellaneous gear landings. Overall, miscellaneous gears contributed 19.8-36.8% (mean 26.7%) to the demersal portion of the annual traditional gear landings in Papar.

In Kuala Penyu, miscellaneous gear landings in 1999 amounted to 55.7 metric tons, with a decrease of 5.6% over the 1997 period (59.0 metric tons). Miscellaneous gears contributed 61.4-100% (mean 74.6%) to the annual traditional gear landings in Kuala Penyu. During the 3-year period, miscellaneous gear contribution to the annual traditional gear landings had decreased by 5.6%, from 62.3% in 1997 to 61.4% in 1999. In 1998, miscellaneous gears contributed 100% to the traditional gear landings. The annual miscellaneous gear landings in Kuala Penyu comprised of 100% demersal species (invertebrates). Overall, miscellaneous gears contributed 61.6-100% (mean 74.7%) to the demersal portion of the annual traditional gear landings in Kuala Penyu.

In Sipitang, miscellaneous gear landings in 1999 amounted only 2.7 metric tons, with an increase of 243.0% over the 1997 period (0.8 metric tons). Miscellaneous gears contributed 0.3-1.7% (mean 0.9%) to the annual traditional gear landings in Sipitang. During the 3-year period, miscellaneous gears contribution to the annual traditional gear landings had increased by 378%, from 0.3% in 1997 to 1.7% in 1999. Miscellaneous gear landings in Sipitang comprised of 100% demersal species (invertebrates). Overall, miscellaneous gears contributed only 1.0-3.6% (mean 2.1%) to the demersal portion of the annual traditional gear landings in Sipitang.

Pelagic and demersal species make up respectively 51% and 49% of the annual traditional gear landings in the non-SSME area. Round scad represents 38% of the pelagic portion of the annual traditional gear landings, followed by tuna (8%), sardine (4%), mackerel (4%) and other pelagic species (46%). While finfish represents 67% of the demersal portion of the annual traditional gear landings, followed by invertebrates (20%) and shrimps (13%).

On the other hand, pelagic and demersal species make up respectively 45% and 55% of the annual commercial gear landings in the non-SSME area. Finfish represents 76% of the demersal portion of the annual commercial gear landings, followed by invertebrates (18%) and shrimps (6%). While round scad represents 17% of the pelagic portion of the annual commercial gear landings, followed by tuna (15%), mackerel (15%), sardine (6%), and other pelagic species (48%).

Overall, pelagic and demersal fishes respectively make up respectively 46% and 54% of the non-SSME annual marine fish landings. Finfish represents 75% of the demersal portion of the annual marine fish landings, followed by invertebrates (18%) and shrimps (7%). Round scad represents 20% of the pelagic portion of the annual marine fish landings, followed by tuna (14%), mackerel (13%), sardine (5%) and other pelagic species (48%).

SSME Area

During the 1991-1999 period, the SSME area contributed 66.9% to the total fish landings in Sabah. The SSME contribution to the annual landings in Sabah had increased by 19% during the 9-year period, from 56% in 1991 to 67% in 1999 (**Figures 122a-122b**). The monthly and quarterly marine fish landing trends in the SSME area during the 1991-1999 period is shown in **Figures 115-119**. The regional contribution to the SSME annual fish landing during the 1991-1999 period is shown in **Figures 132-134**.

During the 1991-1999 period, SSME-3 contributed between 45.0% to the SSME annual landings, followed by SSME-2 (30.7%) and SSME-1 (24.3%) (**Figures 154-155**). SSME-1 and SSME-3 contribution to the annual SSME landings had increased during the last few years, with reduced contribution from SSME-2. During the 1997-1999 period, SSME-3 contributed 49.8% to the SSME annual landings, followed by SSME-1 (26.2%) and SSME-1 (24.0%). The temporal landing trends of each districts in the SSME area are shown respectively in **Figures 156-158** for SSME-1 area**, Figures 174-176** for SSME-2 area and **Figures 193-195** for SSME-3 area. During the 1997-1999 period, Kudat contributed 28.8% to the SSME annual commercial gear landings, followed by Sandakan (22.3%), Kunak (16.7%), Tawau (13.6%) and Semporna (11.0%). On the other hand, Lahad Datu contributed 26.5% to the SSME annual traditional gear landings, followed by Sandakan (25.1%), Kudat (14.0%), Kunak (13.8%) and Tawau (13.7%).

In 1999, landings in the SSME area amounted to 138,236 metric tons, with an increase of 127% over the 1991 period (60,959 metric tons) (**Figures 132**). During the 1991-1999 period, trawl net contributed 28.7% to the SSME annual landings, followed by seine net (23.3%), gill net (18.2%), hook & line (12.7%), lift net (10.1%) and miscellaneous gears (7.0%) (**Figure 250**). Commercial gears contributed 70.3% to the annual landings during the 1991-1999 period, and in recent years, its share of the annual landings had declined due to decrease in gill net and seine net landings and increase in hook & line landings. During the 1997-1999 period, trawl net contributed 30.1% to the SSME annual landings, followed by seine net (22.9%), hook & line (17.9%), gill net (14.7%), lift net (9.3%) and miscellaneous gears (5.2%) (**Figure 140e**). During the 3-year period, commercial gears make up 67.7% of the SSME annual landings.

The fishing gear contribution to the SSME and regional SSME annual landings during the 1991-1999 period is summarized in *Tables 108-111.* The temporal and spatial distribution of landings in the SSME area reflected the different characteristics of the marine fisheries in each region.

Table 108: *Fishing gear breakdown of annual landings in the SSME area, 1991-1999*

Year	% GEAR CONTRIBUTION							
	TN	SN	GN	LN	HL	OT	COM	TRA
1991	28.8	22.8	22.2	9.3	9.5	7.3	73.9	26.1
1992	27.7	21.3	22.5	10.4	8.0	10.1	71.5	28.5
1993	26.1	24.3	19.3	7.0	8.2	15.0	69.7	30.3
1994	33.1	21.3	20.9	10.0	9.0	5.8	75.3	24.7
1995	27.2	23.1	18.6	11.8	14.2	5.2	68.8	31.2
1996	25.5	28.3	16.3	14.3	11.8	3.8	70.1	29.9
1997	27.7	20.9	14.9	13.9	17.0	5.6	63.5	36.5
1998	29.4	22.1	16.3	8.1	18.9	5.2	67.8	32.2
1999	33.1	25.6	13.0	5.8	17.7	4.8	71.7	28.3

Table 109: *Fishing gear breakdown of annual landings in the SSME-1 area, 1991-1999*

Year	% GEAR CONTRIBUTION							
	TN	SN	GN	LN	HL	OT	COM	TRA
1991	50.6	0.0	36.8	7.7	3.8	1.1	87.4	12.6
1992	51.7	0.0	33.9	0.9	1.9	11.6	85.6	14.4
1993	51.6	0.0	14.4	0.3	1.5	32.2	66.0	34.0
1994	79.5	1.9	9.1	0.8	1.7	7.0	90.5	9.5
1995	73.4	6.0	12.3	0.7	2.5	5.2	91.6	8.4
1996	70.5	10.0	10.4	0.4	7.8	0.8	91.0	9.0
1997	59.7	8.7	13.0	0.3	13.6	4.6	81.4	18.6
1998	62.2	11.7	9.6	0.7	14.9	0.8	83.5	16.5
1999	65.7	8.8	6.1	0.7	17.8	0.9	80.6	19.4

Table 110: *Fishing gear breakdown of annual landings in the SSME-2 area, 1991-1999*

Year	% GEAR CONTRIBUTION							
	TN	SN	GN	LN	HL	OT	COM	TRA
1991	31.7	15.3	28.6	0.0	11.4	13.0	75.6	24.4
1992	25.3	15.2	31.4	0.1	11.5	16.5	71.9	28.1
1993	22.6	14.1	42.0	0.0	6.8	14.5	78.7	21.3
1994	22.5	6.9	52.5	0.0	7.5	10.6	81.9	18.1
1995	22.8	8.3	47.2	0.0	10.9	10.8	78.3	21.7
1996	24.9	5.3	45.8	0.0	12.6	11.4	76.0	24.0
1997	24.9	7.7	36.8	0.0	16.1	14.4	69.4	30.6
1998	22.4	5.3	40.2	0.0	18.3	13.8	67.9	32.1
1999	31.5	6.3	33.9	0.0	16.4	11.9	71.7	28.3

Table 111: *Fishing gear breakdown of annual landings in the SSME-3 area, 1991-1999*

Year	% GEAR CONTRIBUTION							
	TN	SN	GN	LN	HL	OT	COM	TRA
1991	14.2	43.6	7.2	21.0	10.3	3.7	64.9	35.1
1992	11.6	44.2	4.2	28.6	9.1	2.4	60.0	40.0
1993	8.2	53.1	3.8	18.7	14.9	1.4	65.1	34.9
1994	9.8	45.9	3.9	24.1	15.1	1.2	59.6	40.4
1995	8.2	38.9	6.2	23.3	21.3	2.1	53.2	46.8
1996	10.3	45.5	4.4	25.9	12.8	1.2	60.1	39.9
1997	15.4	32.8	4.6	26.7	18.9	1.6	52.8	47.2
1998	16.4	37.4	5.8	16.6	21.3	2.5	59.5	40.5
1999	17.4	43.4	6.4	11.1	18.2	3.4	67.2	32.8

Trawl net is the principal landing gear in the SSME-1 area (**Figure 127d**). During the 1991-1999 period, trawl net contributed 62.8% to the SSME-1 annual landings, followed by gill net (16.2%), hook & line gears (7.3%), miscellaneous gears (7.1%), seine net (5.2%) and lift net (1.4%). No seine net landings were recorded in 1991-1993. Commercial gears contributed 84.2% to the SSME-1 annual landings during the 9-year period. In recent years, gill net and seine net landings had declined coupled with increase in hook & line landings. During the 1997-1999 period, trawl net contributed 62.6% to the SSME-1 annual landings, followed by hook & line (15.5%), seine net (9.8%), gill net (9.6%), miscellaneous gears (2.1%) and lift net (0.6%) (**Figure 168**). Commercial gears contributed 81.2% to the SSME-1 annual landings during the 3-year period.

Gill net is the principal landing gear in the SSME-2 area (**Figure 229e**). During the 1991-1999 period, gill net contributed 39.8% to the SSME-2 annual landings, followed by trawl net (25.4%), miscellaneous gears (13.0%), hook & line (12.4%) and seine net (9.4%). No lift net landings were recorded in the SSME-2 (except for 42 metric tons from *selambau* lift net landings in 1992). Commercial gears contributed 74.6% to the SSME-2 annual landings during the 9-year period. During the last few years, commercial gear landings had declined in different proportions. During the 1997-1999 period, gill net contributed 37.0% to the SSME-2 annual landings, followed by trawl net (26.3%), hook & line (17.0%), miscellaneous gears (13.4%) and seine net (6.4%). Commercial gears contributed 69.7% to the SSME-2 annual landings during the 3-year period.

Seine net is the principal landing gear in the SSME-3 area (**Figure 223f**). During the 9-year period, seine net contributed 42.7%, followed by lift net (21.8%), hook & line (15.8%), trawl net (12.4%), gill net (5.2%) and miscellaneous gears (2.2%). Commercial gears make up 60.2% of the SSME-3 annual landings during the 9-year period, and in recent years its share of the annual landings had declined. During the 1997-1999 period, seine net contributed 37.9% to the SSME-3 annual landings, followed by hook & line (19.5%), lift net (18.2%), trawl net (16.4%), gill net (5.6%) and miscellaneous gears (2.5%). Commercial gears make up 59.8% of the SSME-3 annual landings during the 3-year period. Traditional gears play an important role in the annual landings in SSME-3 compared to SSME-1 and SSME-2. During the 1997-1999 period, traditional gears make up respectively 18.2%, 30.3$ and 40.2% of the annual landings in SSME-1, SSME-2 and SSME-3.

In 1999, commercial gear landings in the SSME area amounted to 99,142 metric tons, with an increase of 120% over the 1991 period (45,039 metric tons) (**Figure 141**). During the 1991-1999 period, commercial gears contributed 70.3% to the SSME annual landings (**Figure 155**), with trawl net making up 40.9% of the SSME annual commercial gear landings, followed by seine net (33.2%) and gill net (25.9%). During the 9-year period, commercial gear contribution to the SSME annual landings had decreased by 3%, from 73.9% in 1991 to 71.7% in 1999. The SSME contributed 58.4-74.3% (mean 66.6%) to the annual commercial gear landings during the 1991-1999 period. SSME commercial gear contribution had increased by 5.4%, from 59.4% in 1991 to 62.6% in 1999 (**Figures 145-146**).

The regional contribution to the SSME annual commercial and traditional gear landings during the 1991-1999 period are given respectively in **Figures 169-171** (SSME-1), **Figures 188-190** (SSME-2) and **Figures 207-209** (SSME-3). The average gear landing composition in the SSME area during the 1997-1999 period is given in *Tables 112-115*. Demersal species make up 53.1% of the SSME annual landings. Demersal species make up respectively 81.1% and 75.8% of the annual landings in SSME-1 and SSME-2. On the other hand, pelagic species make up make up 62.2% of the annual landings in SSME-3.

During the 1991-1999 period, SSME-3 contributed 38.5% to the SSME annual commercial gear landings, followed by SSME-2 (32.5%) and SSME-1 (28.9%) (**Figures 142-143**). During the 1997-1999 period, SSME-3 contributed 43.9% to the SSME annual commercial gear landings, followed by SSME-1 (29.0%) and SSME-2 (27.0%).

SSME-2 contribution to the SSME annual commercial gear landings had declined by 45% during the 9-year period, from 45% in 1991 to 24% in 1999. SSME-2 share of the SSME commercial gear landings had decreased throughout the years because of increasing higher landings in SSME-1 and SSME-3. On the other hand, SSME-3 contribution to the SSME annual commercial landings had increased by 45%, from 33% in 1991 to 47% in 1999. Seine net is the principal gear contributing to the commercial gear landing increase in SSME-3 (**Figure 223f**). SSME-1 contribution to the SSME annual commercial gear landings had increased by 25%, from 23% in 1991 to 29% in 1999. Trawl net is the principal gear contributing to the commercial gear landing increase in SSME-1 (**Figure 217d**). The regional contribution to the SSME gear landings is summarized in the following *Tables 116-118*.

In SSME-1, the annual commercial gear landings fluctuated between 10,274 and 28,427 metric tons (mean 22,636 metric tons) during the 1991-1999 period. In 1999, the SSME-1 commercial gear landings amounted to 28,223 metric tons, with an increase of 174.7% over the 1991 period (10,274 metric tons). Kudat is the main contributor of the annual commercial gear landings in SSME-1. Contribution from other districts is insignificant throughout the 9-year period. In 1999, commercial gear landings in Kudat amounted to 27,759 metric tons, with an increase of 181.8% over the 1991 period (9,851 metric tons). Commercial gear landings in Kota Marudu fluctuated between 326 and 1,727 metric tons during the 9-year period. On the other hand, commercial gear landings in Pitas only fluctuated between 66 and 329 metric tons. The gear & district contribution to the annual gear landings and gear landing composition in SSME-1 is summarized in *Table 119-127.*

Table 112: *Gear landing composition in the SSME area, 1997-1999*

Resource Group	% RESOURCE GROUP SHARE								
	TN	SN	GN	LN	HL	OT	Total	COM	TRA
Pelagic	13.5	92.8	51.0	87.1	36.8	12.1	49.2	50.3	46.9
Demersal	86.5	7.2	49.0	12.9	63.2	87.9	50.8	49.7	53.1
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
<u>Pelagic Portion</u>									
sardine	1.3	39.4	1.7	24.7	0.0	9.1	22.7	26.8	13.2
round scad	13.4	20.7	0.1	9.7	0.0	0.1	12.2	15.3	5.0
mackerel	29.4	6.4	0.5	5.2	6.4	8.5	7.2	7.7	5.8
anchovy	1.7	0.0	0.0	29.2	0.0	7.4	4.9	0.2	15.5
tuna	0.0	22.1	7.4	0.0	8.5	0.0	12.5	16.4	3.7
others	54.2	11.3	90.3	31.3	85.1	74.9	40.6	33.6	56.7
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
<u>Demersal Portion</u>									
finfish	67.9	87.8	82.9	34.3	99.7	38.9	74.4	72.1	78.9
shrimp	18.9	2.5	12.7	0.0	0.0	5.3	11.6	16.7	1.4
other invertebrate	13.2	9.7	4.4	65.7	0.3	55.8	14.0	11.2	19.6
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table 113: *Gear landing composition in the SSME-1 area, 1997-1999*

Resource Group	% RESOURCE GROUP SHARE								
	TN	SN	GN	LN	HL	OT	Total	COM	TRA
Pelagic	15.6	77.6	64.0	93.6	18.3	0.8	26.7	28.4	18.9
Demersal	84.4	22.4	36.0	6.4	81.7	99.2	73.3	71.6	81.1
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Pelagic Portion									
sardine	0.0	78.6	5.4	40.9	0.0	0.0	24.4	27.0	6.6
round scad	22.0	5.2	0.4	0.0	0.0	9.7	9.6	11.1	0.0
mackerel	42.4	8.9	1.4	0.7	0.3	0.3	18.5	21.1	0.4
anchovy	2.6	0.2	0.0	28.7	0.0	0.2	1.6	1.2	4.6
tuna	0.0	2.9	24.2	0.0	0.0	0.0	6.1	7.0	0.0
others	33.0	4.2	68.7	29.7	99.7	89.8	39.8	32.6	88.3
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Demersal Portion									
Finfish	85.6	90.7	55.9	0.0	99.7	8.2	84.8	84.1	87.7
Shrimp	6.8	0.0	25.9	0.0	0.0	3.8	6.2	7.6	0.5
other invertebrate	7.7	9.3	18.1	100.0	0.3	88.1	9.0	8.3	11.8
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table 114: *Gear landing composition in the SSME-2 area, 1997-1999*

Resource Group	% RESOURCE GROUP SHARE								
	TN	SN	GN	LN	HL	OT	Total	COM	TRA
Pelagic	8.3	97.1	48.0		31.6	14.8	33.7	37.8	24.2
Demersal	91.7	2.9	52.0		68.4	85.2	66.3	62.2	75.8
TOTAL	100.0	100.0	100.0		100.0	100.0	100.0	100.0	100.0
Pelagic Portion									
sardine	8.9	22.7	1.0		0.0	11.0	6.1	6.9	3.0
round scad	0.0	24.3	0.0		0.0	0.0	4.6	5.9	0.0
mackerel	5.8	22.9	0.0		0.0	10.4	5.3	6.0	2.8
anchovy	0.4	0.0	0.0		0.0	9.0	0.6	0.0	2.4
tuna	0.0	8.7	4.7		7.6	0.0	5.3	5.3	5.6
others	84.9	21.4	94.3		92.4	69.5	78.1	75.8	86.2
TOTAL	100.0	100.0	100.0		100.0	100.0	100.0	100.0	100.0
Demersal Portion									
Finfish	40.1	11.1	96.3		100.0	44.8	67.6	64.9	72.8
Shrimp	30.5	0.0	3.7		0.0	2.6	12.5	18.5	1.3
other invertebrate	29.4	88.9	0.0		0.0	52.6	19.8	16.6	25.9
TOTAL	100.0	100.0	100.0		100.0	100.0	100.0	100.0	100.0

Table 115: *Gear landing composition in the SSME-3 area, 1997-1999*

Resource Group	% RESOURCE GROUP SHARE								
	TN	SN	GN	LN	HL	OT	Total	COM	TRA
Pelagic	14.1	94.2	51.2	87.0	46.5	8.7	68.2	72.2	62.2
Demersal	85.9	5.8	48.8	13.0	53.5	91.3	31.8	27.8	37.8
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
<u>Pelagic Portion</u>									
sardine	0.0	37.2	0.0	24.4	0.0	0.3	26.6	33.1	15.2
round scad	0.0	21.8	0.0	9.8	0.0	0.0	14.6	19.4	6.2
mackerel	11.1	4.8	1.2	5.2	9.3	0.1	5.5	4.8	6.7
anchovy	0.0	0.0	0.0	29.2	0.0	0.4	6.6	0.0	18.3
tuna	0.0	25.1	0.0	0.0	10.1	0.0	15.6	22.3	3.7
others	88.9	11.2	98.8	31.3	80.6	99.2	31.1	20.4	49.9
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
<u>Demersal Portion</u>									
Finfish	58.7	89.8	49.7	34.6	99.6	35.9	70.2	61.6	79.7
Shrimp	33.2	3.7	37.7	0.0	0.0	12.8	16.6	29.7	2.0
other invertebrate	8.1	6.5	12.7	65.4	0.4	51.4	13.2	8.6	18.3
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table 116: *SSME-1 contribution to the SSME annual gear landings (% SSME)*

Year	% SSME-1 CONTRIBUTION								
	TN	SN	GN	LN	HL	OT	TOTAL	COM	TRA
1991	33.8	0.0	31.9	16.0	7.7	3.0	19.3	22.8	9.3
1992	51.1	0.0	41.3	2.4	6.4	31.3	27.4	32.8	13.8
1993	60.6	0.0	22.9	1.4	5.7	65.8	30.7	29.1	34.5
1994	66.3	2.5	12.1	2.3	5.1	33.4	27.6	33.2	10.7
1995	62.4	6.0	15.4	1.4	4.1	23.2	23.1	30.8	6.2
1996	52.4	6.7	12.1	0.5	12.5	4.1	18.9	24.6	5.7
1997	47.6	9.2	19.2	0.5	17.6	18.1	22.0	28.2	11.2
1998	52.3	13.1	14.5	2.2	19.5	3.9	24.7	30.4	12.6
1999	50.3	8.7	11.8	2.9	25.6	4.6	25.3	28.5	17.4

Table 117: *SSME-2 contribution to the SSME annual gear landings (% SSME)*

Year	% SSME-2 CONTRIBUTION								
	TN	SN	GN	LN	HL	OT	TOTAL	COM	TRA
1991	47.9	29.1	56.1	0.0	52.1	78.0	43.6	44.6	40.8
1992	34.1	26.6	52.0	0.5	53.5	60.5	37.3	37.5	36.7
1993	27.8	18.6	69.7	0.0	26.6	30.9	32.1	36.2	22.5
1994	21.8	10.4	80.5	0.0	26.7	58.4	32.0	34.8	23.4
1995	22.5	9.6	68.0	0.0	20.6	56.1	26.8	30.4	18.6
1996	25.4	4.9	73.2	0.0	27.8	78.9	26.1	28.2	20.9
1997	23.7	9.7	64.9	0.0	24.9	67.3	26.3	28.8	22.0
1998	21.3	6.7	68.6	0.0	27.0	73.5	27.9	27.9	27.8
1999	23.2	6.0	63.4	0.0	22.7	59.7	24.4	24.4	24.4

Table 118: *SSME-3 contribution to the SSME annual gear landings (% SSME)*

Year	% SSME-3 CONTRIBUTION								
	TN	SN	GN	LN	HL	OT	TOTAL	COM	TRA
1991	18.3	70.9	12.0	84.0	40.2	19.0	37.1	32.6	49.9
1992	14.8	73.4	6.7	97.1	40.1	8.2	35.4	29.7	49.5
1993	11.6	81.4	7.4	98.6	67.7	3.4	37.2	34.7	43.0
1994	12.0	87.1	7.4	97.7	68.2	8.2	40.3	31.9	66.0
1995	15.1	84.4	16.6	98.6	75.3	20.8	50.1	38.8	75.1
1996	22.1	88.4	14.7	99.5	59.7	17.1	55.0	47.2	73.4
1997	28.8	81.1	15.9	99.5	57.5	14.6	51.7	43.0	66.8
1998	26.4	80.2	16.9	97.8	53.5	22.6	47.4	41.7	59.6
1999	26.5	85.3	24.7	97.1	51.8	35.7	50.3	47.1	58.2

Table 119: *Fishing gear breakdown of annual landings in Kudat, 1991-1999*

Year	% GEAR CONTRIBUTION							
	TN	SN	GN	LN	HL	OT	COM	TRA
1991	53.1	0.0	35.6	7.1	3.8	0.5	88.7	11.3
1992	57.4	0.0	39.7	0.5	2.0	0.5	97.0	3.0
1993	76.2	0.0	21.2	0.1	2.1	0.4	97.4	2.6
1994	87.9	2.2	7.8	0.1	1.7	0.3	97.9	2.1
1995	80.2	6.5	10.3	0.0	2.2	0.6	97.1	2.9
1996	74.0	10.5	7.3	0.0	7.6	0.6	91.9	8.1
1997	64.1	9.4	11.6	0.0	14.3	0.6	85.2	14.8
1998	64.2	12.1	7.9	0.0	15.0	0.7	84.3	15.7
1999	67.3	9.0	4.9	0.0	18.0	0.8	81.2	18.8

Table 120: *Kudat contribution to the SSME-1 annual gear landings (% SSME-1)*

Year	% KUDAT CONTRIBUTION								
	TN	SN	GN	LN	HL	OT	TOTAL	COM	TRA
1991	99.1		91.4	87.3	93.5	38.3	94.5	95.9	84.8
1992	89.7		94.4	47.0	84.4	3.3	80.8	91.5	16.7
1993	91.4		91.2	17.0	87.8	0.7	61.9	91.4	4.7
1994	97.4	100.0	75.5	14.7	88.2	4.2	88.0	95.2	19.8
1995	99.8	100.0	76.6	4.1	81.2	10.7	91.2	96.7	31.3
1996	99.8	100.0	66.3	0.0	92.4	65.3	95.1	96.0	85.9
1997	99.8	100.0	83.5	0.0	97.6	11.0	93.0	97.3	74.2
1998	99.9	100.0	80.1	0.0	97.5	84.2	96.8	97.6	92.5
1999	100.0	100.0	78.5	0.0	98.6	86.7	97.6	98.4	94.7

Table 121: *Gear landing composition in Kudat, 1997-1999*

Resource Group	% RESOURCE GROUP SHARE								
	TN	SN	GN	LN	HL	OT	Total	COM	TRA
Pelagic	15.4	77.6	70.5		18.0	2.1	28.0	30.6	17.3
Demersal	84.6	22.4	29.5		82.0	97.9	72.0	69.4	82.7
TOTAL	100.0	100.0	100.0		100.0	100.0	100.0	100.0	100.0
<u>Pelagic Portion</u>									
sardine	0.0	78.6	5.7		0.0	0.0	24.7	27.7	0.0
round scad	22.0	5.2	0.4		0.0	0.0	10.1	11.4	0.0
mackerel	42.4	8.9	1.4		0.0	0.3	19.3	21.7	0.0
anchovy	2.6	0.2	0.0		0.0	0.2	1.1	1.2	0.0
tuna	0.0	2.9	25.6		0.0	0.0	6.2	6.9	0.0
others	33.0	4.2	66.7		100.0	99.4	38.7	31.2	100.0
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
<u>Demersal Portion</u>									
Finfish	83.2	90.7	72.5		99.7	23.3	85.9	83.1	95.9
Shrimp	8.4	0.0	1.7		0.0	1.0	6.0	7.7	0.0
other invertebrate	8.3	9.3	25.8		0.3	75.7	8.1	9.2	4.0
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table 122: *Fishing gear breakdown of annual landings in Kota Marudu, 1991-1999*

Year	% GEAR CONTRIBUTION							
	TN	SN	GN	LN	HL	OT	COM	TRA
1991	11.6	0.0	69.7	0.0	0.7	18.0	81.3	18.7
1992	33.5	0.0	7.7	0.0	0.5	58.2	41.2	58.8
1993	14.2	0.0	2.7	0.0	0.1	83.0	16.9	83.1
1994	23.1	0.0	16.4	0.0	0.5	60.0	39.5	60.5
1995	3.6	0.0	35.7	0.0	1.7	59.0	39.3	60.7
1996	5.4	0.0	84.4	0.0	1.7	8.5	89.8	10.2
1997	2.1	0.0	28.9	0.0	1.3	67.7	31.0	69.0
1998	5.5	0.0	88.0	0.0	1.1	5.4	93.5	6.5
1999	2.0	0.0	89.7	0.0	2.3	5.9	91.7	8.3

Table 123: *Kota Marudu contribution to the SSME-1 annual gear landings (% SSME-1)*

Year	% KOTA MARUDU CONTRIBUTION								
	TN	SN	GN	LN	HL	OT	TOTAL	COM	TRA
1991	0.9		7.1	0.0	0.7	59.4	3.7	3.5	5.5
1992	10.3		3.6	0.0	4.4	79.5	15.8	7.6	64.6
1993	8.6		5.9	0.0	3.0	80.2	31.1	8.0	76.0
1994	2.6	0.0	16.3	0.0	2.5	77.5	9.1	4.0	57.5
1995	0.2	0.0	14.0	0.0	3.3	55.2	4.8	2.1	35.1
1996	0.2	0.0	21.4	0.0	0.6	27.7	2.6	2.6	3.0
1997	0.2	0.0	9.8	0.0	0.4	64.4	4.4	1.7	16.4
1998	0.1	0.0	13.7	0.0	0.1	9.8	1.5	1.7	0.6
1999	0.0	0.0	15.0	0.0	0.1	6.8	1.0	1.2	0.4

Table 124: *Gear landing composition in Kota Marudu, 1997-1999*

Resource Group	% RESOURCE GROUP SHARE								
	TN	SN	GN	LN	HL	OT	Total	COM	TRA
Pelagic	0.0		25.5		28.9	0.0	14.3	24.2	1.0
Demersal	100.0		74.5		71.1	100.0	85.7	75.8	99.0
TOTAL	100.0		100.0		100.0	100.0	100.0	100.0	100.0
<u>Pelagic Portion</u>									
sardine			5.0		0.0		4.8	5.0	0.0
round scad			0.0		0.0		0.0	0.0	0.0
mackerel			0.0		0.0		0.0	0.0	0.0
anchovy			0.0		0.0		0.0	0.0	0.0
tuna			3.6		0.0		3.5	3.6	0.0
others			91.4		100.0		91.7	91.4	100.0
TOTAL			100.0		100.0		100.0	100.0	100.0
<u>Demersal Portion</u>									
Finfish	21.9		17.6		100.0	0.0	10.2	17.8	2.5
Shrimp	66.4		81.3		0.0	2.0	41.6	80.4	2.0
other invertebrate	11.7		1.1		0.0	97.9	48.2	1.8	95.5
TOTAL	100.0		100.0		100.0	100.0	100.0	100.0	100.0

Table 125: *Fishing gear breakdown of annual landings in Pitas, 1991-1999*

Year	% GEAR CONTRIBUTION							
	TN	SN	GN	LN	HL	OT	COM	TRA
1991	0.0	0.0	31.4	54.8	12.4	1.4	31.4	68.6
1992	1.0	0.0	19.9	14.4	6.2	58.5	21.0	79.0
1993	0.0	0.0	6.1	3.8	2.0	88.1	6.1	93.9
1994	0.0	0.0	25.7	24.8	5.4	44.2	25.7	74.3
1995	0.0	0.0	29.1	16.8	9.8	44.3	29.1	70.9
1996	0.0	0.0	56.2	17.4	24.0	2.5	56.2	43.8
1997	0.0	0.0	33.1	12.7	10.4	43.9	33.1	66.9
1998	0.0	0.0	34.6	42.1	20.4	2.8	34.6	65.4
1999	0.0	0.0	29.5	49.5	16.7	4.3	29.5	70.5

Table 126: *Pitas contribution to the SSME-1 annual gear landings (% SSME-1)*

Year	% PITAS CONTRIBUTION								
	TN	SN	GN	LN	HL	OT	TOTAL	COM	TRA
1991	0.0		1.5	12.7	5.8	2.3	1.8	0.6	9.7
1992	0.1		2.0	53.0	11.3	17.2	3.4	0.8	18.7
1993	0.0		2.9	83.0	9.2	19.1	7.0	0.6	19.3
1994	0.0	0.0	8.2	85.3	9.4	18.3	2.9	0.8	22.6
1995	0.0	0.0	9.4	95.9	15.5	34.1	4.0	1.3	33.7
1996	0.0	0.0	12.3	100.0	7.0	6.9	2.3	1.4	11.1
1997	0.0	0.0	6.6	100.0	2.0	24.6	2.6	1.1	9.4
1998	0.0	0.0	6.3	100.0	2.4	6.0	1.7	0.7	6.9
1999	0.0	0.0	6.5	100.0	1.3	6.5	1.3	0.5	4.9

Table 127: *Gear landing composition in Pitas, 1997-1999*

Resource Group	% RESOURCE GROUP SHARE								
	TN	SN	GN	LN	HL	OT	Total	COM	TRA
Pelagic			55.9	93.6	34.8	0.4	54.2	55.9	53.3
Demersal			44.1	6.4	65.2	99.6	45.8	44.1	46.7
TOTAL			100.0	100.0	100.0	100.0	100.0	100.0	100.0
Pelagic Portion									
sardine			0.0	40.9	0.0	0.0	23.0	0.0	34.7
round scad			0.0	0.0	0.0	100.0	0.2	0.0	0.2
mackerel			1.9	0.7	9.7	0.0	2.0	1.9	2.1
anchovy			0.0	28.7	0.0	0.0	16.2	0.0	24.4
tuna			19.0	0.0	0.0	0.0	6.4	19.0	0.0
others			79.1	29.7	90.3	0.0	52.3	79.1	38.7
TOTAL			100.0	100.0	100.0	100.0	100.0	100.0	100.0
Demersal Portion									
Finfish			42.1		100.0	0.0	35.2	42.1	32.0
Shrimp			48.2		0.0	13.4	20.8	48.2	8.2
other invertebrate			9.6		0.0	86.6	44.1	9.6	59.8
TOTAL			100.0		100.0	100.0	100.0	100.0	100.0

During the 1991-1999 period, Kudat contributed 95.5% to the SSME-1 annual commercial gear landings, followed by Kota Marudu (3.6%) and Pitas (0.9%). Kudat contribution to the SSME-1 had increased by 2.6%, from 95.0% in 1991 to 98.4% in 1999. On the other hand, both Kota Marudu and Pitas contribution to the SSME-1 annual commercial gear landings had declined respectively by 66.7% and 23.8% during the same period. During the 1997-1999 period, Kudat contributed 97.7% to the SSME-1 annual commercial gear landings, followed by Kota Marudu (1.5%) and Pitas (0.8%).

In SSME-2, the annual commercial gear landings fluctuated between 20,068 and 29,810 metric tons (mean 24,494 metric tons) during the 1991-1999 period. In 1999, the SSME-2 commercial gear landings amounted to 24,175 metric tons, with an increase of 20.5% over the 1991 period (20,068 metric tons). Sandakan contributed more than 80% to the annual commercial gear landings in SSME-2. During the 9-year period, commercial gear landings in Sandakan fluctuated between 15,917 and 22,816 metric tons, and landings had increased by 27.5% from 15,917 in 1991 to 20,289 metric tons in 1999. Commercial gear landings in Beluran fluctuated between 2,946 and 8,810 metric tons. Landings had increased by 112.2% from 4,151 metric tons in 1991 to its peak of 8,810 metric tons in 1994, and since then landings had declined by 55.9% to 3,886 metric tons in 1999. The gear & district contribution to the annual gear landings and gear landing composition in SSME-2 is summarized in *Table 128-133.*

During the 1991-1999 period, Sandakan contributed 81% to the SSME-2 annual commercial gear landings. Sandakan contribution to the SSME-2 had increased by 5.8%, from 79.3% in 1991 to 83.9% in 1999. On the other hand, Beluran contributed 19% to the SSME-2 annual commercial gear landings, and during the 9-year period Beluran contribution to the SSME-2 had declined by 22.3%, from 20.7% in 1991 to 16.1% in 1999. During the 1997-1999 period, both Sandakan and Beluran contributed respectively 83.4% and 16.6% to the SSME-2 annual commercial gear landings.

Table 128: *Fishing gear breakdown of annual landings in Sandakan, 1991-1999*

Year	% GEAR CONTRIBUTION							
	TN	SN	GN	LN	HL	OT	COM	TRA
1991	30.3	20.0	28.2	0.0	14.8	6.8	78.5	21.5
1992	25.0	19.1	31.2	0.0	14.3	10.3	75.4	24.6
1993	23.9	16.7	38.3	0.0	7.9	13.2	78.9	21.1
1994	21.8	9.3	46.3	0.0	9.9	12.8	77.3	22.7
1995	21.1	9.6	45.9	0.0	12.3	11.0	76.7	23.3
1996	24.9	6.7	41.7	0.0	15.4	11.3	73.3	26.7
1997	21.3	9.3	35.0	0.0	18.6	15.8	65.6	34.4
1998	21.5	5.9	38.5	0.0	20.0	14.2	65.8	34.2
1999	28.9	7.2	32.9	0.0	18.6	12.5	69.0	31.0

Table 129: *Sandakan contribution to the SSME-2 annual gear landings (% SSME-2)*

Year	% SANDAKAN CONTRIBUTION								
	TN	SN	GN	LN	HL	OT	TOTAL	COM	TRA
1991	72.9	100.0	75.3		99.1	39.6	76.4	79.3	67.3
1992	78.5	100.0	79.1	0.0	99.0	49.8	79.5	83.3	69.7
1993	88.9	100.0	76.9		98.6	76.9	84.3	84.5	83.9
1994	72.1	100.0	65.8		99.0	89.8	74.6	70.4	93.6
1995	79.3	100.0	83.6		97.1	87.5	85.9	84.1	92.3
1996	80.0	100.0	72.6		97.7	78.7	79.8	76.9	88.7
1997	71.1	100.0	79.2		96.1	91.0	83.2	78.6	93.7
1998	86.6	100.0	86.7		98.8	93.0	90.5	87.7	96.3
1999	80.0	100.0	84.6		98.7	91.6	87.3	83.9	95.7

Table 130: *Gear landing composition in Sandakan, 1997-1999*

Resource Group	% RESOURCE GROUP SHARE								
	TN	SN	GN	LN	HL	OT	Total	COM	TRA
Pelagic	9.6	100.0	45.0		32.0	15.9	35.0	40.3	25.1
Demersal	90.4	0.0	55.0		68.0	84.1	65.0	59.7	74.9
TOTAL	100	100	100		100	100	100	100	100
Pelagic Portion									
sardine	0.0	22.7	0.0		0.0	11.3	5.8	6.7	3.2
round scad	0.0	23.6	0.0		0.0	0.0	5.2	7.0	0.0
mackerel	0.0	22.8	0.0		0.0	10.6	5.8	6.8	3.0
anchovy	0.0	0.0	0.0		0.0	8.9	0.7	0.0	2.5
tuna	0.0	9.8	7.1		9.3	0.0	7.4	7.6	6.7
others	100.0	21.2	92.9		90.7	69.2	75.2	71.9	84.6
TOTAL	100.0	100.0	100.0		100.0	100.0	100.0	100.0	100.0
Demersal Portion									
Finfish	41.9		100.0		100.0	47.9	73.4	72.3	75.2
Shrimp	27.4		0.0		0.0	2.9	8.4	13.1	1.4
other invertebrate	30.7		0.0		0.0	49.3	18.2	14.6	23.5
TOTAL	100.0		100.0		100.0	100.0	100.0	100.0	100.0

Table 131: *Fishing gear breakdown of annual landings in Beluran, 1991-1999*

Year	% GEAR CONTRIBUTION							
	TN	SN	GN	LN	HL	OT	COM	TRA
1991	36.3	0.0	29.9	0.0	0.4	33.4	66.2	33.8
1992	26.5	0.0	32.0	0.6	0.6	40.3	58.5	41.5
1993	16.0	0.0	62.0	0.0	0.6	21.3	78.1	21.9
1994	24.8	0.0	70.7	0.0	0.3	4.2	95.5	4.5
1995	33.4	0.0	54.8	0.0	2.3	9.6	88.1	11.9
1996	24.6	0.0	62.0	0.0	1.4	12.0	86.6	13.4
1997	42.9	0.0	45.7	0.0	3.7	7.7	88.5	11.5
1998	31.6	0.0	56.0	0.0	2.4	10.1	87.6	12.4
1999	49.4	0.0	41.1	0.0	1.7	7.8	90.5	9.5

Table 132: *Beluran contribution to the SSME-2 annual gear landings (% SSME-2)*

Year	% BELURAN CONTRIBUTION								
	TN	SN	GN	LN	HL	OT	TOTAL	COM	TRA
1991	27.1	0.0	24.7		0.9	60.4	23.6	20.7	32.7
1992	21.5	0.0	20.9	100.0	1.0	50.2	20.5	16.7	30.3
1993	11.1	0.0	23.1		1.4	23.1	15.7	15.5	16.1
1994	27.9	0.0	34.2		1.0	10.2	25.4	29.6	6.4
1995	20.7	0.0	16.4		2.9	12.5	14.1	15.9	7.7
1996	20.0	0.0	27.4		2.3	21.3	20.2	23.1	11.3
1997	28.9	0.0	20.8		3.9	9.0	16.8	21.4	6.3
1998	13.4	0.0	13.3		1.2	7.0	9.5	12.3	3.7
1999	20.0	0.0	15.4		1.3	8.4	12.7	16.1	4.3

Table 133: *Gear landing composition in Beluran, 1997-1999*

Resource Group	% RESOURCE GROUP SHARE								
	TN	SN	GN	LN	HL	OT	Total	COM	TRA
Pelagic	8.1	6.3	63.6		13.0	2.9	31.6	34.6	5.4
Demersal	91.9	93.7	36.4		87.0	97.1	68.4	65.4	94.6
TOTAL	100	100	100		100	100	100	100	100
Pelagic Portion									
sardine	50.7	0.0	5.4		0.0	0.0	10.6	10.8	0.0
round scad	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0
mackerel	33.0	0.0	0.0		0.0	0.0	3.9	4.0	0.0
anchovy	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0
tuna	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0
others	16.4	100.0	94.6		100.0	100.0	85.5	85.2	100.0
TOTAL	100.0	100.0	100.0		100.0	100.0	100.0	100.0	100.0
Demersal Portion									
Finfish	21.4	11.1	67.1		100.0	14.8	33.4	33.3	33.8
Shrimp	57.3	0.0	32.9		0.0	0.0	42.5	49.4	0.0
other invertebrate	21.3	88.9	0.0		0.0	85.2	24.1	17.2	66.2
TOTAL	100.0	100.0	100.0		100.0	100.0	100.0	100.0	100.0

In SSME-3, the annual commercial gear landings fluctuated between 14,697 and 46,744 metric tons (mean 30,690 metric tons) during the 1991-1999 period. In 1999, the SSME-3 commercial gear landings amounted to 46,744 metric tons, with an increase of 218.1% over the 1991 period (14,697 metric tons). During the 9-year period, Kunak contributed 44% to the SSME-3 annual commercial gear landings, followed by Semporna (29%), Tawau (22%) and Lahad Datu (5%). Landings in Kunak had increased by 181.0%, from 6,830 metric tons in 1991 to 19,221 metric tons in 1999. Landings in Kunak had increased by 144.9% from 6,839 metric tons in 1991 to 16,747 metric tons in 1993; decreased by 20.4% to 13,336 metric tons in 1995, peaked at

19,893 metric tons in 1996, declined to its minimum of 6,224 metric tons in 1995, and then increased by 208.8% to 19,221 metric tons in 1999. Landings in Semporna increased by 321.4% from 3,463 metric tons in 1991 to its peak of 14,592 metric tons in 1996, and since then had declined by 33.2% down to 9,742 metric tons in 1999. In Tawau, landings throughout the 9-year period had increased steadily, and had increased by 291.5% from 3,510 metric tons in 1991 to 13,743 metric tons in 1999. In Lahad Datu, landings fluctuated between 772 and 1,694 metric tons during the 1991-1997 period, and increased significantly by 138.4% to its peak of 4,038 metric tons in 1999. During the 1991-1999 period, commercial gear landings in Kunak had increased by 356.3% from 885 metric tons in 1991 to 4,038 metric tons in 1999. The gear & district contribution to the annual gear landings and gear landing composition in SSME-3 is summarized in *Table 134-145.*

During the 1991-1999 period, Kunak contributed 44.0% to the SSME-3 annual commercial gear landings, followed by Semporna (28.6%), Tawau (22.3%) and Lahad Datu (5.2%). During the 9-year period, Kunak maintained its position as the major contributor in the SSME-3 except in 1997 when it's share of the commercial gear landings declined to 20% due to a sudden drop in the overall commercial gear landings in the region. SSME-3 landings had declined by 30.3% from 44,670 metric tons in 1996 to 31,146 metric tons in 1997. Tawau share of the SSME-3 commercial gear landings had increased steadily throughout the years, peaked at 31.8% during the 1997-1998, and then slightly declined to 29.4% in 1999. On the other hand, Semporna share of the SSME-3 landings had also increased steadily throughout the years, from 19-24% in the early 90s, peaked at 42.8% in 1997, and since then had declined by 51.3% to only 20.8% in 1999. Lahad Datu maintained its share of the SSME-3 commercial gear landings around 4.1% from 1992-1997, and since 1997 had increased steadily and peaked at 8.6% in 1999.

Table 134: *Fishing gear breakdown of annual landings in Tawau, 1991-1999*

Year	% GEAR CONTRIBUTION							
	TN	SN	GN	LN	HL	OT	COM	TRA
1991	55.8	5.4	13.3	12.3	6.0	7.2	74.5	25.5
1992	67.7	9.9	8.8	6.6	2.3	4.7	86.4	13.6
1993	60.9	9.0	11.5	13.1	1.0	4.5	81.4	18.6
1994	49.3	0.0	11.1	34.6	1.3	3.7	60.4	39.6
1995	39.2	0.0	12.2	42.9	2.2	3.5	51.4	48.6
1996	42.2	0.0	10.5	43.7	1.3	2.3	52.7	47.3
1997	52.7	0.0	9.5	33.4	1.4	3.1	62.2	37.8
1998	54.1	0.0	14.6	24.3	1.6	5.4	68.6	31.4
1999	55.7	0.0	14.8	20.2	1.6	7.6	70.6	29.4

Table 135: *Tawau contribution to the SSME-3 annual gear landings (% SSME-3)*

Year	% TAWAU CONTRIBUTION								
	TN	SN	GN	LN	HL	OT	TOTAL	COM	TRA
1991	81.8	2.6	38.7	12.2	12.1	40.3	20.8	23.9	15.1
1992	82.6	3.2	29.4	3.3	3.6	28.1	14.2	20.4	4.8
1993	74.2	1.7	29.8	7.0	0.7	33.1	9.9	12.4	5.3
1994	75.6	0.0	43.4	21.7	1.3	46.8	15.1	15.3	14.8
1995	79.6	0.0	33.1	30.7	1.7	27.2	16.7	16.1	17.3
1996	92.6	0.0	54.0	38.0	2.3	43.6	22.5	19.7	26.7
1997	92.3	0.0	55.9	33.7	2.0	51.8	27.0	31.8	21.6
1998	91.3	0.0	69.1	40.3	2.1	60.3	27.6	31.8	21.4
1999	89.6	0.0	64.8	50.9	2.4	62.2	28.0	29.4	25.2

Table 136: *Gear landing composition in Tawau, 1997-1999*

Resource Group	% RESOURCE GROUP SHARE								
	TN	SN	GN	LN	HL	OT	Total	COM	TRA
Pelagic	17.4		50.7	80.0	10.5	4.8	36.9	23.8	64.0
Demersal	82.6		49.3	20.0	89.5	95.2	63.1	76.2	36.0
TOTAL	100.0		100.0	100.0	100.0	100.0	100.0	100.0	100.0
Pelagic Portion									
sardine	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0
round scad	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0
mackerel	10.5		0.0	0.0	0.0	0.0	2.7	6.1	0.0
anchovy	0.0		0.0	59.8	0.0	0.0	33.1	0.0	58.6
tuna	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0
others	89.5		100.0	40.2	100.0	100.0	64.2	93.9	41.4
TOTAL	100.0		100.0	100.0	100.0	100.0	100.0	100.0	100.0
Demersal Portion									
Finfish	68.2		43.4	47.4	100.0	28.4	61.3	65.0	45.0
Shrimp	25.8		56.6	0.0	0.0	19.5	25.8	29.7	8.7
other invertebrate	6.0		0.0	52.6	0.0	52.1	12.9	5.3	46.2
TOTAL	100.0		100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table 137: *Fishing gear breakdown of annual landings in Semporna, 1991-1999*

Year	% GEAR CONTRIBUTION							
	TN	SN	GN	LN	HL	OT	COM	TRA
1991	6.0	70.1	7.0	0.0	11.5	5.3	83.2	16.8
1992	4.6	75.7	5.2	0.0	10.8	3.6	85.5	14.5
1993	2.8	63.3	5.5	0.0	25.9	2.5	71.6	28.4
1994	3.0	79.8	3.7	0.0	12.0	1.5	86.5	13.5
1995	1.4	56.9	8.9	0.0	28.7	4.1	67.2	32.8
1996	2.0	78.3	3.5	0.0	14.3	1.9	83.8	16.2
1997	2.5	85.6	2.2	0.0	8.4	1.4	90.2	9.8
1998	2.6	80.6	3.1	0.0	11.3	2.4	86.3	13.7
1999	3.2	73.5	4.4	0.0	15.8	3.1	81.1	18.9

Table 138: *Semporna contribution to the SSME-3 annual gear landings (% SSME-3)*

Year	% SEMPORNA CONTRIBUTION								
	TN	SN	GN	LN	HL	OT	TOTAL	COM	TRA
1991	7.8	29.6	18.1	0.0	20.5	26.4	18.4	23.6	8.8
1992	6.2	26.8	19.2	0.0	18.7	24.0	15.6	22.3	5.7
1993	5.8	20.5	24.5	0.0	29.8	31.8	17.2	18.9	14.0
1994	6.0	34.1	18.7	0.0	15.5	25.6	19.6	28.5	6.5
1995	5.2	43.8	43.4	0.0	40.3	57.2	30.0	37.8	21.0
1996	4.6	40.3	18.9	0.0	26.3	37.4	23.4	32.7	9.5
1997	4.0	65.3	12.0	0.0	11.1	21.4	25.0	42.8	5.2
1998	3.3	44.4	10.8	0.0	10.9	20.0	20.6	29.8	7.0
1999	3.2	29.2	12.0	0.0	15.0	15.6	17.3	20.8	10.0

Table 139: *Gear landing composition in Semporna, 1997-1999*

Resource Group	% RESOURCE GROUP SHARE								
	TN	SN	GN	LN	HL	OT	Total	COM	TRA
Pelagic	0.0	99.7	40.8		46.4	11.9	87.0	94.4	40.8
Demersal	100.0	0.3	59.2		53.6	88.1	13.0	5.6	59.2
TOTAL	100.0	100.0	100.0		100.0	100.0	100.0	100.0	100.0
Pelagic Portion									
sardine		35.3	0.0		0.0	1.4	32.5	34.8	0.1
round scad		5.7	0.0		0.0	0.0	5.2	5.6	0.0
mackerel		2.1	0.0		0.0	0.0	1.9	2.1	0.0
anchovy		0.0	0.0		0.0	1.4	0.0	0.0	0.1
tuna		46.3	0.0		81.7	0.0	47.6	45.5	77.9
others		10.6	100.0		18.3	97.2	12.7	12.0	22.0
TOTAL		100.0	100.0		100.0	100.0	100.0	100.0	100.0
Demersal Portion									
Finfish	23.7	37.0	3.9		96.9	42.0	58.8	16.9	83.7
Shrimp	58.7	0.0	5.7		0.0	1.1	13.3	35.1	0.3
other invertebrate	17.6	63.0	90.3		3.1	57.0	28.0	48.0	16.0
TOTAL	100.0	100.0	100.0		100.0	100.0	100.0	100.0	100.0

Table 140: *Fishing gear breakdown of annual landings in Kunak, 1991-1999*

Year	% GEAR CONTRIBUTION							
	TN	SN	GN	LN	HL	OT	COM	TRA
1991	1.3	56.7	4.7	33.8	3.5	0.0	62.7	37.3
1992	0.8	48.3	3.2	43.9	3.8	0.0	52.3	47.7
1993	0.8	63.7	2.3	26.8	6.4	0.0	66.8	33.2
1994	1.8	53.3	2.4	33.6	8.7	0.2	57.5	42.5
1995	1.9	44.9	3.0	34.4	15.4	0.4	49.8	50.2
1996	0.0	54.4	2.1	32.8	10.6	0.1	56.5	43.5
1997	0.0	27.4	3.2	48.3	21.0	0.2	30.6	69.4
1998	0.0	60.5	1.7	27.3	10.5	0.1	62.2	37.8
1999	0.0	81.8	1.2	11.9	5.0	0.2	83.0	17.0

Table 141: *Kunak contribution to the SSME-3 annual gear landings (% SSME-3)*

Year	% KUNAK CONTRIBUTION								
	TN	SN	GN	LN	HL	OT	TOTAL	COM	TRA
1991	4.4	62.7	31.6	77.4	16.2	0.0	48.2	46.5	51.2
1992	4.0	66.6	46.3	93.5	25.7	0.0	60.9	53.1	72.6
1993	5.8	75.6	38.3	90.5	27.0	0.0	62.9	64.6	59.9
1994	9.8	62.3	32.8	74.6	30.8	10.3	53.6	51.7	56.3
1995	10.3	51.4	21.8	65.7	32.2	7.4	44.5	41.7	47.8
1996	0.0	56.6	23.1	60.0	39.3	5.2	47.4	44.5	51.7
1997	0.0	28.8	24.3	62.3	38.2	3.9	34.5	20.0	50.6
1998	0.0	50.3	9.2	50.9	15.2	1.3	31.1	32.5	29.1
1999	0.0	62.8	6.2	35.5	9.2	1.5	33.3	41.1	17.3

Table 142: *Gear landing composition in Kunak, 1997-1999*

Resource Group	% RESOURCE GROUP SHARE								
	TN	SN	GN	LN	HL	OT	Total	COM	TRA
Pelagic		100.0	46.8	92.4	41.3	24.1	89.7	98.2	77.1
Demersal		0.0	53.2	7.6	58.7	75.9	10.3	1.8	22.9
TOTAL		100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Pelagic Portion									
sardine		44.9	0.0	40.2	0.0	0.0	40.6	44.2	33.8
round scad		29.8	0.0	17.6	0.0	0.0	24.3	29.3	14.8
mackerel		7.0	0.0	7.8	0.0	0.0	6.8	6.9	6.6
anchovy		0.0	0.0	11.1	0.0	0.0	3.2	0.0	9.3
tuna		8.6	0.0	0.0	0.0	0.0	5.5	8.4	0.0
others		9.7	100.0	23.3	100.0	100.0	19.6	11.1	35.5
TOTAL		100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Demersal Portion									
Finfish			100.0	6.2	100.0	100.0	80.3	100.0	78.0
Shrimp			0.0	0.0	0.0	0.0	0.0	0.0	0.0
other invertebrate			0.0	93.8	0.0	0.0	19.7	0.0	22.0
TOTAL			100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table 143: *Fishing gear breakdown of annual landings in Lahad Datu, 1991-1999*

Year	% GEAR CONTRIBUTION							
	TN	SN	GN	LN	HL	OT	COM	TRA
1991	6.7	17.6	6.6	17.3	41.9	9.8	30.9	69.1
1992	9.0	16.3	2.3	9.9	50.6	12.0	27.5	72.5
1993	11.7	12.0	2.9	4.8	63.8	4.8	26.6	73.4
1994	7.2	14.1	1.7	7.7	67.6	1.7	22.9	77.1
1995	4.5	20.9	1.2	9.4	62.0	2.0	26.6	73.4
1996	4.3	21.0	2.7	7.9	61.6	2.4	28.0	72.0
1997	4.2	14.3	2.6	8.0	68.1	2.7	21.2	78.8
1998	4.3	9.5	3.0	7.0	73.9	2.2	16.9	83.1
1999	5.9	16.2	5.1	7.0	62.5	3.3	27.2	72.8

Table 144: *Lahad Datu contribution to the SSME-3 annual gear landings (% SSME-3)*

Year	% LAHAD DATU CONTRIBUTION								
	TN	SN	GN	LN	HL	OT	TOTAL	COM	TRA
1991	6.0	5.1	11.7	10.4	51.3	33.4	12.6	6.0	24.9
1992	7.2	3.4	5.0	3.2	52.1	47.8	9.3	4.3	16.9
1993	14.2	2.3	7.5	2.6	42.4	35.1	9.9	4.1	20.9
1994	8.6	3.6	5.0	3.8	52.5	17.3	11.7	4.5	22.4
1995	4.9	4.8	1.7	3.6	25.7	8.2	8.9	4.4	13.9
1996	2.8	3.1	4.1	2.0	32.2	13.8	6.7	3.1	12.1
1997	3.7	5.9	7.8	4.1	48.7	22.9	13.5	5.4	22.6
1998	5.4	5.3	10.9	8.7	71.8	18.5	20.7	5.9	42.6
1999	7.2	8.0	17.1	13.5	73.4	20.7	21.4	8.6	47.5

Table 145: *Gear landing composition in Lahad Datu, 1997-1999*

Resource Group	% RESOURCE GROUP SHARE								
	TN	SN	GN	LN	HL	OT	Total	COM	TRA
Pelagic	0.0	96.9	67.2	86.6	49.3	15.6	55.7	70.2	51.6
Demersal	100.0	3.1	32.8	13.4	50.7	84.4	44.3	29.8	48.4
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Pelagic Portion									
sardine		0.0	0.0	25.1	0.0	0.0	2.8	0.0	3.9
round scad		76.5	0.0	0.0	0.0	0.0	17.9	63.8	0.0
mackerel		4.0	7.2	11.3	13.4	0.2	10.6	4.6	13.0
anchovy		0.0	0.0	16.1	0.0	0.0	1.8	0.0	2.5
tuna		16.1	0.0	0.0	0.0	0.0	3.8	13.5	0.0
others		3.4	92.8	47.4	86.6	99.8	63.1	18.1	80.6
TOTAL		100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Demersal Portion									
Finfish	35.9	47.0	96.9	47.4	100.0	49.4	88.4	48.2	95.5
Shrimp	41.0	53.0	3.1	0.0	0.0	2.6	5.3	34.5	0.2
other invertebrate	23.1	0.0	0.0	52.6	0.0	48.0	6.3	17.2	4.4
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

In 1999, trawl net landings in the SSME area amounted to 45,725 metric tons, with an increase of 160% over the 1991 period (17,581 metric tons) (**Figure 212**). Trawl net contributed 40.9% and 44.3% respectively to the SSME commercial gear landings during the 1991-1999 and 1997-1999 periods (**Figure 213**). Trawl net contribution to the SSME annual commercial gear landings had increased by 18.2%, from 39.0% in 1991 to 46.1% in 1999 (**Figure 217c**). During the 1991-1999 period, SSME-1 contributed 52.4% to the SSME annual trawl net landings, followed by SSME-2 (28.8%) and SSME-3 (19.6%). During the 1997-1999 period, SSME-1 contributed 50.0% to the SSME annual trawl net landings, followed by SSME-3 (27.4%) and SSME-2 (22.6%) (**Figure 214**). SSME-1 contribution to the SSME annual trawl net landings had increased by 48.7%, from 33.8% in 1991 to 50.3% in 1999. SSME-3 contribution to the SSME annual trawl net landings had also increased by 44.9%, from 18.3% in 1991 to 26.5% in 1999. On the other hand, SSME-2 contribution to the SSME annual trawl net landings had decreased by 51.5%, from 47.9% in 1991 to only 23.2% in 1999.

Trawl net landings in the SSME-1 area fluctuated between 5,948 and 24,969 metric tons during the 1991-1999 period. Trawl net landings had increased by 286.8%, from 5,948 metric tons in 1991 to 23,000 metric tons in 1999. Trawl net landings had initially increased by 319.8% to its peak of 24,969 metric tons in 1994, declined by 39.9% to 15,011 metric tons in 1997, and then increased by 20.1% to 19,378 metric tons in 1998 and to its present landing in 1999. During the 1991-1999 period, trawl net landings contributed respectively 62.8% and 74.6% to the SSME-1 annual total and commercial gear landings. Trawl net contribution to the SSME-1 annual landings had increased by 57.1%, from 50.6% in 1991 to 79.5% in 1994, declined by 24.8% to 59.7% in 1997, and increased by 10.0% to 65.7% in 1999. In terms of commercial gear landings, trawl net contribution had increased by 51.7%, from 57.9% in 1991 to 87.8% in 1994, declined by 16.5% to 73.3% in 1997, and then increased by 11.1% to 81.5% in 1999. Overall, trawl net contribution to the SSME-1 annual commercial gear and total landings had respectively increased by 40.8% and 29.9% during the 9-year period.

Kudat and Kota Marudu contributed respectively 97.4% and 2.6% to the SSME-1 annual trawl net landings during the 1991-1999 period. No trawl net landings were recorded in Pitas except in 1992 (8 metric tons). Kudat and Kota Marudu contributed respectively 99.9% and 0.1% to the SSME-1 annual trawl net landings during the 1991-1999 period.

During the 9-year period, trawl net landings in Kudat had increased by 290.0%, from 5,897 metric tons in 1991 to 23,000 metric tons in 1999. Trawl net landings in Kudat reached its peak of 24,310 metric tons in 1994, declined by 38.3% to 14,988 metric tons in 1997, and then increased by 53.5% to 23,000 metric tons in 1999. Trawl net contributed 76.1% and 69.4% respectively to the annual commercial gear and total landings in Kudat. Trawl net contribution to the annual commercial gear landings had increased by 48.8%, from 60.4% in 1991 to 89.8% in 1994, declined by 16.2% to 75.3% in 1997, and then increased by 10.1% to 82.9% in 1999. On the other hand, trawl net contribution to the annual total landings had increased by 64.2%, from 53.5% in 1991 to 64.2% in 1994, then declined by 27.0% to 64.1% in 1997, and then increased by 4.9% to 67.3% in 1999. Overall, trawl net contribution to the Kudat annual commercial gear and total landings had respectively increased by 38.4% and 26.8% during the 9-year period.

In Kota Marudu, annual trawl net landings fluctuated between 7 and 1,450 metric tons during the 9-year period. During the 1992-1994, trawl net landings peaked around 659-1450 metric tons, and then declined down to only 7 metric tons in 1999. The decline in landings was due to the shifting of the trawler fleet to Kudat and matter of economics. Most of the remaining trawlers in Kota Marudu tend to land their catches in Kudat, where the demand is much higher with better prices offered. The establishment of fish meal plants based in Kudat also attributed to the increasing trawl net landings, where in recent years a high portion of the trawl net landings comprised of trash fish. Most of the trawler by-catch including undersized commercial species had been discarded due to poor demand. Trawl net contributed 29.8% and 11.2% respectively to the annual commercial gear and total landings in Kota Marudu. During the 1991-1994 period, trawl net contributed 59.5% and 20.6% respectively to the commercial gear and total landings. Trawl net contribution to the commercial gear and total annual landings declined respectively by 96.3% and 90.1% to only 2.2% and 2.0% in 1999. Overall, trawl net contribution to the Kota Marudu annual commercial gear and total landings had respectively declined by 84.5% and 82.5% during the 9-year period.

Trawl net landings in the SSME-2 area fluctuated between 7,328 and 10,610 metric tons during the 1991-1999 period. Trawl net landings had increased by 26.0%, from 8,420 metric tons in 1991 to 10,610 metric tons in 1999. Except for 1999, trawl net landings in the SSME-2 seem to have stagnated around the 7,500-8,500 metric ton level. Trawl net landings contributed 34.2% and 25.4% respectively to the annual commercial gear and total landings in the SSME-2 area. Trawl net contribution to the annual commercial gear landings had declined by 34.5%, from 42.0% in 1991 to 27.5% in 1994, and then increased by 59.6% to 43.9% in 1999. On the other hand, trawl net contribution to the annual landings had declined by 29.2%, from 31.7% in 1991 to 22.4% in 1998, and increased by 40.3% to 31.5% in 1999. Overall, trawl net contribution to the SSME-2 annual commercial gear landings had increased by 4.6% during the 9-year period. On the other hand, trawl net contribution to the SSME-2 annual total landings had declined by 0.7%.

Sandakan and Beluran contributed respectively 78.8% and 21.2% to the SSME-2 annual trawl net landings during the 1991-1999 period. In recent years, contribution from Beluran had declined by 30.8%, from 28.9% in 1997 to 20.0% in 1999. During the 1998-1999 period, Sandakan and Beluran contributed respectively 83.3% and 16.7% to the SSME-2 annual trawl net landings.

During the 9-year period, trawl net landings in Sandakan fluctuated between 5,317 and 6,883 metric tons (mean 6,279 metric tons: 78.7% SSME-2 landings), peaking at 8,489 metric tons in 1999. Except for 1999, trawl net landings seem to have stagnated around the 5,500-6,500 metric ton level. In Beluran, trawl net landings fluctuated between 862 and 2,284 metric tons during the 1991-1999 period. The high annual trawl net landing variation is primarily due to trawler landing preference, where some trawlers operating in Beluran sometimes land their catches in Sandakan. Sandakan-based trawlers operating in the Kinabatangan territorial waters also land their catches in Sandakan.

Trawl net contributed 33.2% and 24.3% respectively to the commercial gear and total annual landings in Sandakan. Trawl net contribution to the total annual landings had declined by 26.9%, from 30.3% in 1991 to 22.1% during the 1994-1998 period, and then increased by 30.5% to 28.9% in 1999. In terms of contribution to the commercial gear landings, trawl net contribution had decreased by 19.8%, from 38.6% in 1991 to 31.0% during the 1994-1998 period, and then increased by35.2% to 41.8% in 1999. Overall, trawl net contribution to the annual commercial gear landings had increased by 8.4%. On the other hand, trawl net contribution to the annual total landings had declined by 4.7% during the 9-year period.

In Beluran, trawl net contributed 39.1% and 31.7% respectively to the annual commercial gear and total during the 1991-1999 period. Trawl net contribution to the annual total landings had increased by 36.1% during the 9-year period, from 36.3% in 1991 to 49.4% in 1999. On the other hand, contribution to the annual commercial gear landings had declined by 0.5%, from 54.9% in 1991 to 54.6% in 1999.

Trawl net landings in the SSME-3 area fluctuated between 3,213 and 12,108 metric tons during the 1991-1999 period. Trawl net landings had increased by 276.8%, from 3,213 metric tons in 1991 to 12,108 metric tons in 1999. The annual trawl net landings increased steadily throughout the years, with most of the landings contributed by Tawau. Trawl net contributed 20.6% and 12.4% respectively to the SSME-3 annual commercial gear and total landings. Trawl net contribution to the commercial gear landings had decreased by 29.6%, from 21.9% in 1991 to 15.4% in 1995, and then increased by 89.4% to 29.2% in 1997, finally declined by 11.2% to 25.9% in 1999. On the other hand, trawl net contribution to the total landings had decreased by 42.2%, from 14.2% in 1991 to 8.2% in 1995, and increased steadily by 112.5% to 17.4% in 1999. The significant increase in trawl net contribution is due to the increase in trawl net landings in Tawau since 1995.

Tawau contributed 84.4% to the SSME-3 annual trawl net landings during the 1991-1999 period, followed by Lahad Datu (6.7%), Semporna (5.1%) and Kunak (3.8%). In Kunak, trawl net landings were only recorded for the 1991-1995 period. Since 1996, the trawler fleet based in Kunak had moved to other areas in the SSME-3 area. During the 1997-1999 period, Tawau contributed 91.1% to the SSME-3 annual trawl net landings, followed by Lahad Datu (5.4%) and Semporna (3.5%).

During the 9-year period, trawl net landings in Tawau fluctuated between 2,415 and 10,854 metric tons. Trawl net landings had increased by 312.8%, from 2,629 metric tons in 1991 to 10,854 metric tons in 1999. During the 1991-1995 period, annual trawl net landings only fluctuated around 2,400-3,900 metric tons, and in 1996 trawl net landings had increased to 7,049 metric tons, an increase of 79.8% over the 1995 period (3,921 metric tons). Trawl net landings increased steadily until its peak of 10,854 metric tons in 1999. The increase in trawl net landings during the last 5-years was due to the increase in the by-catch landings to meet the increasing demand from shrimp farms and fish meal plants based in Tawau. Prior to 1996, most of the trawler by-catch had been discarded at sea due to poor demand in Tawau. Trawl net contributed 53.1% (range: 39.2-67.7%) to the Tawau annual landings. Trawl net contribution to the annual landings in Tawau had decreased by 42.1%, from its peak of 67.7% in 1992 to 39.2% in 1995, and with the significant increase in trawl net landings since 1996, trawl net contribution had increased by 32.0% from 42.2% in 1996 to 55.7% in 1999.

In Lahad Datu, annual trawl net landings fluctuated between 193 and 871 metric tons during the 9-year period. The annual trawl net landings had increased by 351.2%, from 193 metric tons in 1991 to 871 metric tons in 1999. Except for landings in 1999, the trawler fleet in Lahad Datu only landed 200-500 metric tons annually. This is due to the limited trawling ground in the Darvel Bay, and the historical landing data might give a clue on the probable sustainable limits of the local trawler fishery in the area. During the 1991-1999 period, trawl net contributed 6.4% to the annual landings in Lahad Datu. Trawl net contribution had increased by 72.8%, from 6.7% in 1991 to 11.7% in 1993, declined by 62.8% to 4.3% during the 1995-1998 period, and then increased by 35.2% to 5.9% in 1999.

Trawl net landings in Kunak fluctuated between 138 and 507 metric tons during the 1991-1995 period. The reasons for the trawler fleet to shift to other areas in the SSME-3 area are unknown and might be related to economic factors. However, the limited trawling areas in Kunak and traveling time needed to access the trawling ground outside the Darvel Bay might be a possible answer. During the 5-year period, the annual trawl net landings only averaged 284 metric tons contributing only 1.3% to the annual landings in Kunak. In nearby Semporna, trawl net landings fluctuated between 190 and 382 metric tons, contributing only 3.1% (range: 1.4-6.0%) to the annual landings during the 1991-1999 period. The trawling area in Semporna is very limited confined to the inner parts of the Darvel Bay.

In 1999, seine net landings in the SSME area amounted to 35,386 metric tons, with an increase of 154.3% over the 1991 period (13,913 metric tons) (**Figure 218**). Seine net contributed 33.9% and 33.8% respectively to the SSME commercial gear landings during the 1991-1999 and 1997-1999 periods (**Figure 223c**). During the 1991-1999 period, SSME-3 contributed 82.3% to the SSME annual seine net landings, followed by SSME-2 (13.5%) and SSME-1 (11.5%). During the 1997-1999 period, SSME-3 contributed 82.2% to the SSME annual seine net landings, followed by SSME-1 (10.3%), and SSME-2 (7.5%) (**Figure 219**). SSME-3 contribution to the SSME annual seine net landings had increased by 20.3%, from 70.9 in 1991 to 85.3% in 1999 (**Figure 220**). Likewise, SSME-1 contribution to the SSME annual seine net landings had also increased by 81.2%, from 2.5% in 1994 to 8.7% in 1999. On the other hand, SSME-2 contribution to the SSME annual seine net landings had decreased by 79.4%, from 29.1% in 1991 to only 6.0% in 1999.

Seine net landings in the SSME-1 area fluctuated between 595 and 3,650 metric tons during the 1994-1999 period. Only Kudat contributed to the seine net landings in SSME-1. Purse seining was only introduced in 1994, and since then seine net landings had increased throughout the years. Seine net landings had increased by 418.7%, from 595 metric tons in 1994 to 3,086 metric tons in 1999. Since 1998, seine net had replaced gill net as the third principal landing gear in the SSME-1. During the 1998-1999 period, trawl net landed 64.0% to the SSME-1 annual landings, followed by hook & line (16.4%), seine net (10.3%), gill net (7.8%), miscellaneous gears (0.9%) and lift net (0.7%).

Seine net landings in the SSME-2 area fluctuated between 1,867 and 4,828 metric tons during the 1991-1999 period. Seine net landings had decreased by 197.4%, from 4,051 metric tons in 1991 to 2,125 metric tons in 1999. Only Sandakan contributed to the seine net landings in SSME-2. Seine net landings had increased by declined by 47.6%, from 4,051 metric tons in 1991 to 2,125 metric tons in 1999. Seine net landings had initially increased by 19.2% to 4,828 metric tons in 1993, declined by 61.3% to 1,867 metric tons in 1996, and fluctuated around the 2,000 metric ton level between 1997 and 1999. Since 1994, seine net has the smallest share of the SSME-2 annual landings. Seine net contributed 14.8% and 6.6% respectively to the annual landings during the 1991-1993 and 1994-1999 periods. During the 1991-1993 period, seine net was the third principal gear in the SSME-2 after gill net (34.0%) and trawl net (31.7%).

Seine net landings in the SSME-3 area fluctuated between 13,913 and 38,248 metric tons during the 1991-1999 period. Seine net landings had increased by 174.9%, from 13,913 metric tons in 1991 to 38,248 metric tons in 1996, declined by 37.6% to 23,877 metric tons in 1997, and then increased by 48.2% to 35,386 metric tons in 1999. Overall, seine net landings in the SSME-3 had increased by 154.3% during the 9-year period. Kunak contributed 57.4% to the SSME-3 annual seine net landings during the 1991-1999 period, followed by Semporna (37.1%), Lahad Datu (4.6%) and Tawau (0.8%). In Tawau, seine net landings were only recorded in the early 90s, During the 1991-1993 period, seine net landings in Tawau fluctuated between 254-421 metric tons, contributing 7.2-11.5% and 5.4-9.9% respectively to the annual commercial gear and total landings in Tawau. During the 1997-1999 period, Kunak contributed 47.3% to the SSME-3 annual seine net landings, followed by Semporna (46.3%) and Lahad Datu (6.4%).

Seine net landings in Kunak fluctuated between 5,567 and 19,146 metric tons during the 1991-1999 period. Seine net landings had initially increased by 158.2%, from 6,185 metric tons in 1991 to 15,972 metric tons in 1993, declined by 24.7% to 12,021 metric tons in 1995, and then increased to its peak of 19,146 metric tons in 1996, declined again by 70.9% to its minimum of 5,567 metric tons in 1997, and since then increased by 240.3% to 18,944 metric tons in 1999. Overall, seine net landings in Kunak had increased by 206.3% during the 9-year period. Seine net contributed 93.6% and 54.6% respectively to the annual commercial gear and total landings in Kunak during the 1991-1999 period. During the 9-year period, seine net contribution to the annual commercial gear landings had increased by 9.0%, from 90.4% in 1991 to 98.6% in 1999. Seine net is the principal landing gear in Kunak. During the 1991-1999 period, seine contribution to the annual landings in Kunak had increased by 44.1%, from 56.7% in 1991 to 81.8% in 1999. In 1997, seine net contribution had shrunk to only 27.4% because reduced landings (5,567 metric tons), where lift net became the principal landing gear (48.3% contribution). During the last two years, seine net contributed 71.1% to the annual landings in Kunak, followed by lift net (19.6%), hook & line (7.7%), gill net (1.5%) and miscellaneous gears (0.1%).

Seine net landings in Semporna fluctuated between 2,920 and 13,628 metric tons during the 1991-1999 period. Seine is the principal landings gear in Semporna. During the 1991-1999 period, seine net landings had increased by 202.2%, from 2,920 metric tons in 1991 to 8,825 metric tons in 1999. Seine net landings had initially increased by 366.7% to 13,628 metric tons in 1996, and since then had declined by 36.2% to its present landings in 1999. During the 1991-1999 period, seine net contributed 90.0% and 73.8% respectively to the annual commercial gear and total landings in Semporna Seine net contribution to the annual commercial gear landings had increased by 7.4%, from 84.3% in 1991 to 90.6% in 1999. On the other hand, seine net contribution to the annual landings in Semporna had increased by 4.8%, from 70.1% in 1991 to 73.5% in 1999.

Seine net landings in Lahad Datu fluctuated between 456 and 2,406 metric tons during the 1991-1999 period. During the 9-year period, seine net contributed 62.2% and 15.8% respectively to the annual commercial gear and total landings in Lahad Datu. Seine net contribution to the annual commercial gear landings had increased by 4.8%, from 56.8% in 1991 to 59.6% in 1999. During the 9-year period, seine net contribution to the annual commercial gear landings had initially declined by 20.3% to 45.3% in 1993, then increased to its peak of 78.4% in 1995, and declined by 24.0% down to its present level in 1999. Seine net contribution to the annual landings in Lahad Datu fluctuated between 9.5-21.0% during the 9-year period, with initial decline by 31.6% from 17.6% in 1991 to 12.0% in 1993, increased by 74.6% to its peak of 21.0% in 1996, declined by 54.6% to its mininum of 9.5% in 1998, and then increased by 69.5% to its present level in 1999.

Gill net landings in the SSME area fluctuated 13,545 and 23,717 metric tons during the 1991-1999 period. In 1999, gill net landings in the SSME area amounted to 18,031 metric tons, with an increase of 33% over the 1991 period (13,545 metric tons) (**Figure 224**). During the 1991-1999 and 1997-1999 periods, gill net contributed 25.9% and 21.9% respectively to the SSME commercial gear landings (**Figure 229c**). During the 1991-1999 period, SSME-2 contributed 66.3% to the SSME annual gill net landings, followed by SSME-3 (13.6%) and SSME-1 (20.1%). During the 1997-1999 period, SSME-2 contributed 65.7% to the SSME annual gill net landings, followed by SSME-3 (19.2%) and SSME-1 (15.2%) (**Figure 225**). SSME-1 contribution to the SSME annual gill net landings had declined by 63.0%, from 31.9% in 1991 to 11.8% in 1999 (**Figure 226**). On the other hand, SSME-2 contribution to the SSME annual gill net landings had increased by 13.1%, from 56.1% in 1991 to 63.4% in 1999. SSME-3 contribution to the SSME annual gill net landings had increased by 106.6%, from 12.0% in 1991 to 24.7% in 1999.

In SSME-1, gill net landings fluctuated between 1,672 and 7,450 metric tons during the 1991-1999 period. In 1999, gill net landings in the SSME-1 amounted to 1,672 metric tons, with a decrease of 57.7% over the 1991 period (3,954 metric tons). During the 9-year period, gill net contribution to the annual landings in the SSME-1 had declined by 83.5%, from 36.8% in 1991 to only 6.1% in 1999. Gill net contribution to the annual commercial gear landings had also declined by 82.1%, from 42.1% in 1991 to 7.5% in 1999. The decline in landing contribution was due to increased trawl net landings and increasing contribution from seine net to the overall landings throughout the years. During the 1991-1999 period, Kudat contributed 81.9% to the SSME-1 annual gill net landings, followed by Kota Marudu (11.9%) and Pitas (6.2%). During the last few years, Kudat share of the SSME-1 annual gill net landings had declined slightly due to increased landings in other distrcts. During the 1997-1999 period, Kudat contributed 80.7% to the SSME-1 annual landings, followed by Kota Marudu (12.8%) and Pitas (6.5%).

In SSME-2, gill net landings fluctuated between 7,597 and 19,088 metric tons during the 1991-1999 period. During the 9-year period, gill net landings had increased by 50.6%, from 7,597 metric tons in 1991 to 11,440 metric tons in 1999. Gill net landings had initially increased by 151.3%, from 7,597 metric tons to its peak landing of 19,088 metric tons in 1994, and since then had declined by 40.1% to its present landings in 1999. Despite the gradual decline in landings and contribution to the annual landings, gill net still maintained its position as the principal landings gear in the SSME-2 during the 9-year period because of significant decline in landings from other important contributing gears (trawl net & seine net). Gill net contribution to the SSME-2 annual landings had fluctuated between 28.6-52.5% during the 1991-1999 period. Gill net contribution had increased by 18.7%, from 28.6% in 1991 to 33.9% in 1999. Its contribution had initially increased by 83.4% to its peak of 52,5% in 1994, and since then had declined by 35.3% to its present level in 1999. During the 1991-1999 period, Sandakan and Beluran had respectively contributed 78.2% and 21.8% to the SSME-2 annual gill net landings. Because of declining gill net landings in Beluran, Sandakan share of the SSME-2 annual gill net landings had increased throughout the 9-year period. Sandakan and Beluran contributed respectively 83.5% and 16.5% to the SSME-2 annual gill net landings during the 1997-1999 period.

In SSME-3, gill net landings fluctuated between 1,273 and 4,462 metric tons during the 1991-1999 period. Gill net landings had increased by 175.1% during the 9-year period, from 1,622 metric tons in 1991 to 4,462 metric tons in 1999. Gill net only contributed respectively 8.6% and 5.2% to the SSME-3 annual commercial gear and total landings during the 1991-1999 period. Gill net contribution to the SSME-3 commercial gear landings had declined by 13.5%, from 11.0% in 1991 to 9.5% in 1999. Contribution to the SSME-2 annual landings had decreased by 10.4%, from 7.2% in 1991 to 6.4% in 1999. During the 1991-1999 period, Tawau contributed 46.4% to the SSME-3 annual gill net landings, followed by Kunak (26.0%), Semporna (19.7%) and Lahad Datu (7.9%). Tawau and Lahad Datu share of the SSME-3 annual gill net landings had increased throughout the years. During the 1997-1999 period, Tawau contributed 63.3% to the SSME-3 annual gill net landings, followed by Kunak (13.2%), Semporna (11.6%) and Lahad Datu (11.9%).

In 1999, traditional gear landings in the SSME area amounted to 99,142 metric tons, with an increase of 120% over the 1991 period (45,039 metric tons) (**Figure 135**). During the 1991-1999 period, traditional gears contributed 29.7% to the SSME annual landings, with hook & line making up 42.3% of the annual traditional gear landings, followed by lift net (33.9%) and miscellaneous gears (23.8%). During the 1997-1999 period, traditional gears contributed 32.3% to the SSME annual landings, with hook & line making up 55.9% of the annual traditional gear landings, followed by lift net (27.8%) and miscellaneous gears (16.3%) (**Figures 147-149**). Traditional gear contribution to the SSME annual landings had increased by 8.3%, from 26.1% in 1991 to 28.3% in 1999. The SSME contribution to the annual traditional gear landings had increased by 63.9%, from 48.9% in 1991 to 80.1% in 1999. During the 1991-1999 period, SSME-3 contributed 60.2% to the SSME annual traditional gear landings, followed by SSME-2 (26.3%) and SSME-1 (13.5%). During the 1997-1999 period, SSME-3 contributed 61.6% to the SSME annual traditional gear landings, followed by SSME-2 (24.7%) and SSME-1 (13.7%). During the 9-year period, SSME-3 contribution had increased by 16.8%, from 49.9% in 1991 to 58.2% in 1999. On the other hand, SSME-2 contribution to the SSME annual traditional gear declined by 40.2%, from 40.8% in 1991 to 24.4% in 1999. SSME-1 contribution to the SSME annual traditional gear landings had increased by 86.0%, from 9.3% in 1991 to 17.4% in 1999.

In SSME-1, the annual traditional gear landings fluctuated between 1,844 and 11,179 metric tons (mean 4,509 metric tons) during the 1991-1999 period. In 1999, the SSME-1 traditional gear landings amounted to 6,791 metric tons, with an increase of 268.3% over the 1991 period (1,844 metric tons). Landings peaked at 11,170 metric tons because of high jellyfish landings. Kudat is the main contributor of the annual traditional gear landings in SSME-1. Contribution from other districts is insignificant in recent years. In the early 90s, both Kota Marudu and Pitas shared important roles in the traditional gear landings, and since the decline of the jellyfish fishery in the Marudu Bay, their position had now been superceded by Kudat, where its share of the hook & line landings contributed a significant portion of the traditional gear landings in recent years. In 1999, traditional gear landings in Kudat amounted to 6,432 metric tons, with an increase of 410.1% over the 1991 period (1,261 metric tons). Since 1996, there was a significant increase in traditional gear landings, where landings had increased by 172.3%, from 727 metric tons in 1995 to 1,980 metric tons in 1996. Since then, landings had increased steadily to its peak of 6,432 metric tons in 1999. Traditional gear landings in Kota Marudu fluctuated between 29 and 8,494 metric tons during the 9-year period. Traditional gear landings in Kota Marudu had significantly decreased from 439-8,494 metric tons between 1991-1995 (mean 2,727 metric tons) to only 29-765 metric tons between 1996-1999 (mean 223 metric tons). On the other hand, traditional gear landings in Pitas fluctuated between 144-2,154 metric tons during the 1991-1999 period, and in recent years maintained its landings around the 250-450 metric ton level. *Bagang* lift net is the principal traditional gear in Pitas, and in recent years had contributed the bulk of the traditional gear landings in Pitas.

During the 1991-1999 period, Kudat contributed 54.2% to the SSME-1 annual traditional gear landings, followed by Kota Marudu (30.8%) and Pitas (14.9%). Kudat contribution to the SSME-1 had increased by 38.5%, from 68.4% in 1991 to 94.7% in 1999. On the other hand, both Kota Marudu and Pitas share of the SSME-1 annual traditional gear landings had declined respectively by 98.2% and 37.8% during the 9-year period. During the 1997-1999 period, Kudat contributed 87.1% to the SSME-1 annual traditional gear landings, followed by Pitas (7.1%) and Kota Marudu (5.8%).

In SSME-2, the annual traditional gear landings fluctuated between 6,493 and 11,311 metric tons (mean 8,297 metric tons) during the 1991-1999 period. In 1999, the SSME-2 traditional gear landings amounted to 9,533 metric tons, with an increase of 46.8% over the 1991 period (6,493 metric tons). Traditional gear landings increased by 74.2% to its peak of 11,311 metric tons in

1998, and then declined by 15.7% to 6,493 metric tons in 1999. Sandakan contributed the bulk of the SSME-2 annual traditional gear landings. The traditional gear landings in Sandakan had increased by 149.2%, from 4,371 metric tons in 1991 to its peak of 10,892 metric tons in 1998, and then declined by 16.2% to 9.127 metric tons in 1999. On the other hand, traditional gear landings in Beluran had declined significantly by 80.9%, from 2,122 metric tons in 1991 to 406 metric tons in 1999. The sharp decline in traditional gear landings in Beluran was due to the decline of the cockle fishery in the Labuk Bay, which had contributed more than 80% of the annual traditional gear landings in the early 90s.

During the 1991-1999 period, Sandakan contributed 86.8% to the SSME-2 annual traditional gear landings. Sandakan share of the SSME-2 annual traditional gear landings had increased by 42.2% from 67.3% in 1991 to 95.7% in 1999. On the other hand, Beluran contributed 13.2% to the SSME-2 annual traditional gear landings. Its share of the SSME-2 landings had declined by 87.0% during the 9-year period, from 32.7% in 1991 to 4.3% in 1999. During the 1997-1999 period, Sandakan contributed 95.2% to the SSME-2 annual traditional gear landings. Beluran only contributed 4.8% to the SSME-2 annual production.

In SSME-3, the annual traditional gear landings fluctuated between 7,940 and 29,604 metric tons (mean 20,557 metric tons). The annual landings increased by 272.8% from 7,940 metric tons in 1991 to its peak of 29,604 metric tons in 1996, and since then landings had declined steadily by 23,1% to 22,769 metric tons in 1999. Kunak used to be the main contributor of the SSME-3 annual traditional gear landings in the early 90s, and in recent years its position had been taken over by Lahad Datu and Tawau. Traditional gear landings in Kunak increased by 276.9%, from 4,062 metric tons in 1991 to its peak of 15,311 metric tons in 1996, and since then had declined by 74.2% to its minimum of 3,946 metric tons in 1999. Traditional gear landings in Lahad Datu had increased by 448.0%, from 1,975 metric tons in 1991 to 10,824 metric tons in 1999. The landings had increased by 80.7% to 3,569 metric tons in 1996, and since then had significantly increased by 203.3% to its peak in 1999. Traditional gear landings in Tawau had increased by 376.8%, from 1,202 metric tons in 1991 to 5,731 metric tons in 1999. Landings had increased by 557.4% to its peak of 7,903 metric tons in 1995, and then maintained its landings around the 5,000-6,000 metric ton level between 1997-1999. The sudden increase in landings since 1995 was attributed by *bagang* lift net contribution. Tawau is now the principal contributor of *bagang* lift net landings in Sabah. In Semporna, traditional gear landings had increased by 223.6%, from 701 metric tons in 1991 to 2,268 metric tons in 1999. Landings had increased by 742.1% to its peak of 5,903 metric tons in 1995, and then declined to around 1,800 metric tons between 1997-1999. It is believed that the traditional gear landings in Semporna had been underestimated throughout the years. Most of the coastal communities in Semporna, living along the coast or in the numerous islands, are involved in traditional fishing and most of the landings had not been covered under the existing SMPP program. The traditional fishing activities in Semporna are artisanal in nature (Sather, 1997), where catches are only meant for household consumption with the surplus being dried-processed.

During the 1991-1999 period, Kunak contributed 48.5% to the SSME-3 annual traditional gear landings, followed by Lahad Datu (24.9%), Tawau (16.9%) and Semporna (9.7%). In recent years, Lahad Datu share of the SSME-3 annual traditional gear landings had significantly increased, and now had taken over Kunak position. During the 1997-1999 period, Lahad Datu contributed 37.6% to the SSME-3 annual traditional gear landings, followed by Kunak (32.4%), Tawau (22.7%) and Semporna (7.4%).

In 1999, lift net landings in the SSME area amounted to 7,969 metric tons, with an increase of 40.6% over the 1991 period (5,666 metric tons). Lift net contributed 33.9% and 27.8% respectively to the SSME traditional gear landings during the 1991-1999 and 1997-1999 periods. During the 1991-1999 period, SSME-3 and SSME-1 contributed respectively 96.7% and 3.3% to the SSME annual lift net landings. During the 1997-1999 period, SSME-3 and SSME-1 contributed respectively 98.1% and 1.9% to the SSME annual lift net landings. SSME-3 contribution to the SSME annual lift net landings had increased by 15.5%, from 84.0% in 1991 to 97.1% in 1999. On the other hand, SSME-1 contribution to the SSME annual lift net landings had decreased by 81.8%, from 16.0% in 1991 to 2.9% in 1999.

In 1999, hook & line gear landings in the SSME area amounted to 24,427 metric tons, with an increase of 320% over the 1991 period (5,813 metric tons). Hook & line contributed 42.3% and 55.9% respectively to the SSME annual traditional gear landings during the 1991-1999 and 1997-1999 periods. During the 1991-1999 period, SSME-3 contributed 57.1% to the SSME annual hook & line landings, followed by SSME-2 (31.3%) and SSME-1 (11.6%). During the 1997-1999 period, SSME-3 contributed 54.3% to the SSME annual hook & line landings, followed by SSME-2 (24.9%) and SSME-1 (20.9%). SSME-1 contribution to the SSME annual hook & line landings had increased by 231.2%, from 7.7% in 1991 to 25.6% in 1999. Likewise, SSME-3 contribution had also increased by 28.7%, from 40.2% in 1991 to 51.8% in 1999. On the other hand, SSME-2 contribution had decreased by 56.5%, from 52.1% in 1991 to 22.7% in 1999.

In 1999, miscellaneous gears landings in the SSME area amounted to 6,699 metric tons, with an increase of 51% over the 1991 period (4,441 metric tons). Miscellaneous gears contributed 12.6-49.6% (mean 23.8) and 15.4-17.1% (mean 16.3%) respectively to the SSME annual traditional gear landings during the 1991-1999 and 1997-1999 periods. During the 1991-1999 period, SSME-2 contributed 62.6% to the SSME annual miscellaneous gear landings, followed by SSME-1 (20.81%) and SSME-3 (16.6%). During the 1997-1999 period, SSME-2 contributed 66.8% to the SSME annual miscellaneous gear landings, followed by SSME-3 (24.3%) and SSME-1 (8.9%). During the 1991-1999 period, SSME-3 contribution to the SSME annual miscellaneous gear landings had increased by 88.3%, from 19.0% in 1991 to 35.7% in 1999. On the other hand, SSME-2 contribution had decreased by 18.4%, from 78.1% in 1991 to 59.7% in 1999.

The summary of the commercial and traditional gear landings in Sabah during the 1991-1999 period is given respectively in *Tables 147-150*.

Table 147: *Commercial gear landing breakdown by fishing region, Sabah 1991-1999*

Mean Annual Fish Landings	% STATE SHARE					Mean Annual (metric ton)
	SSME-1	SSME-2	SSME-3	SSME	Non-SSME	
1991-1999						
Trawl Net	32.13	16.51	11.07	59.71	40.29	55,970
Range:	19.2-47.1	9.6-27.2	8.3-13.9	44.9-71.0	29.0-55.1	30,955-91,289
Seine Net	3.93	10.47	63.63	78.03	21.97	33,313
Range:	0.0-9.4	4.2-21.7	49.2-76.1	69.4-86.1	13.9-30.6	20,061-44,416
Gill Net	13.53	47.59	10.03	71.15	28.85	27,847
Range:	8.5-23.9	30.0-57.4	3.9-19.4	54.5-81.9	18.1-45.5	22,106-33,564
TOTAL GEARS	19.33	21.70	25.61	66.64	33.36	117,130
Range:	13.5-24.4	15.3-26.6	19.4-35.1	58.4-74.3	25.7-41.6	75,875-158,427
1997-1999						
Trawl Net	23.60	10.74	12.84	47.17	52.83	80,573
Range:	22.1-25.2	9.6-11.6	11.9-13.4	44.9-50.1	49.9-55.1	67,903-91,289
Seine Net	7.71	5.58	61.79	75.08	24.92	38,543
Range:	6.8-9.4	4.8-7.1	57.5-68.3	71.7-80.1	19.9-28.3	32,537-44,416
Gill Net	11.96	51.99	15.17	79.11	20.89	23,417
Range:	9.3-14.7	49.8-56.2	12.2-19.4	76.9-81.9	18.1-23.1	22,106-25,169
TOTAL GEARS	17.42	16.19	26.42	60.03	39.97	142,533
Range:	16.7-17.8	15.3-17.0	24.3-29.5	58.4-62.6	37.4-41.6	122,546-158,423

Table 148: *Commercial gear landing breakdown by SSME Sub Region, 1991-1999*

Mean Annual Fish Landings	% SSME SHARE			Mean Annual (metric ton)
	SSME-1	SSME-2	SSME-3	
1991-1999				
Trawl Net	52.98	27.51	19.51	32,018
Range:	33.8-66.3	21.3-47.9	11.6-28.8	17,581-45,725
Seine Net	5.13	13.52	81.35	26,138
Range:	0.0-13.1	4.9-29.1	70.9-88.4	13,913-38,248
Gill Net	20.12	66.28	13.60	19,664
Range:	11.8-41.3	52.0-80.5	6.7-24.7	13,545-23,717
TOTAL GEARS	28.93	32.54	38.53	77,819
Range:	22.8-33.2	24.4-44.6	29.7-47.2	45,039-99,142
1997-1999				
Trawl Net	50.04	22.73	27.22	38,125
Range:	47.6-52.3	21.3-23.7	26.4-28.8	31,567-45,725
Seine Net	10.33	7.47	82.19	29,061
Range:	8.7-13.1	6.0-9.7	80.2-85.3	23,877-35,386
Gill Net	15.15	65.66	19.19	18,552
Range:	11.8-19.2	63.4-68.6	15.9-24.7	17,008-20,618
TOTAL GEARS	29.03	27.03	43.94	85,739
Range:	28.2-30.4	24.4-28.8	41.7-47.1	72,452-99,142

Table 149: *Traditional gear landing breakdown by fishing region, Sabah 1991-1999*

Mean Annual Fish Landings	% REGIONAL SHARE					Mean Annual (metric ton)
	SSME-1	SSME-2	SSME-3	SSME	Non-SSME	
1991-1999						
Lift Net	1.84	0.03	65.04	66.91	33.09	16,563
Range:	0.4-7.2	0.0-0.2	38.0-82.4	45.2-82.9	17.1-54.8	10,155-24,468
Hook & Line	8.51	18.54	37.66	64.70	35.30	21,686
Range:	2.3-22.1	10.8-23.0	14.7-56.1	36.6-86.4	13.6-63.4	14,742-28,261
Misc. Gears	16.90	47.27	12.17	76.34	23.66	9,569
Range:	2.5-59.4	27.9-65.5	3.0-23.1	64.6-90.3	9.7-35.4	5,290-17,804
TOTAL GEARS	9.08	17.50	42.11	68.70	31.30	47,817
Range:	4.4-20.9	13.4-22.8	24.4-56.1	48.9-82.0	18.0-51.1	32,562-53,523
1997-1999						
Lift Net	1.50	0.00	79.00	80.51	19.49	13,998
Range:	0.4-2.3	0.0-0.0	76.2-82.4	78.5-82.9	17.1-21.5	10,155-19,119
Hook & Line	17.71	21.03	45.84	84.57	15.43	26,649
Range:	14.4-22.1	19.6-23.0	44.7-47.2	82.0-86.4	13.6-18.0	23,683-28,261
Misc. Gears	6.32	47.21	16.77	70.30	29.70	9,398
Range:	2.9-13.1	38.5-54.5	10.5-23.1	64.6-74.2	25.8-35.4	8,908-10,369
TOTAL GEARS	11.09	20.02	49.80	80.91	19.09	50,046
Range:	9.0-13.0	17.7-22.8	46.7-53.9	80.1-82.0	18.0-19.9	48,785-51,719

Table 150: *Traditional gear landing breakdown by SSME Sub Region, 1991-1999*

Mean Annual Fish Landings	% SSME SHARE SSME-1	SSME-2	SSME-3	Mean Annual (metric ton)
1991-1999				
Lift Net	3.30	0.05	96.65	11,213
Range:	0.5-16.0	0.0-0.5	84.0-99.5	5,666-19,338
Hook & Line	11.58	31.31	57.11	14,692
Range:	4.1-25.6	20.6-53.5	40.1-75.3	5,813-24,426
Misc. Gears	20.81	62.58	16.61	7,419
Range:	3.0-65.8	30.9-78.9	3.4-35.7	4,441-16,079
TOTAL GEARS	13.49	26.34	60.17	33,323
Range:	5.7-34.5	18.6-40.8	43.0-75.1	15,920-41,698
1997-1999				
Lift Net	1.89	0.00	98.11	11,337
Range:	0.5-2.9	0.0-0.0	97.1-99.5	7,969-15,842
Hook & Line	20.87	24.87	54.26	22,577
Range:	17.6-25.6	22.7-27.0	51.8-57.5	19,425-24,426
Misc. Gears	8.89	66.83	24.28	6,579
Range:	3.9-18.1	59.7-73.5	14.6-35.7	6,431-6,699
TOTAL GEARS	13.72	24.73	61.55	40,493
Range:	11.2-17.4	22.0-27.8	58.2-66.8	39,093-41,698

Figure 111. Spatial distribution breakdown of gear landings in Sabah during the 1991 period

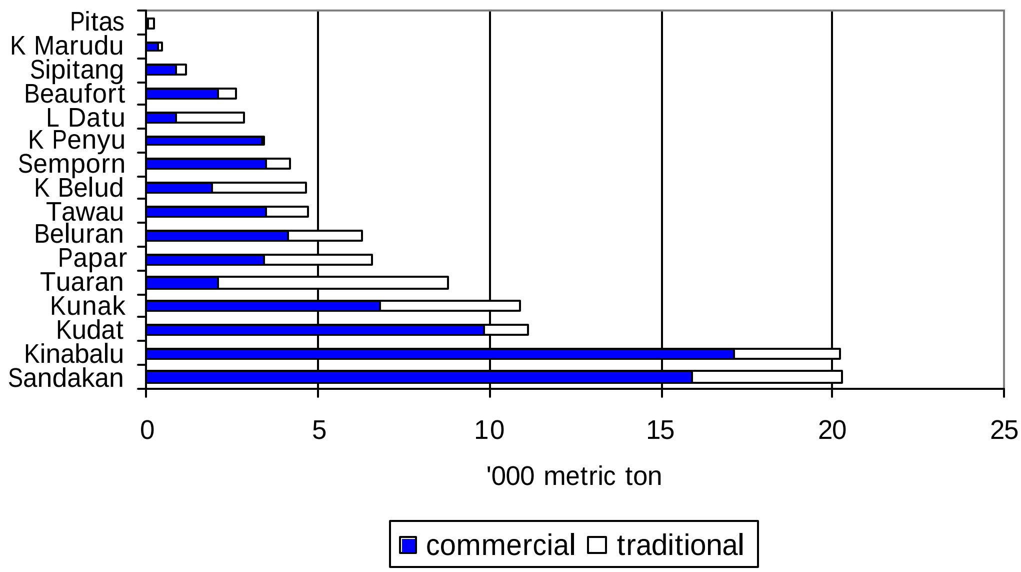


Figure 112. Spatial distribution breakdown of gear landings in Sabah during the 1999 period

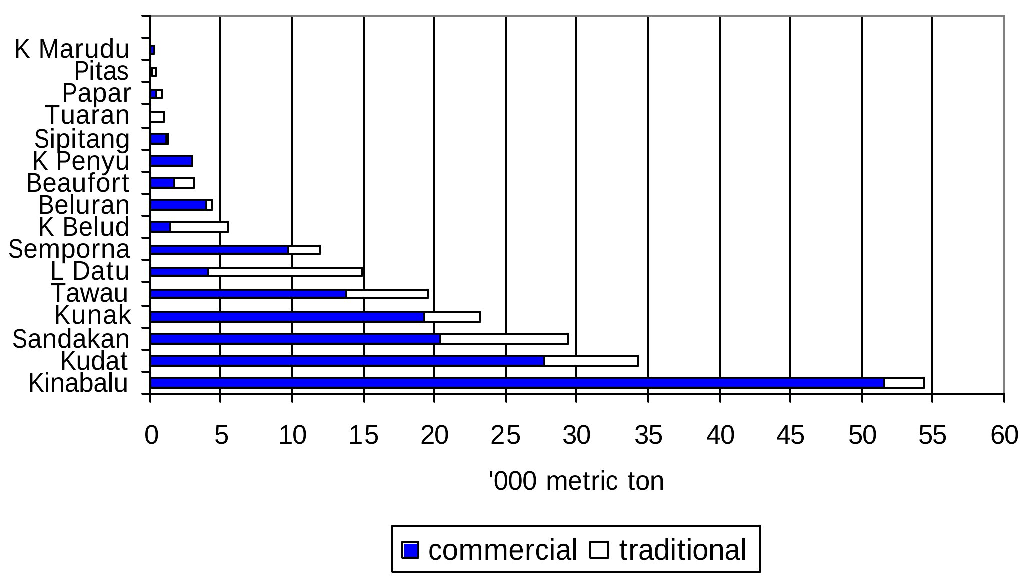


Figure 113. Spatial gear contribution breakdown of marine fish landings in Sabah during the 1991 period

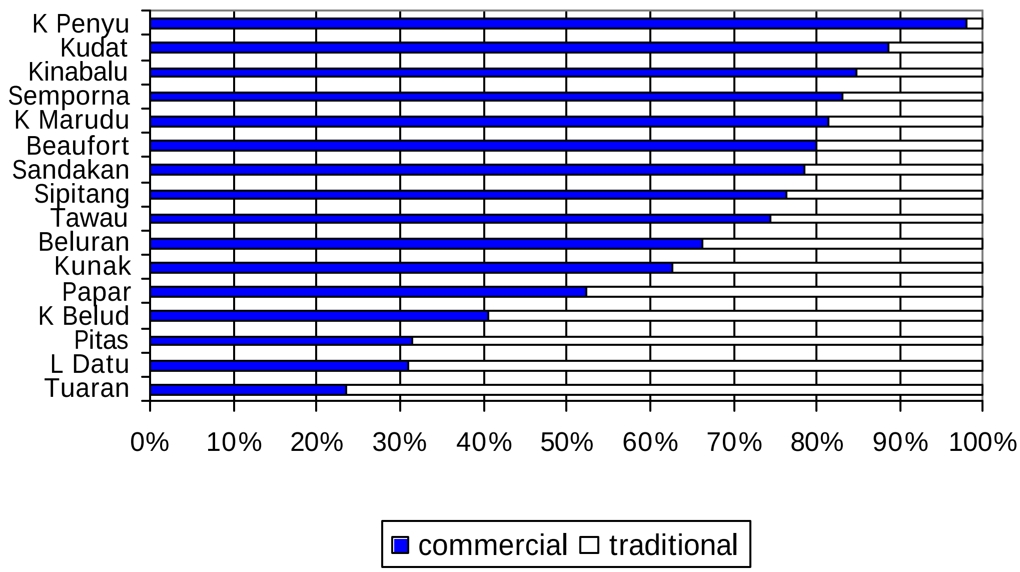


Figure 114. Spatial gear contribution breakdown of marine fish landings in Sabah during the 1999 period

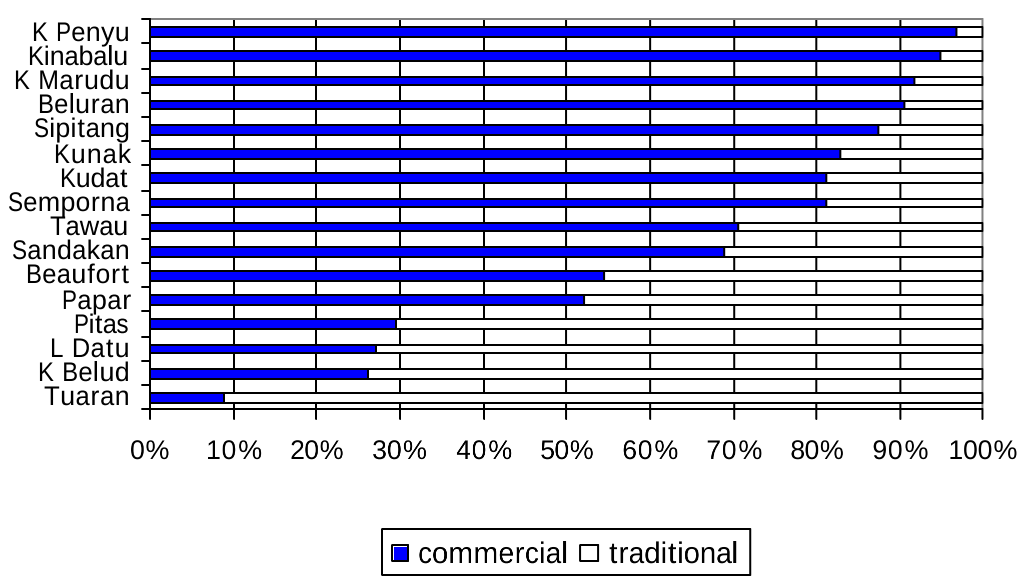


Figure 115a. Temporal monthly trends of marine fish landings in Sabah, 1991-1999

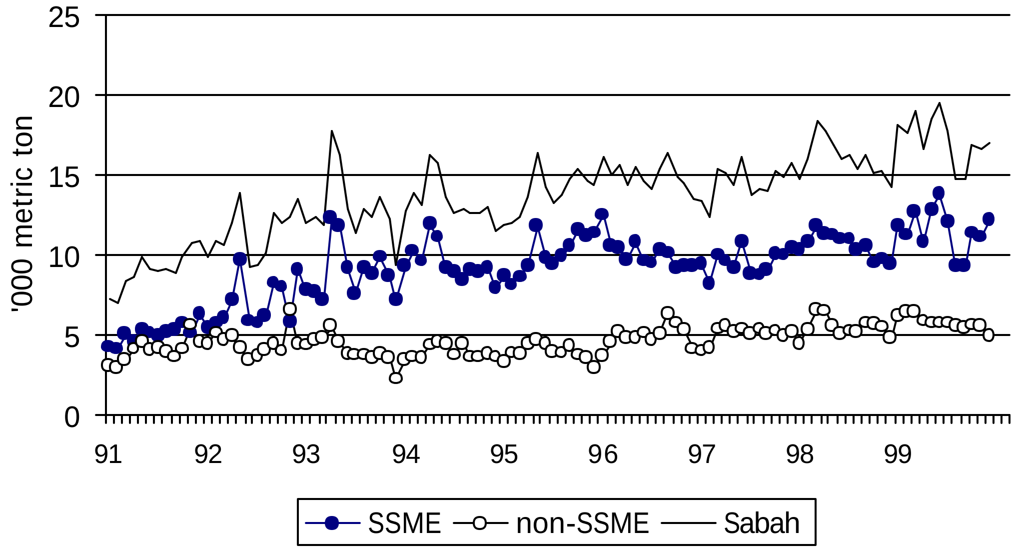
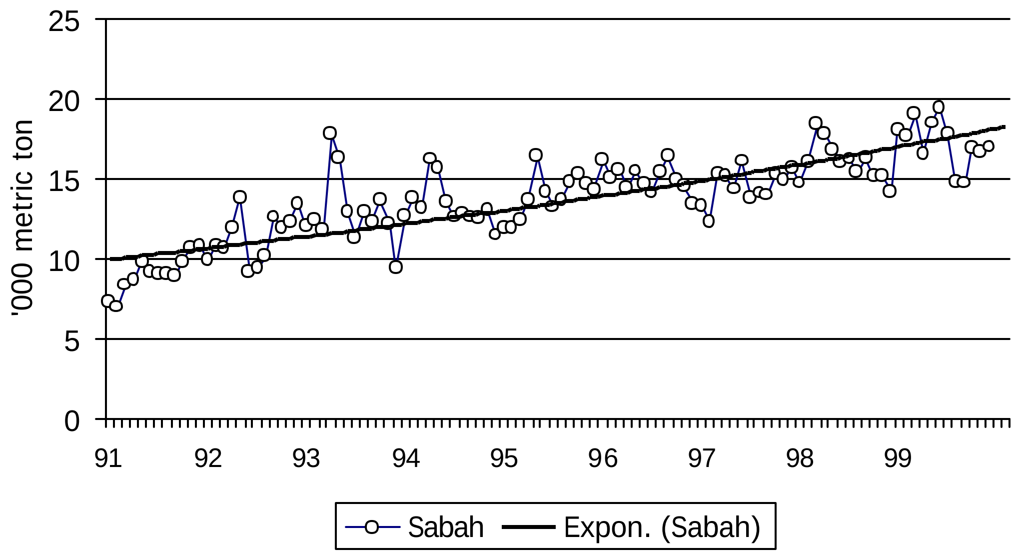


Figure 115b. Temporal monthly trends of marine fish landings in Sabah, 1991-1999: Total Landings



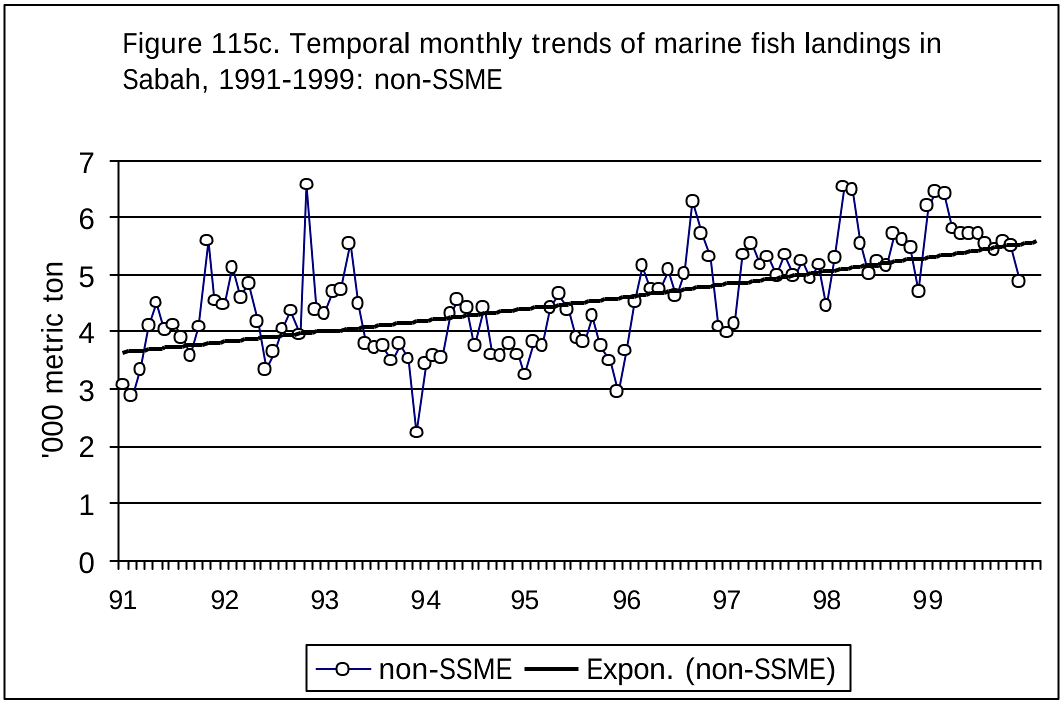


Figure 115c. Temporal monthly trends of marine fish landings in Sabah, 1991-1999: non-SSME
'000 metric ton
0
1
2
3
4
5
6
7
91
92
93
94
95
96
97
98
99
non-SSME
Expon. (non-SSME)

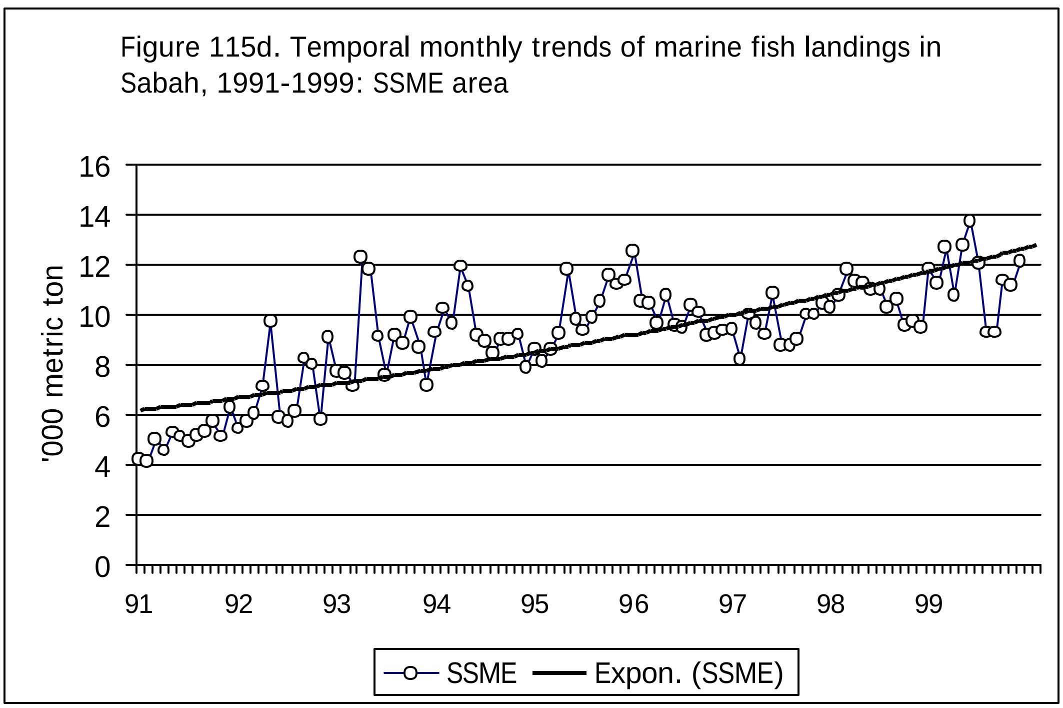


Figure 115d. Temporal monthly trends of marine fish landings in Sabah, 1991-1999: SSME area
'000 metric ton
0
2
4
6
8
10
12
14
16
91
92
93
94
95
96
97
98
99
SSME
Expon. (SSME)

Figure 116a. Temporal monthly trends of marine fish landings in the SSME area, 1991-1999

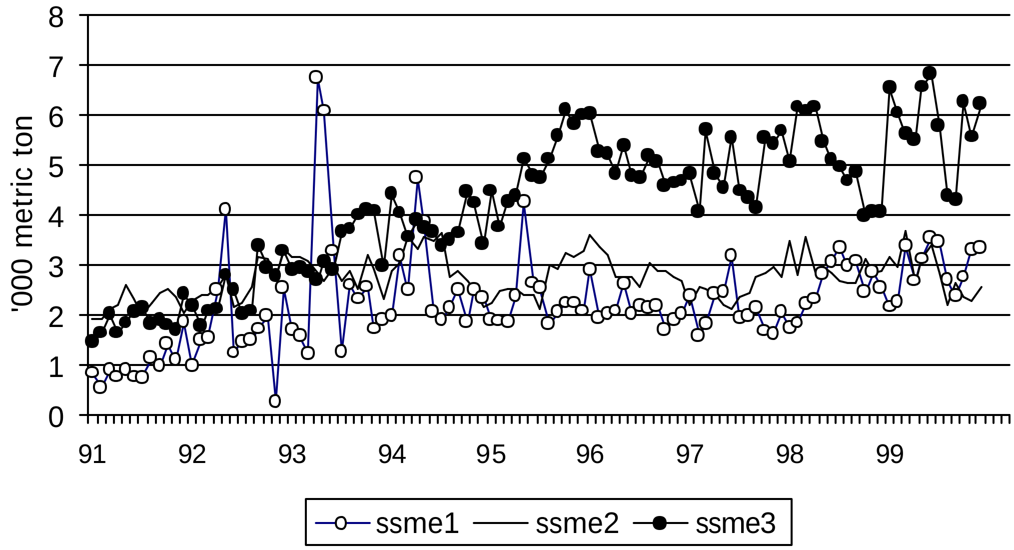
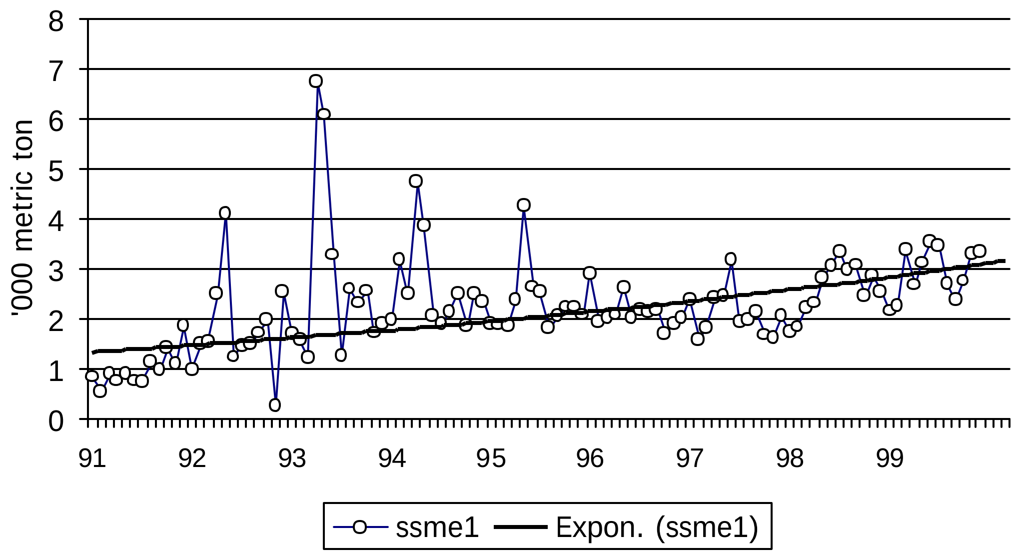


Figure 116b. Temporal monthly trends of marine fish landings in the SSME area, 1991-1999: SSME1



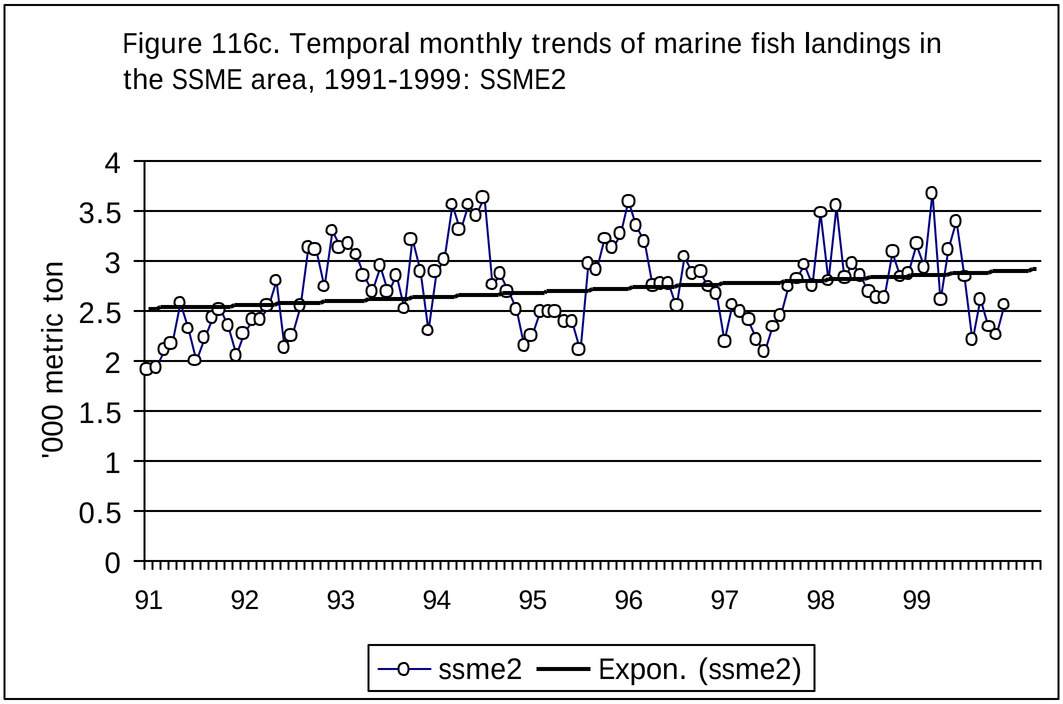


Figure 116c. Temporal monthly trends of marine fish landings in the SSME area, 1991-1999: SSME2
'000 metric ton
4
3.5
3
2.5
2
1.5
1
0.5
0
91
92
93
94
95
96
97
98
99
ssme2
Expon. (ssme2)

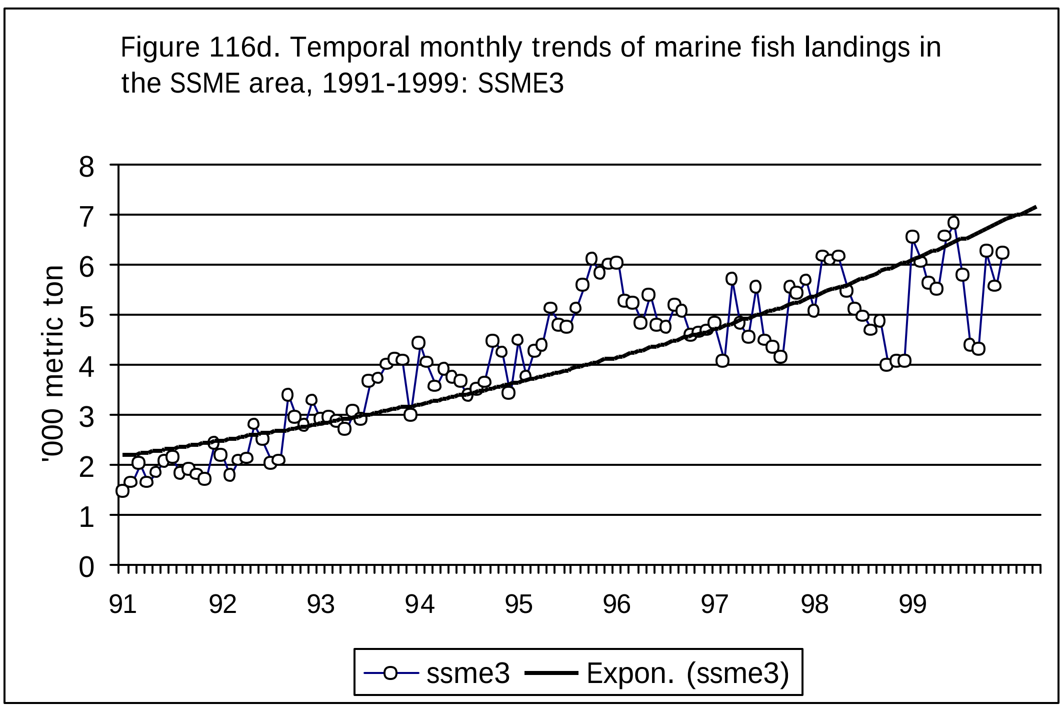


Figure 116d. Temporal monthly trends of marine fish landings in the SSME area, 1991-1999: SSME3
'000 metric ton
8
7
6
5
4
3
2
1
0
91
92
93
94
95
96
97
98
99
ssme3
Expon. (ssme3)

Figure 117a. Temporal quarterly trends of marine fish landings in Sabah, 1991-1999

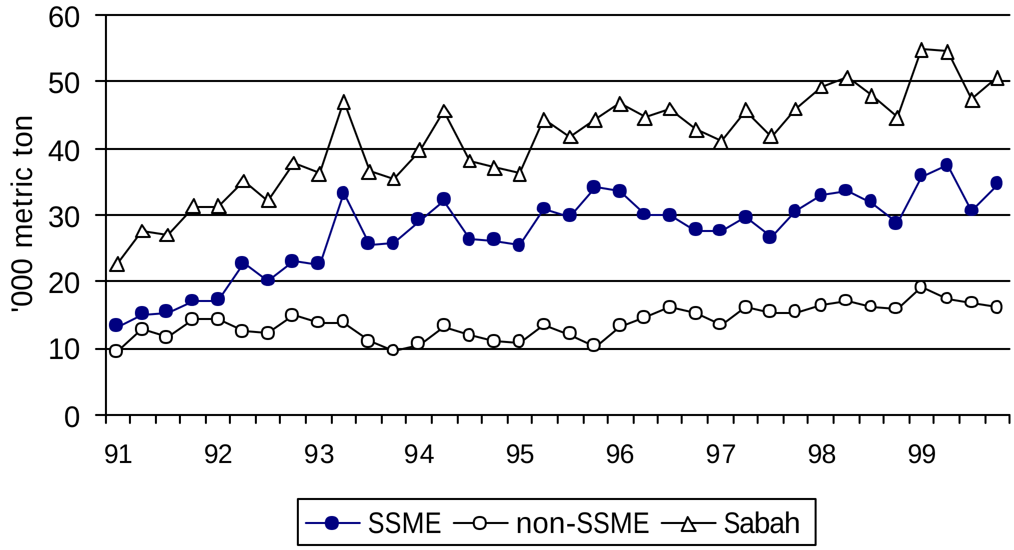
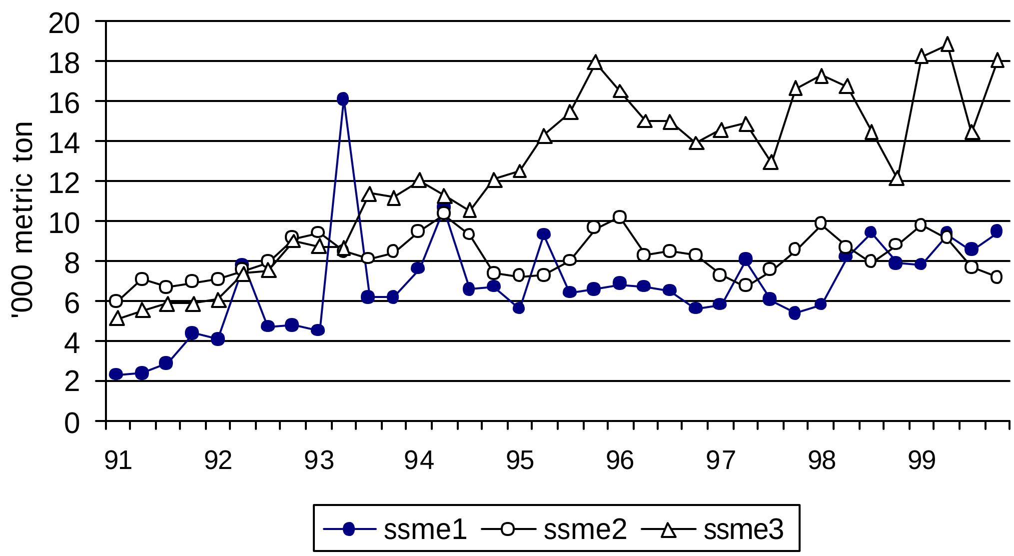


Figure 117b. Temporal quarterly trends of marine fish landings in Sabah, 1991-1999: SSME area



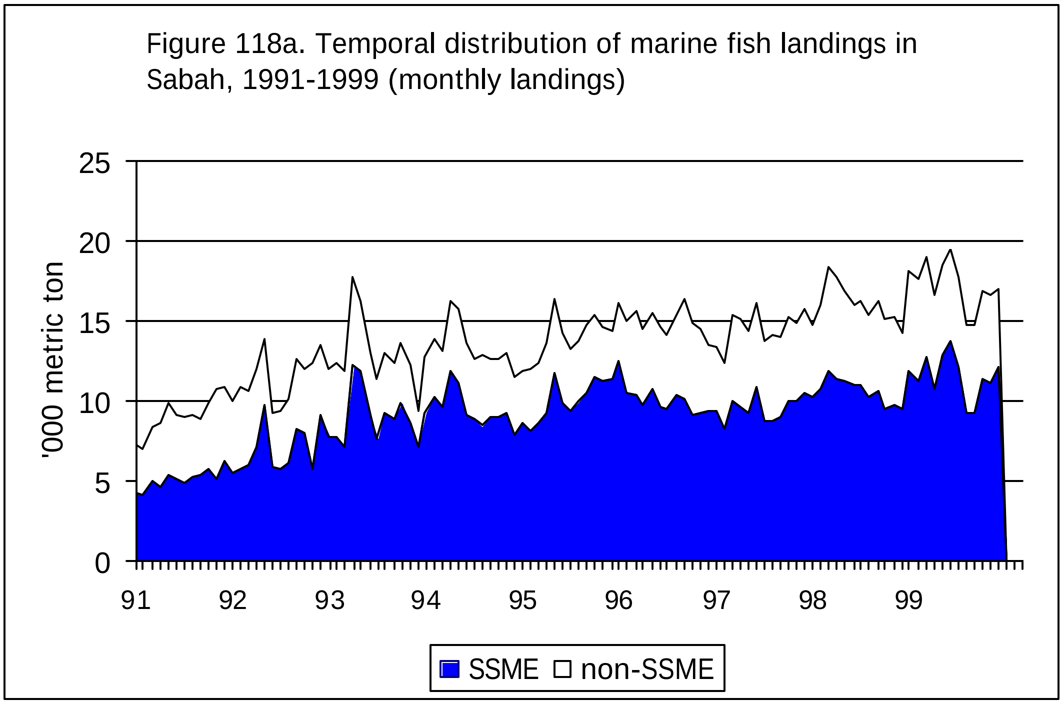


Figure 118a. Temporal distribution of marine fish landings in Sabah, 1991-1999 (monthly landings)
'000 metric ton
0
5
10
15
20
25
91
92
93
94
95
96
97
98
99
SSME
non-SSME

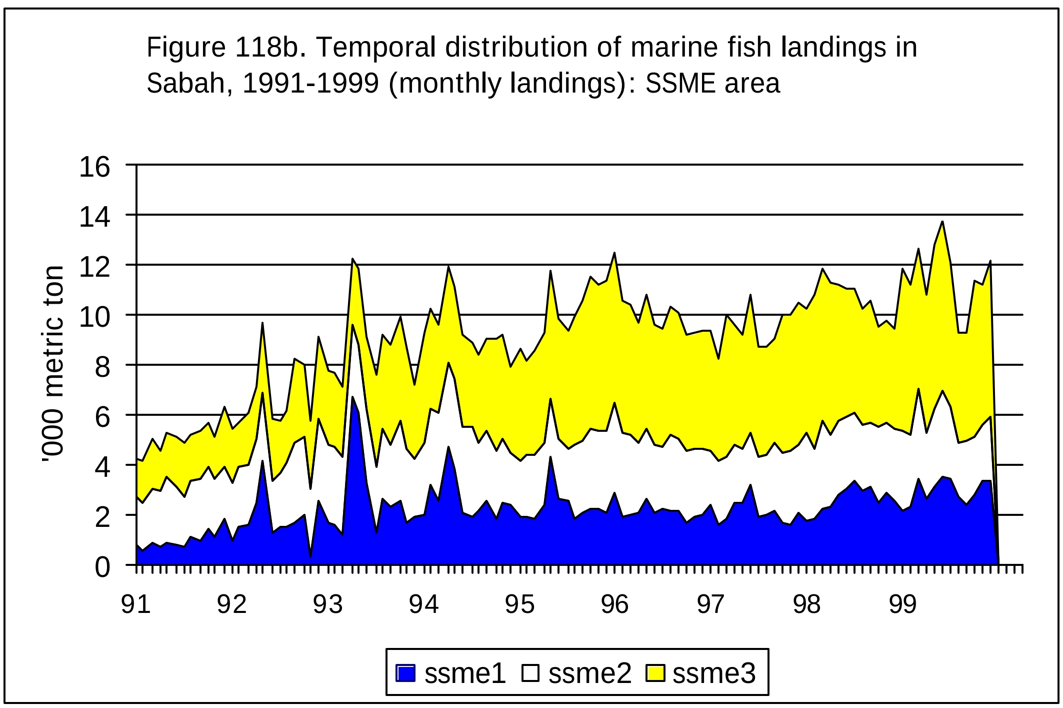


Figure 118b. Temporal distribution of marine fish landings in Sabah, 1991-1999 (monthly landings): SSME area
'000 metric ton
0
2
4
6
8
10
12
14
16
91
92
93
94
95
96
97
98
99
ssme1
ssme2
ssme3

Figure 118c. Temporal distribution of marine fish landings in Sabah, 1991-1999 (quarterly landings)

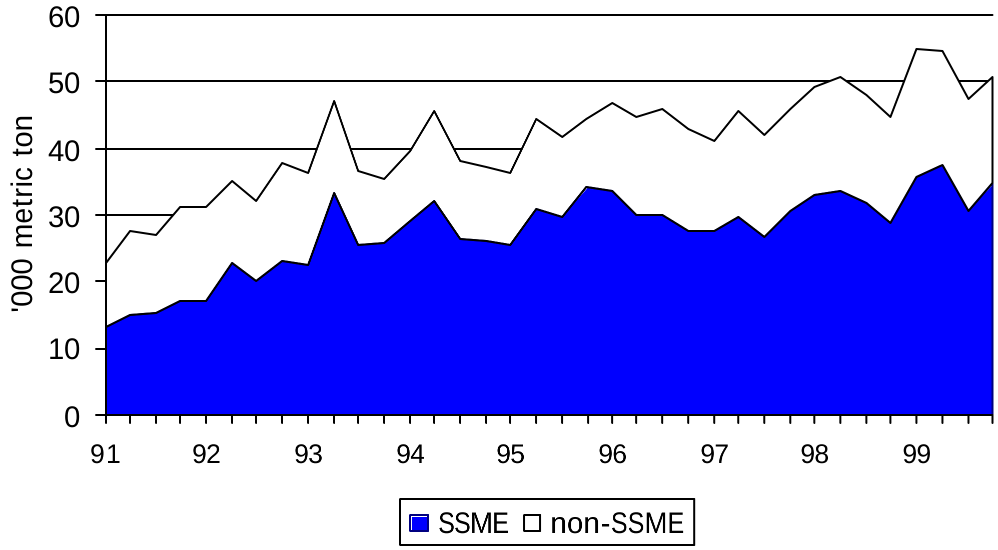


Figure 118d. Temporal distribution of marine fish landings in Sabah, 1991-1999 (quarterly landings): SSME area

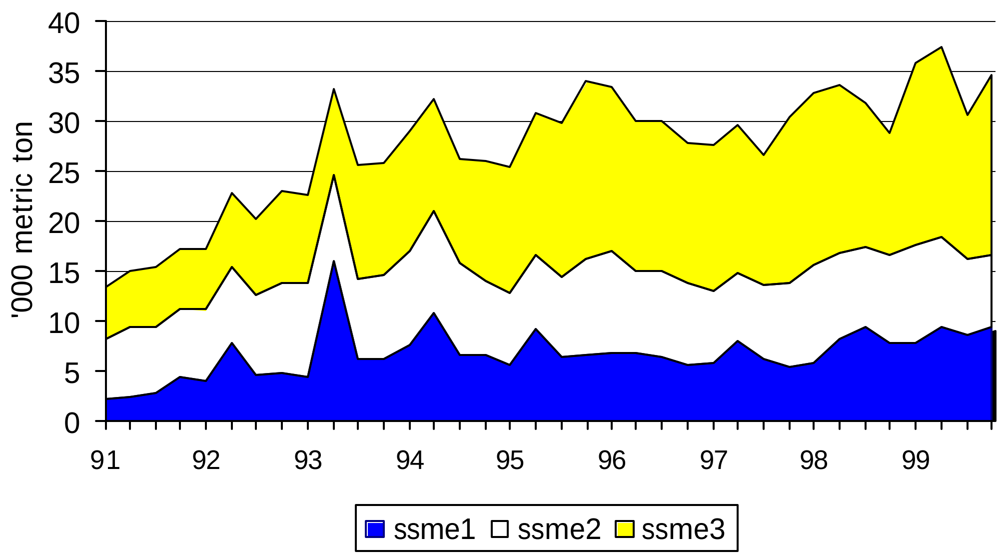


Figure 119a. Temporal distribution of marine fish landings in Sabah, 1991-1999 (% monthly)

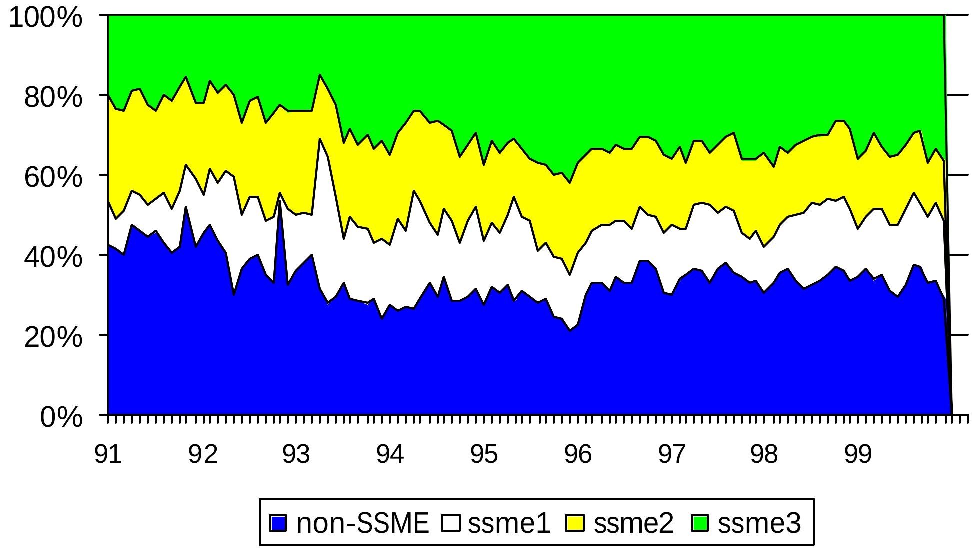
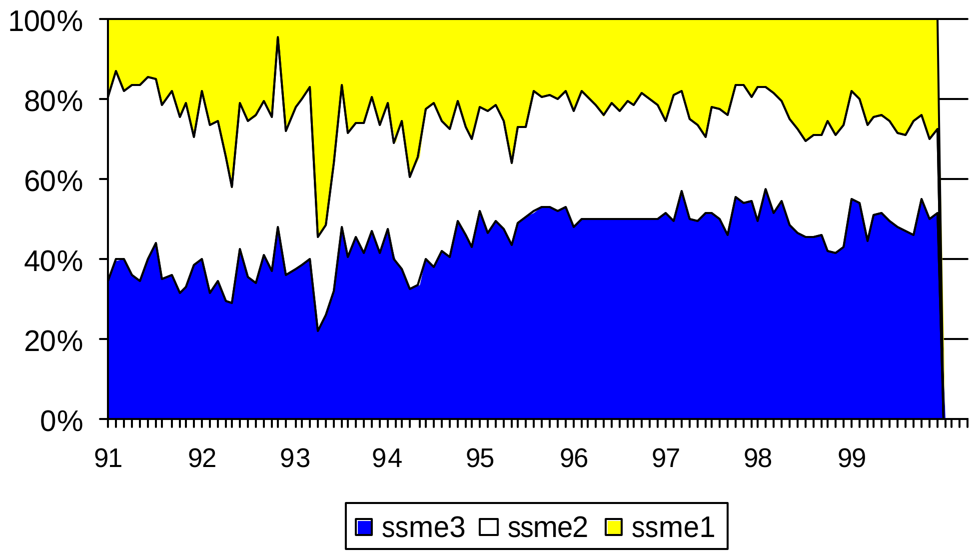


Figure 119b. Temporal distribution of marine fish landings in Sabah, 1991-1999 (% monthly): SSME area



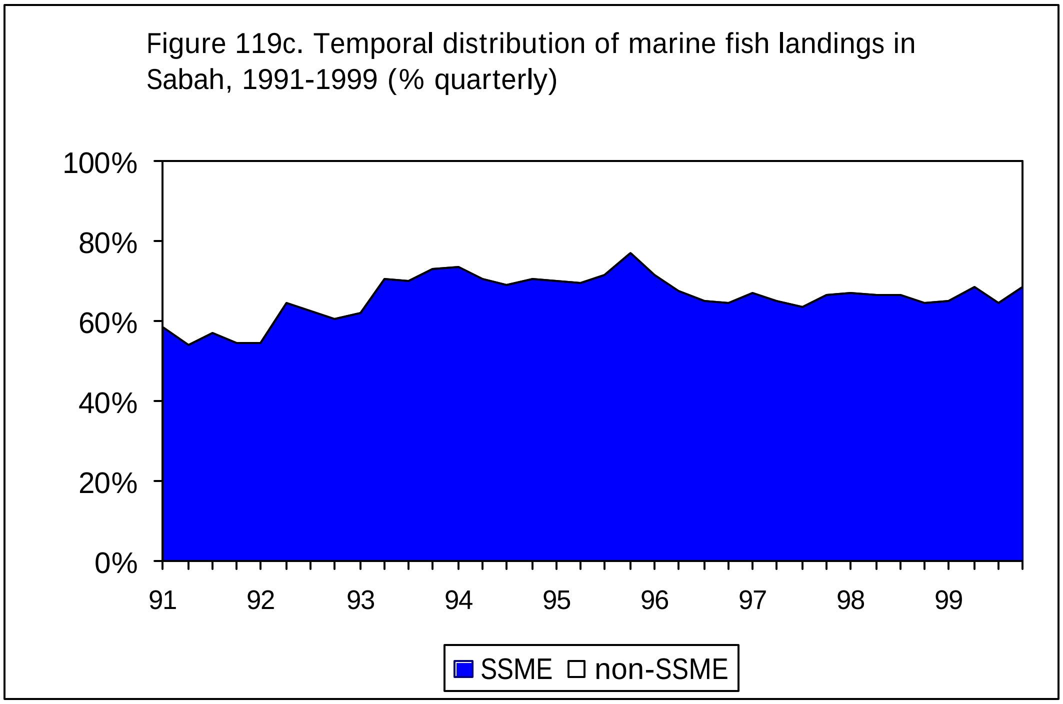


Figure 119c. Temporal distribution of marine fish landings in Sabah, 1991-1999 (% quarterly)
100%
80%
60%
40%
20%
0%
91
92
93
94
95
96
97
98
99
SSME
non-SSME

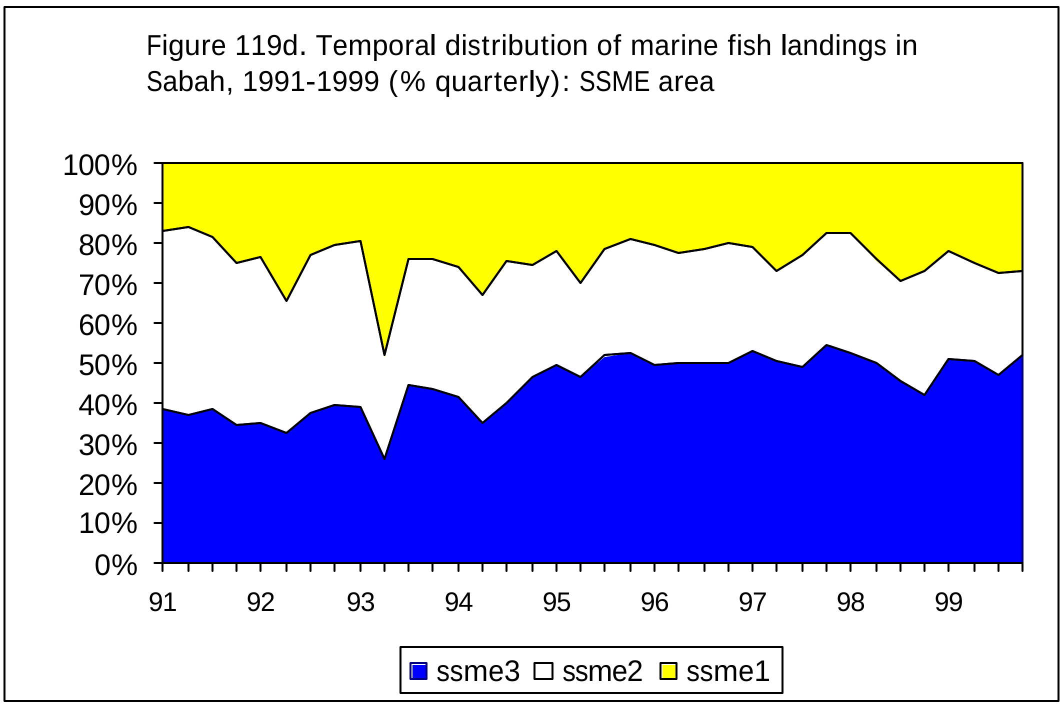


Figure 119d. Temporal distribution of marine fish landings in Sabah, 1991-1999 (% quarterly): SSME area
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
91
92
93
94
95
96
97
98
99
ssme3
ssme2
ssme1

Figure 120. Temporal and spatial changes in marine fish landings, Sabah 1991-1999 period

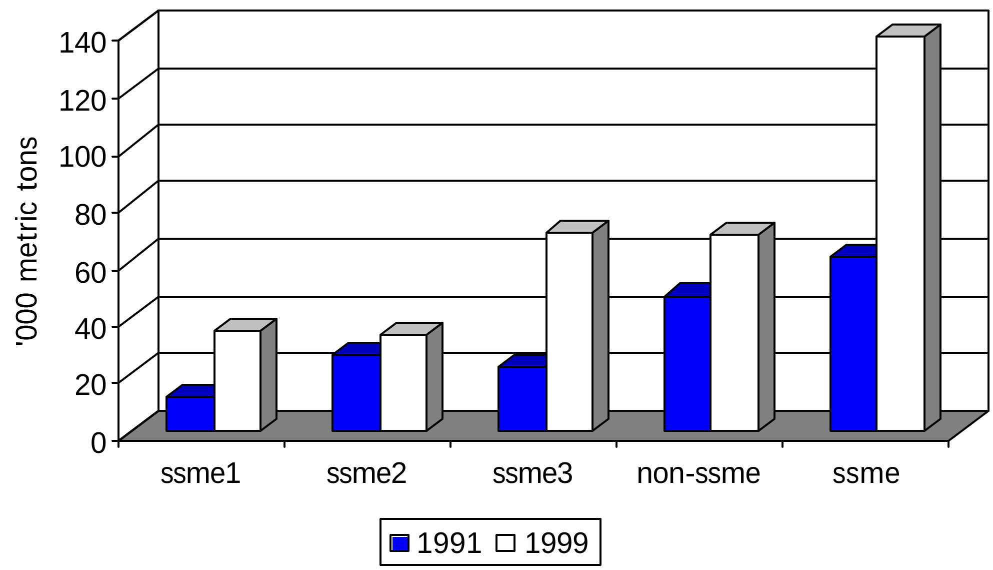


Figure 121. Temporal and spatial changes in marine fish landings, Sabah 1991-1999 period (% annual)

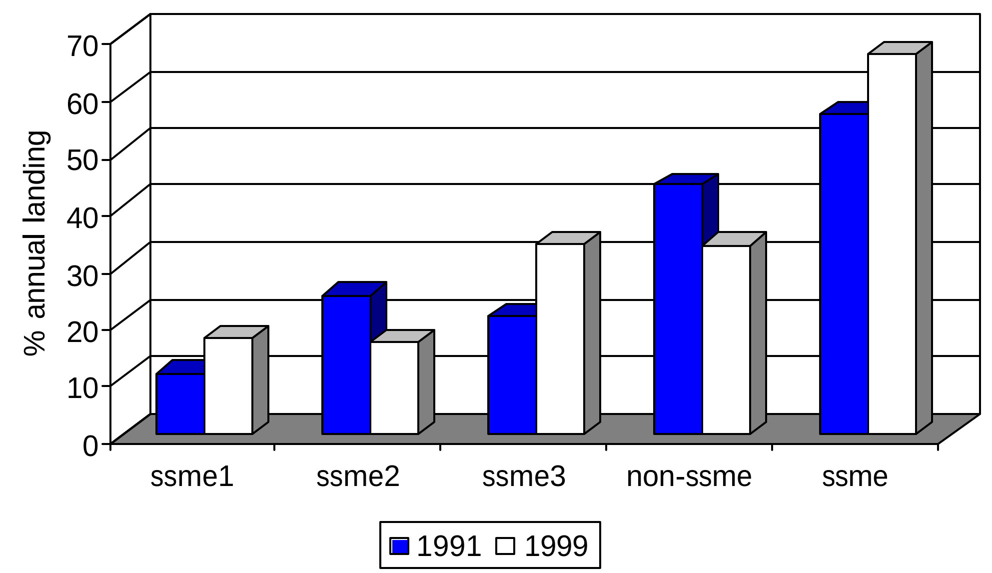


Figure 122a. Temporal distribution of total marine fish landings in Sabah, 1991-1999

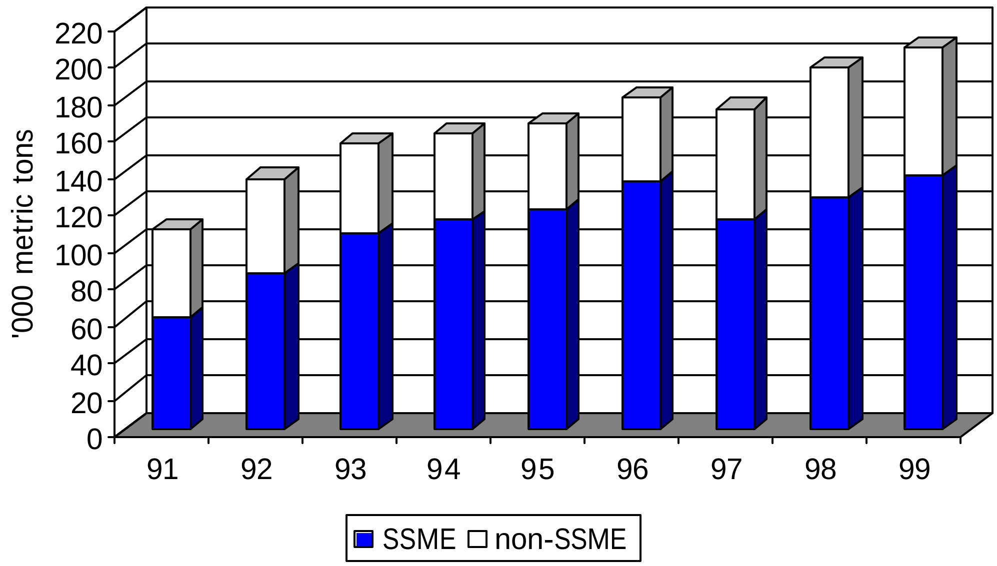


Figure 122b. Temporal distribution of total marine fish landings in Sabah, 1991-1999

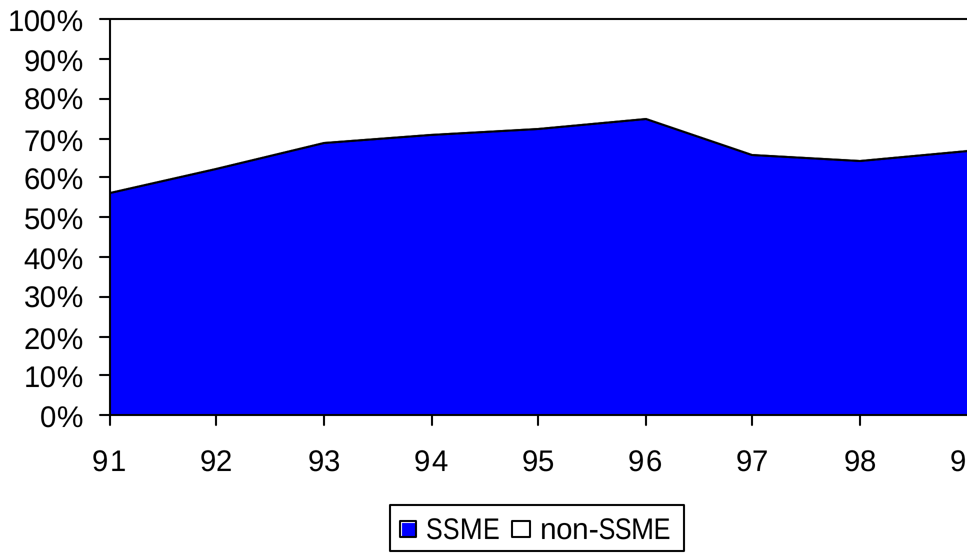


Figure 123a. Temporal distribution of total marine fish landings in Sabah, 1991-1999 (including Kota Kinabalu)

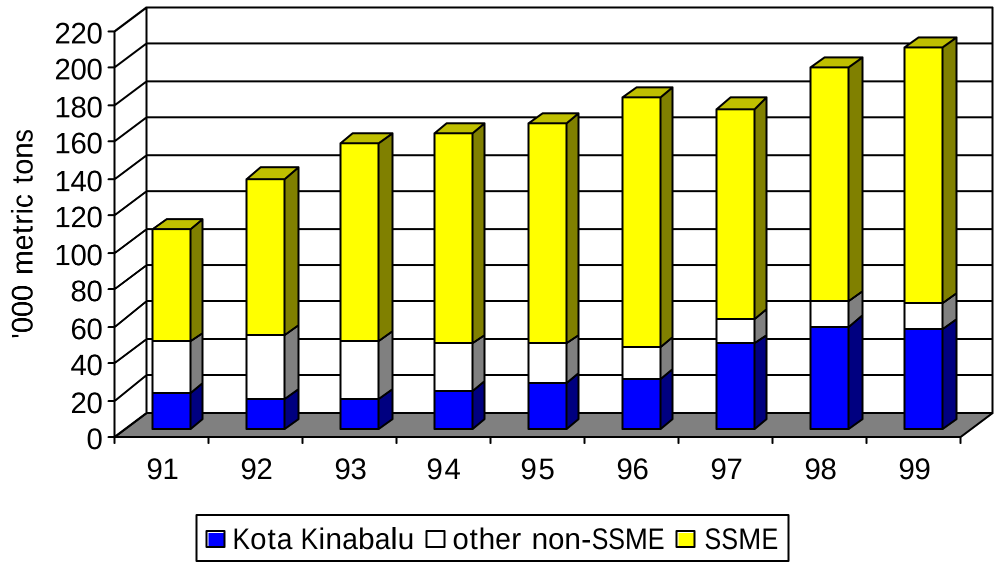


Figure 123b. Temporal distribution of total marine fish landings in Sabah, 1991-1999 (including Kota Kinabalu)

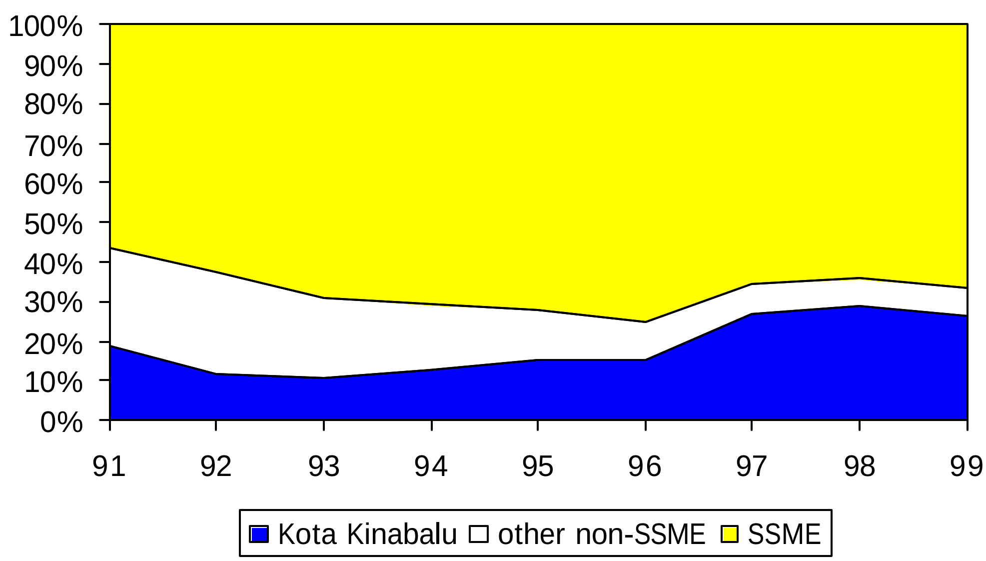


Figure 123c. Temporal distribution of traditional gear landings in Sabah, 1991-1999 (including Kota Kinabalu)

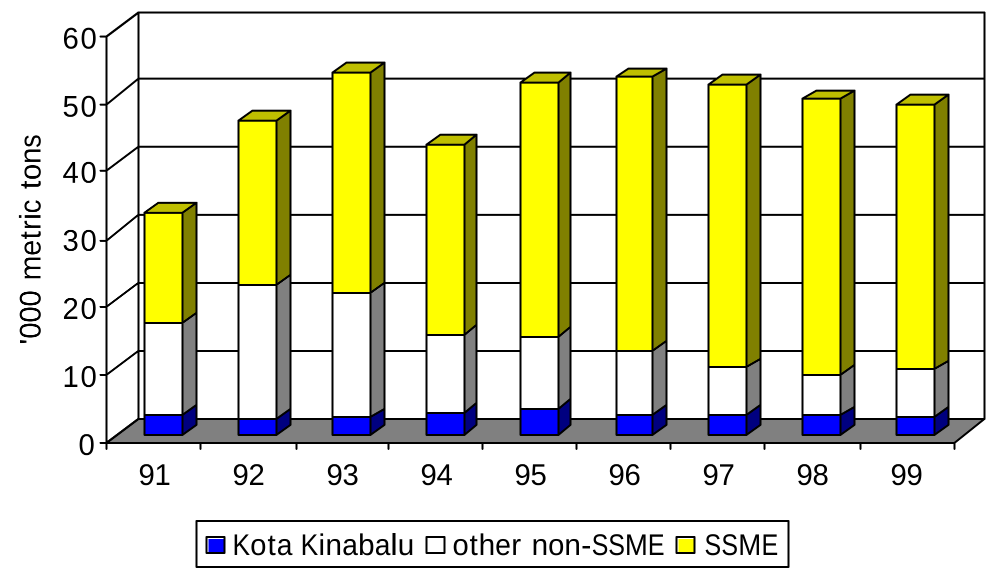


Figure 123d. Temporal distribution of traditional gear landings in Sabah, 1991-1999 (including Kota Kinabalu)

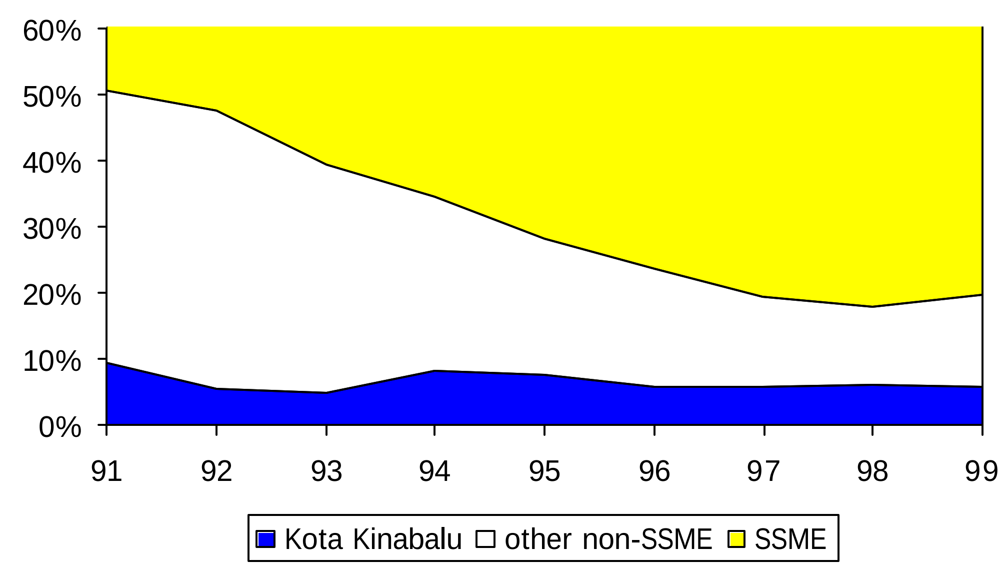


Figure 123e. Temporal distribution of commercial gear landings in Sabah, 1991-1999 (including Kota Kinabalu)

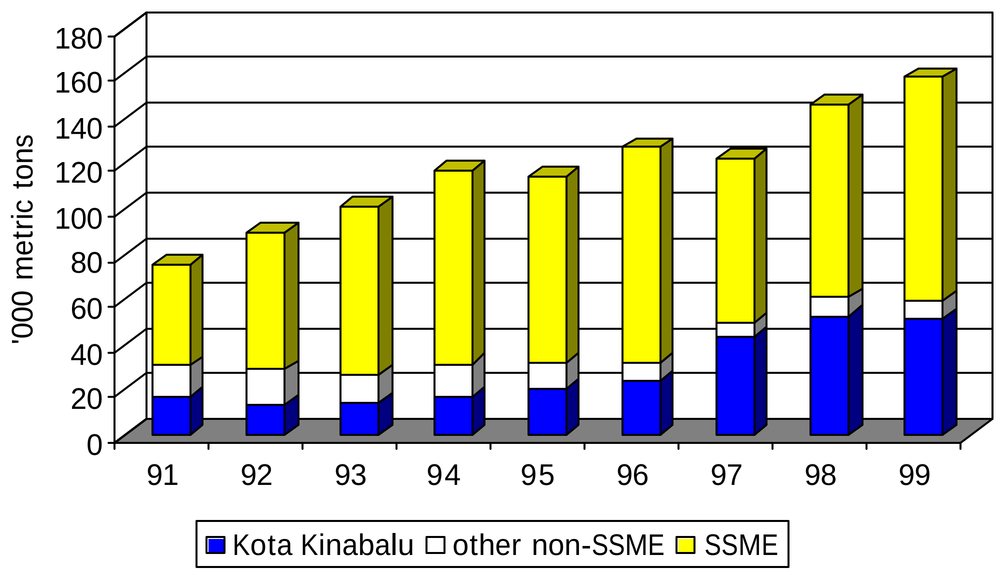


Figure 123f. Temporal distribution of commercial gear landings in Sabah, 1991-1999 (including Kota Kinabalu)

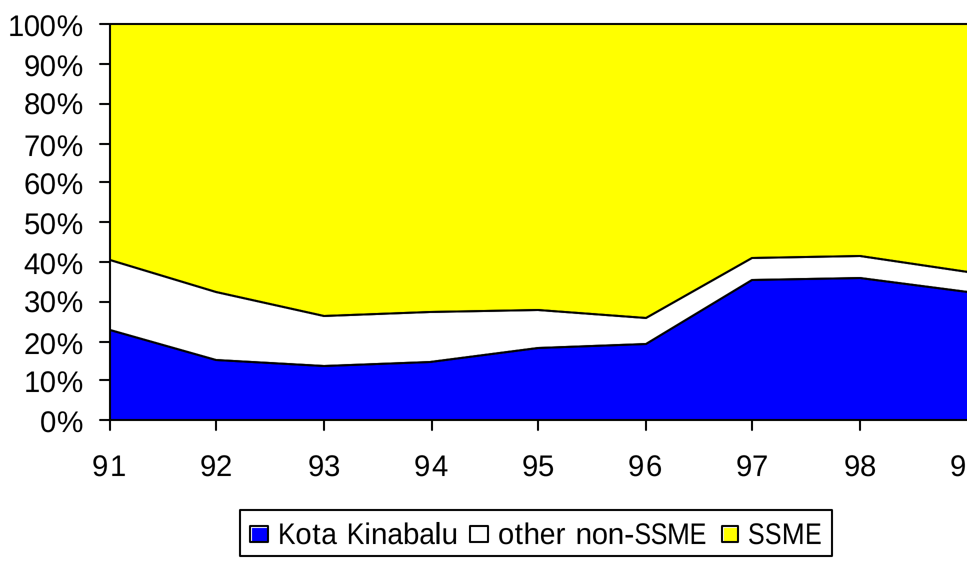


Figure 124. Temporal distribution of marine fish landings in Sabah, 1991-1999 (% annual)

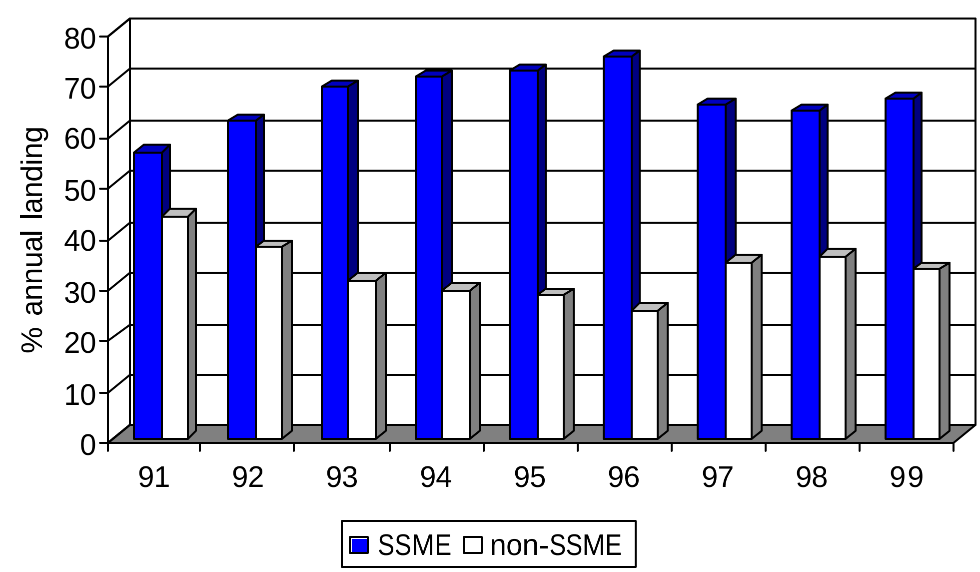


Figure 125. Temporal distribution of marine fish landings by gear group in Sabah, 1991-1999

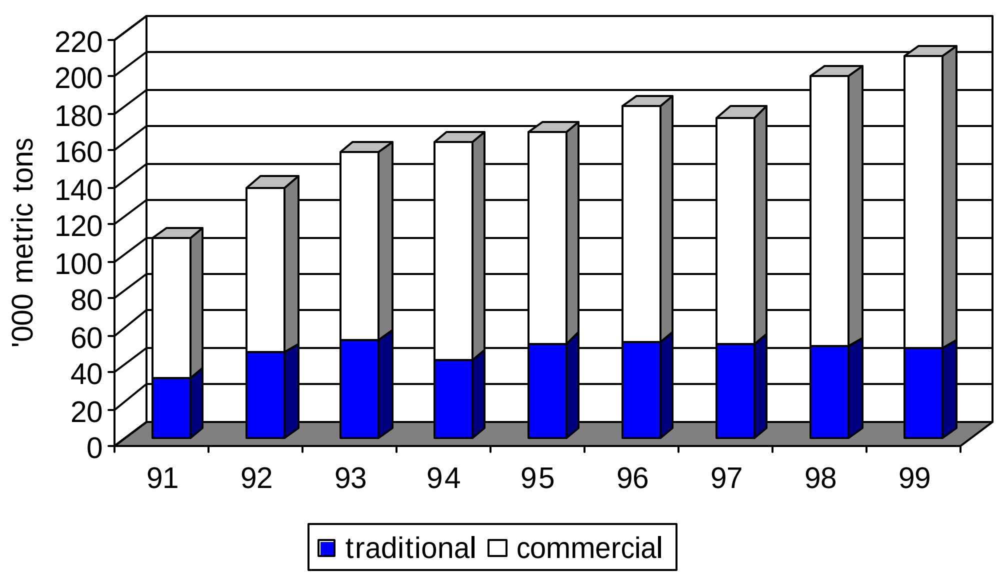


Figure 126. Temporal distribution of marine fish landings by gear group in Sabah, 1991-1999

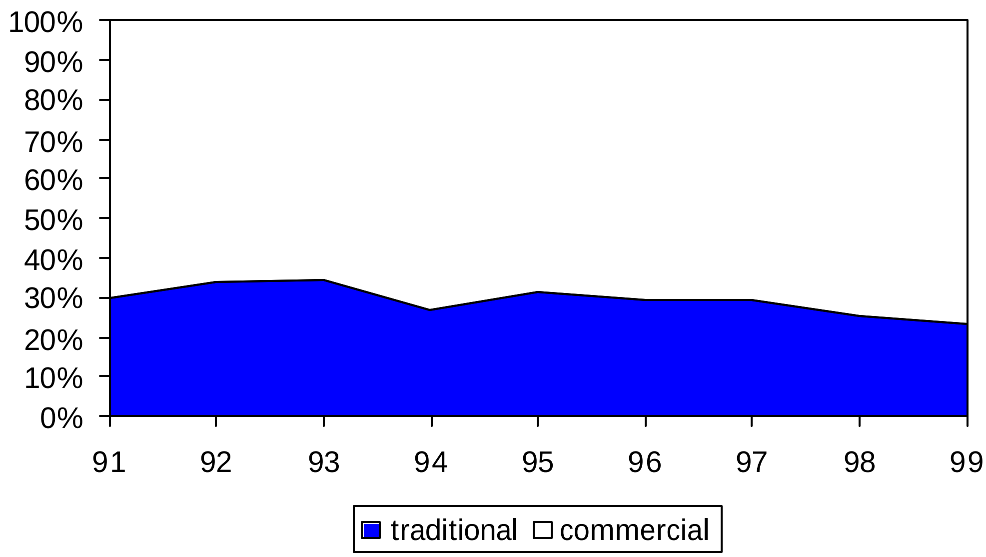


Figure 127. Temporal distribution of marine fish landings by gear group in Sabah, 1991-1999 (% annual)

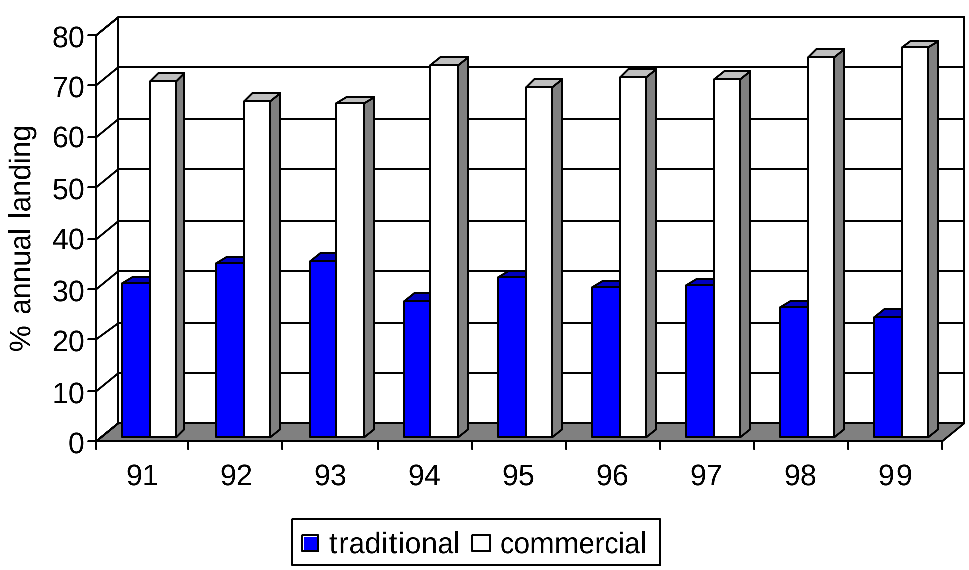


Figure 128. Temporal and spatial changes in traditional gear landings, Sabah 1991-1999 period

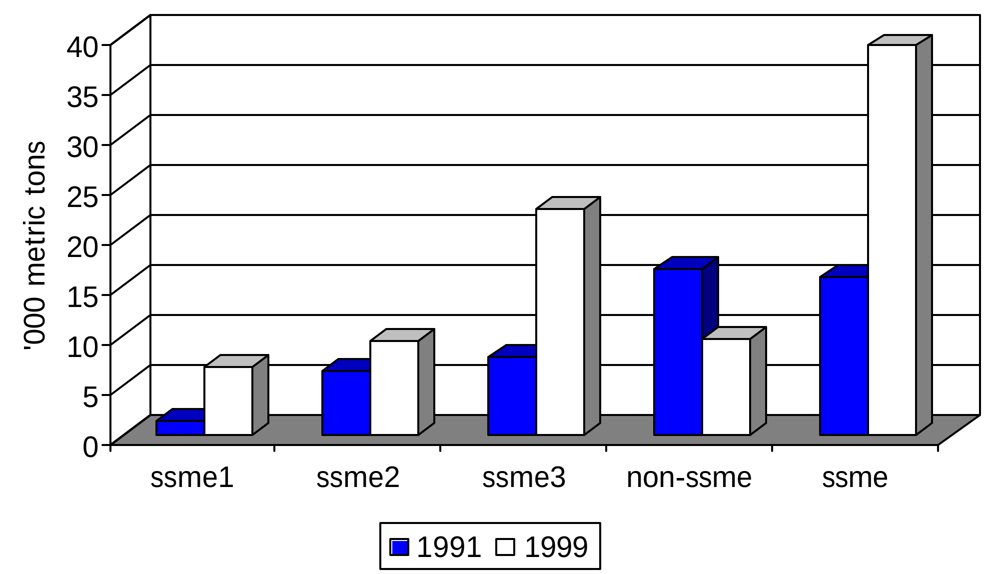


Figure 129. Temporal and spatial changes in traditional gear landings, Sabah 1991-1999 period (% annual)

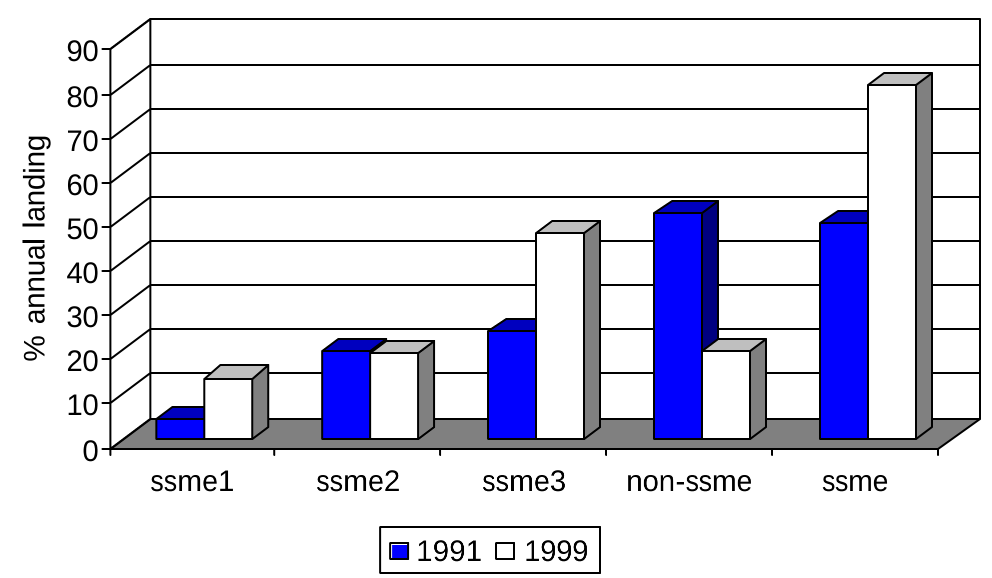


Figure 130a. Temporal and spatial changes in commercial gear landings, Sabah 1991-1999 period

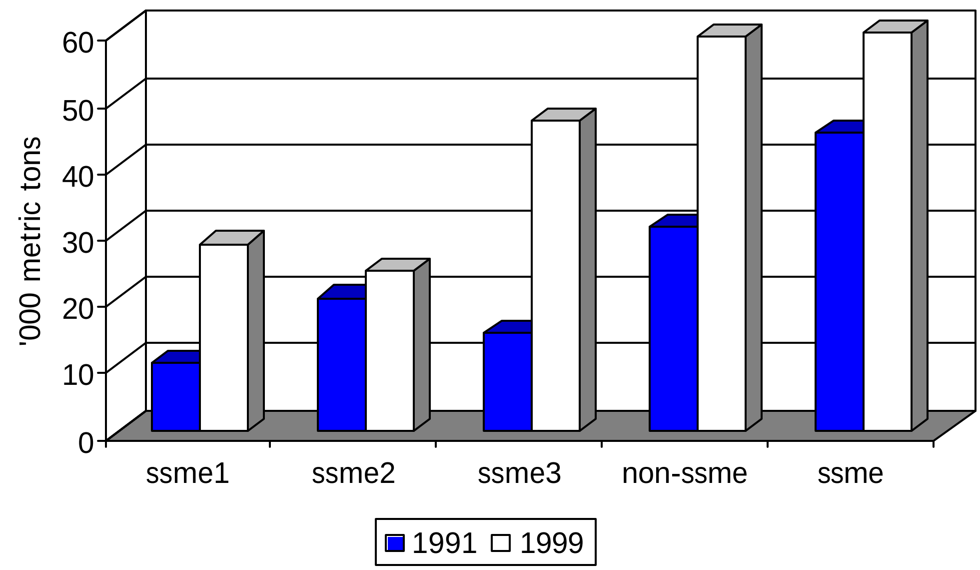


Figure 130b. Temporal and spatial changes in commercial gear landings, Sabah 1991-1999 period (% annual)

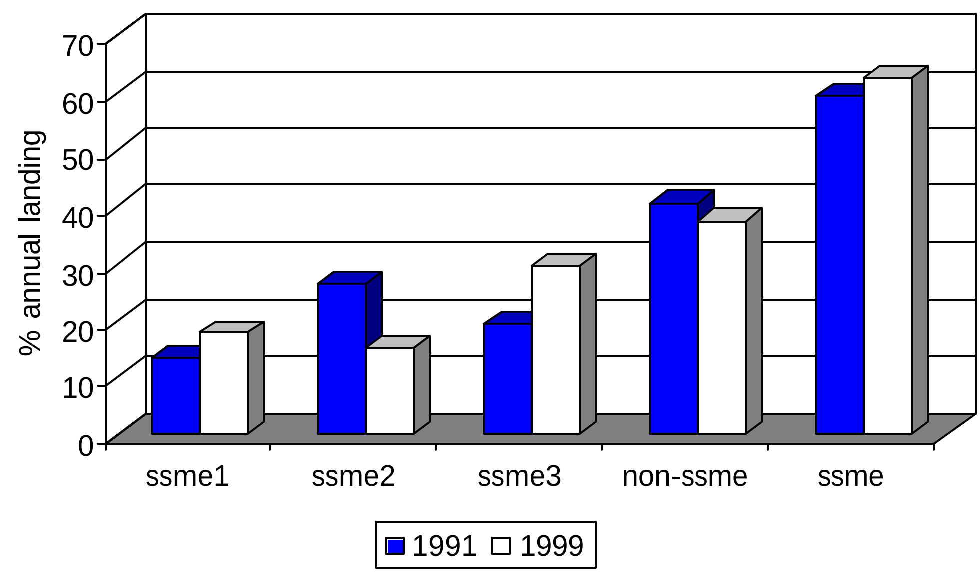


Figure 131a. Temporal distribution of marine fish landings by gear group in the non-SSME area, 1991-1999

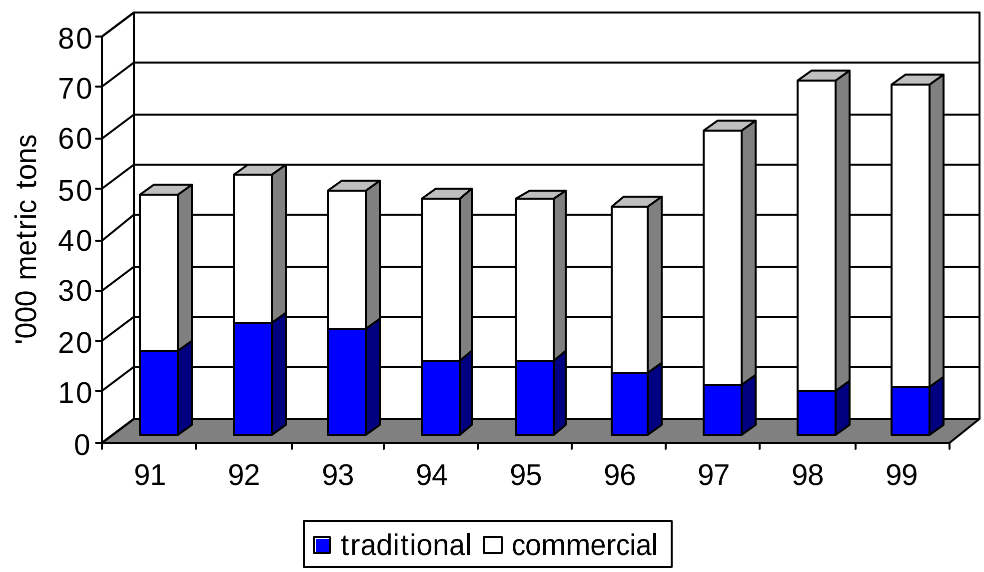


Figure 131b. Temporal distribution of marine fish landings by gear group in the non-SSME area, 1991-1999

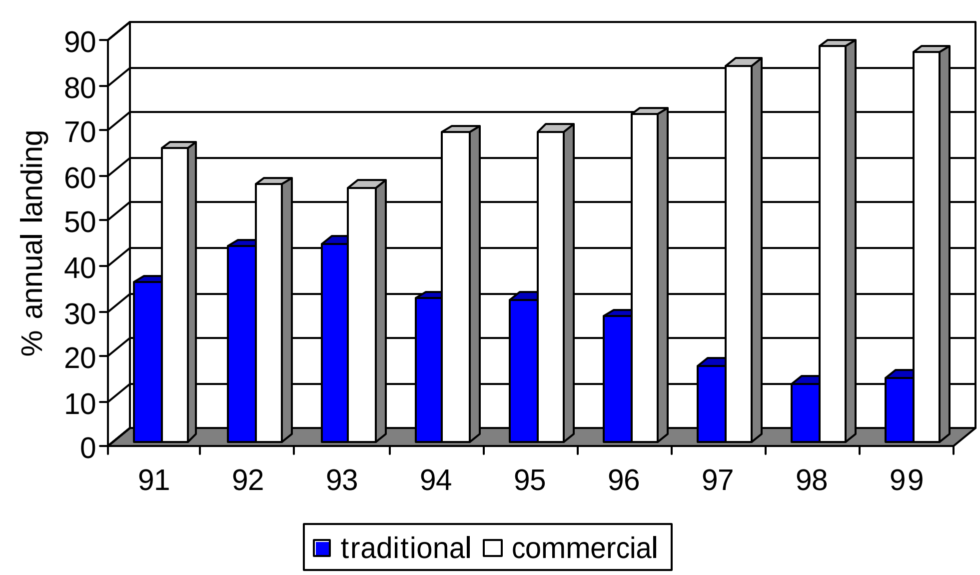


Figure 131c. Temporal distribution of marine fish landings by gear group in the non-SSME area, 1991-1999

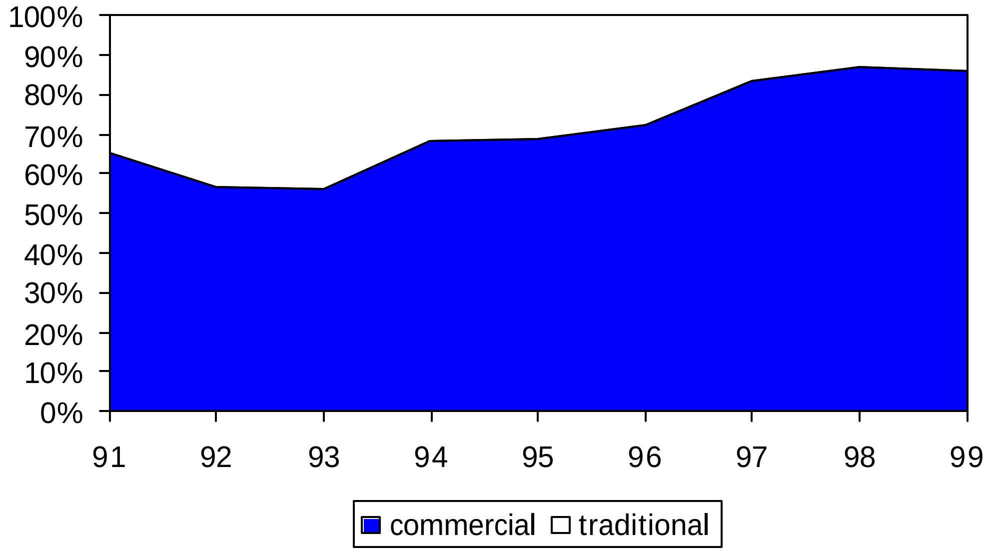


Figure 131d. Temporal distribution of marine fish landings by district in the non-SSME area, 1991-1999

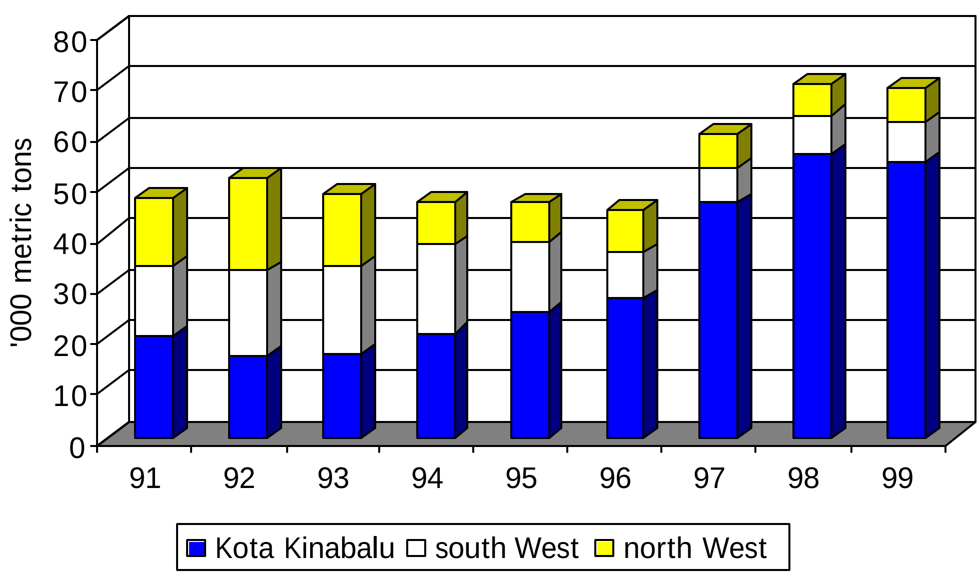


Figure 131e. Temporal distribution of marine fish landings by district in the non-SSME area, 1991-1999 (% annual)

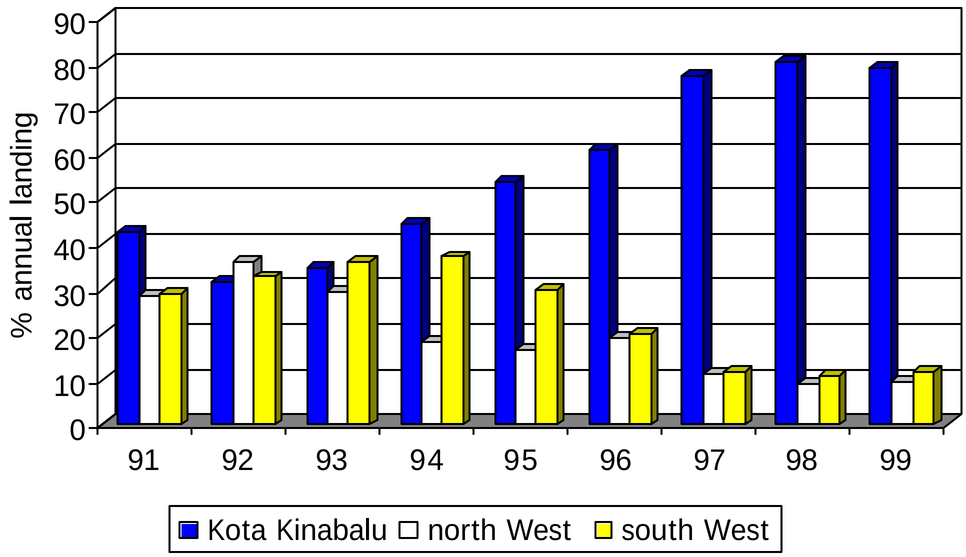


Figure 131f. Temporal distribution of marine fish landings by district in the non-SSME area, 1991-1999

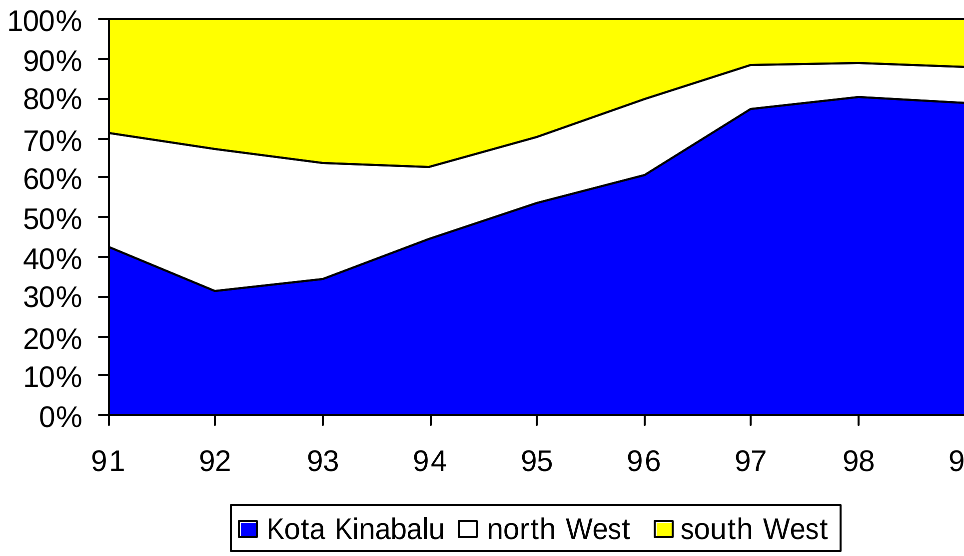


Figure 132. Temporal distribution of marine fish landings in the SSME area, 1991-1999

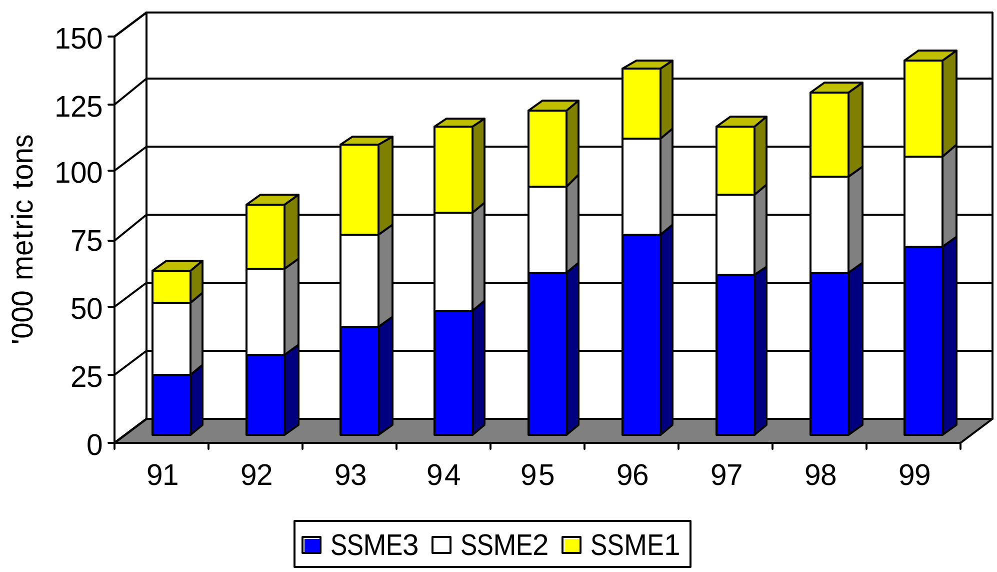


Figure 133. Temporal distribution of marine fish landings in the SSME area, 1991-1999

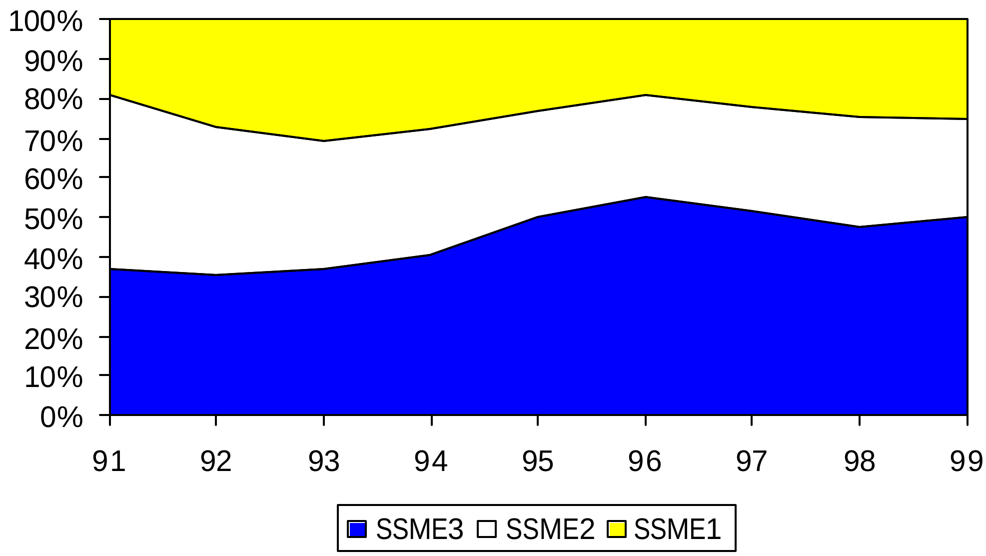


Figure 134. Temporal distribution of marine fish landings in the SSME area, 1991-1999 (% annual)

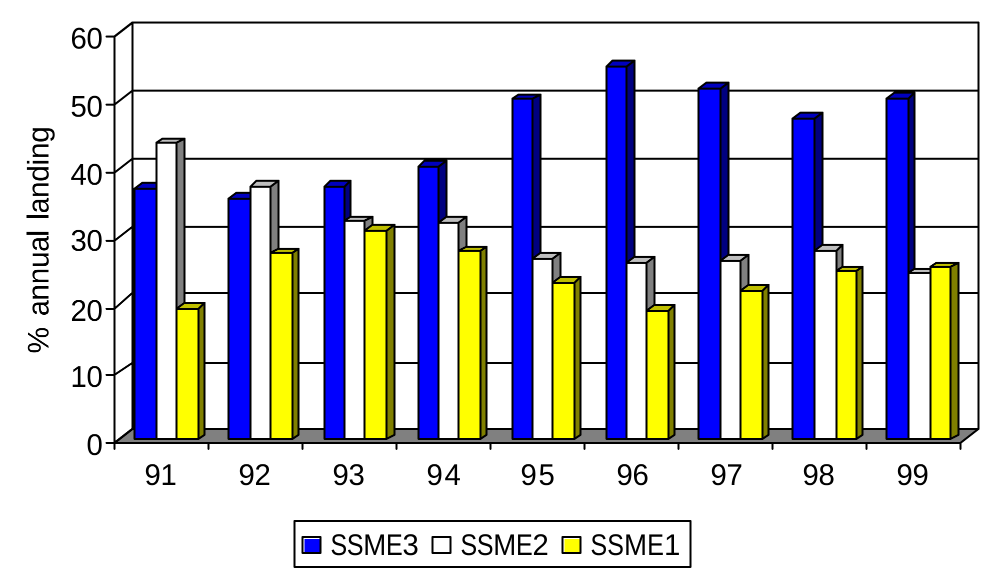


Figure 135. Temporal distribution of traditional gear landings in the SSME area, 1991-1999

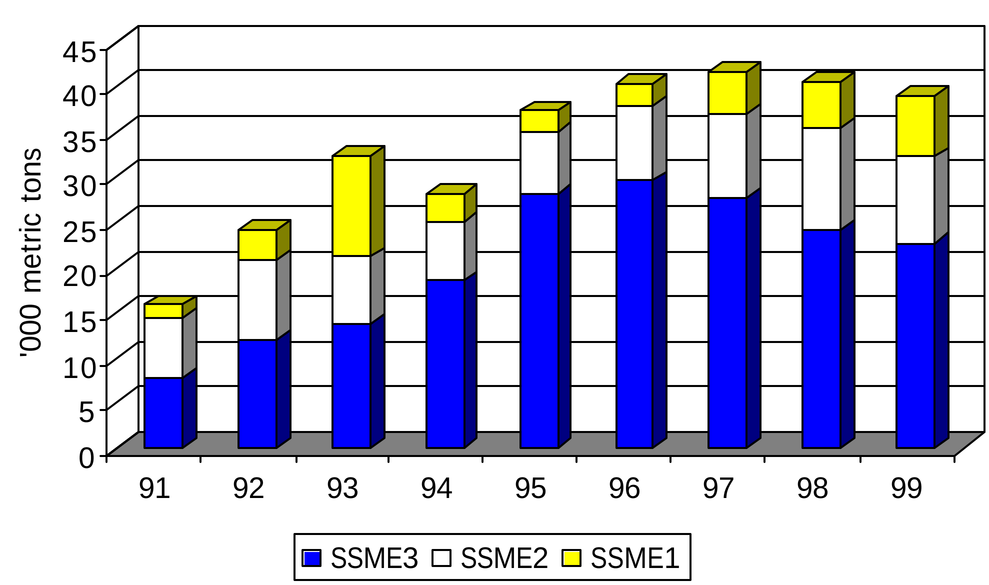


Figure 136. Temporal distribution of traditional gear landings in the SSME area, 1991-1999

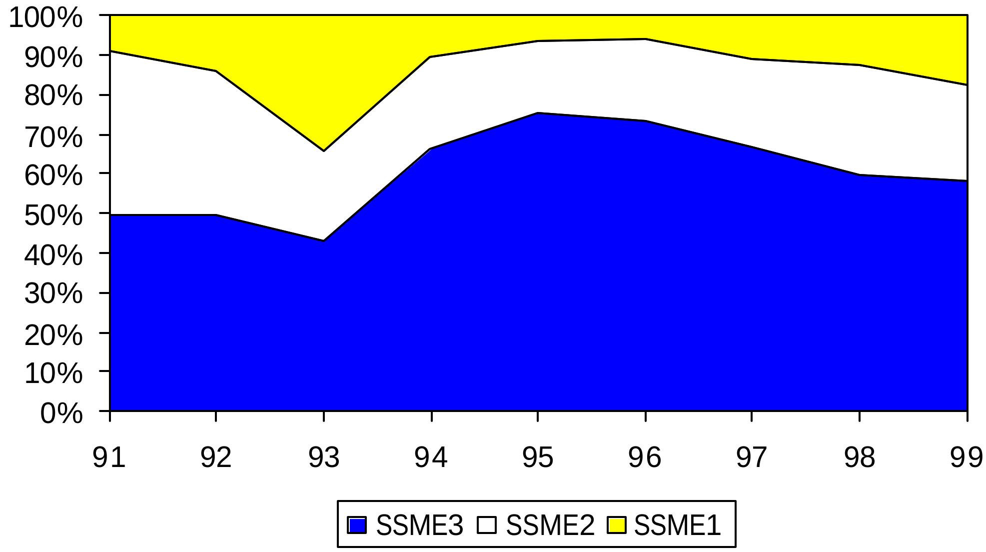


Figure 137. Temporal distribution of traditional gear landings in the SSME area, 1991-1999 (% annual)

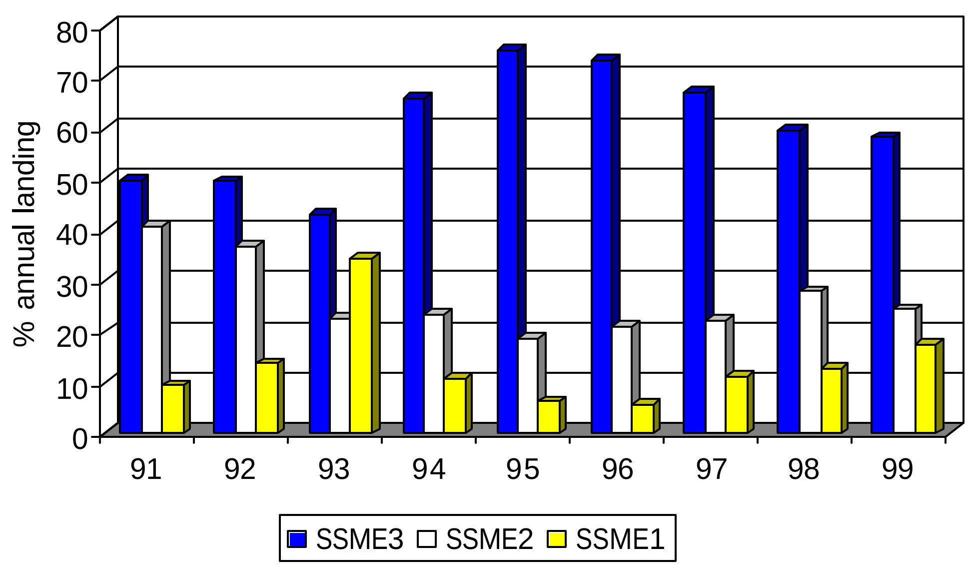


Figure 138a. Temporal distribution of traditional gear landings in Sabah, 1991-1999

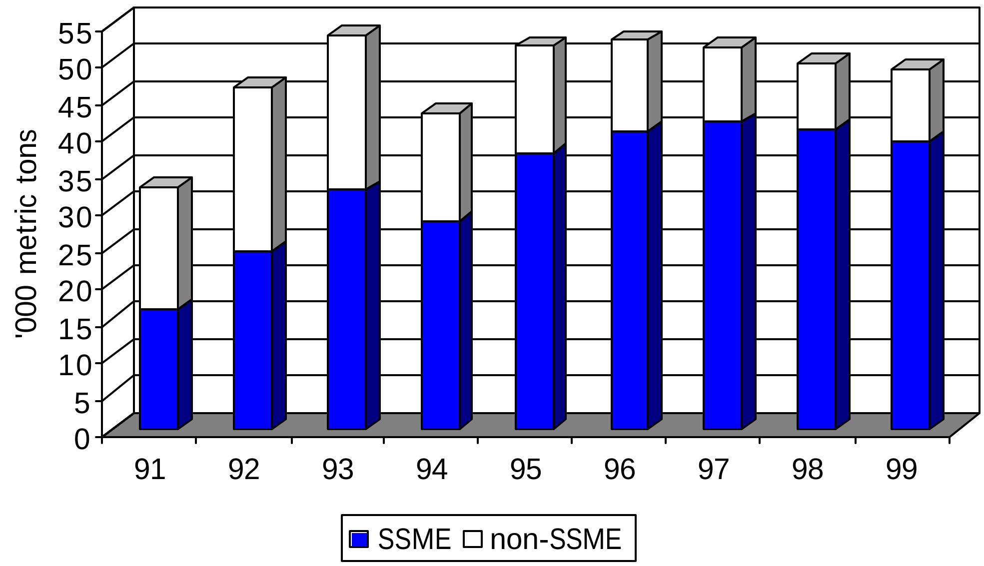


Figure 138b. Temporal distribution of traditional gear landings in Sabah, 1991-1999

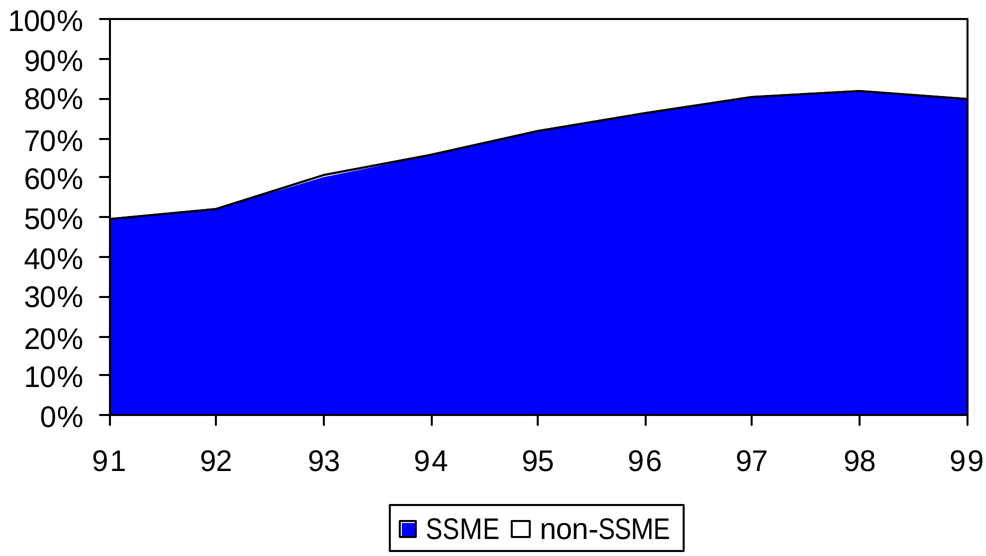


Figure 139a. Temporal distribution of traditional gear landings in Sabah, 1991-1999 (% annual)

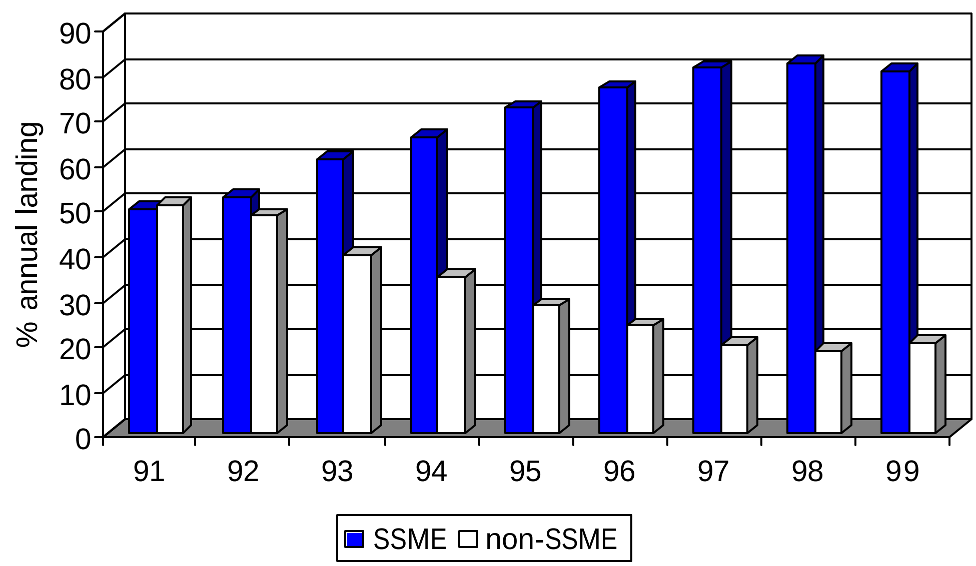


Figure 139b. Temporal distribution of traditional gear landings in the non-SSME area, 1991-1999

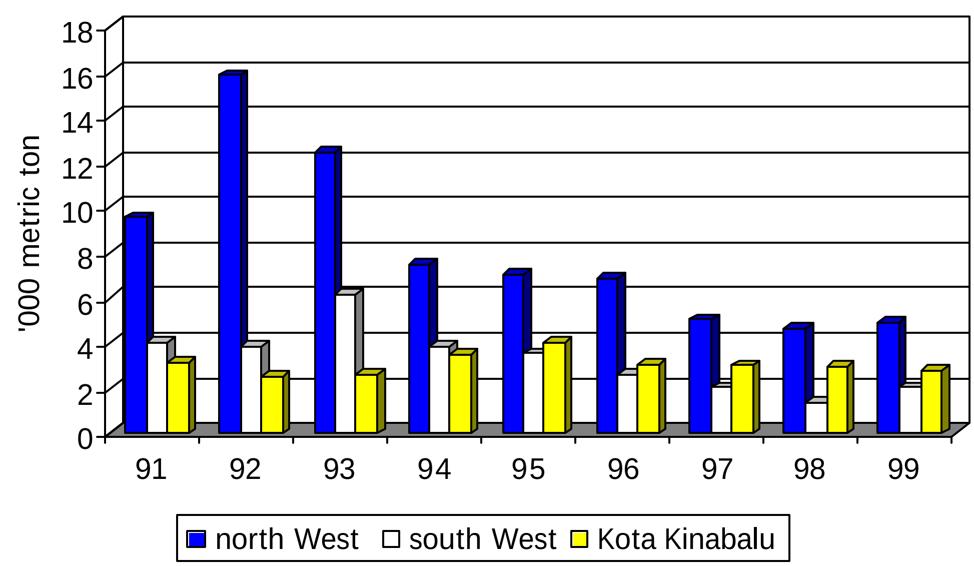


Figure 139c. Temporal distribution of traditional gear landings in Sabah, 1991-1999 (% annual)

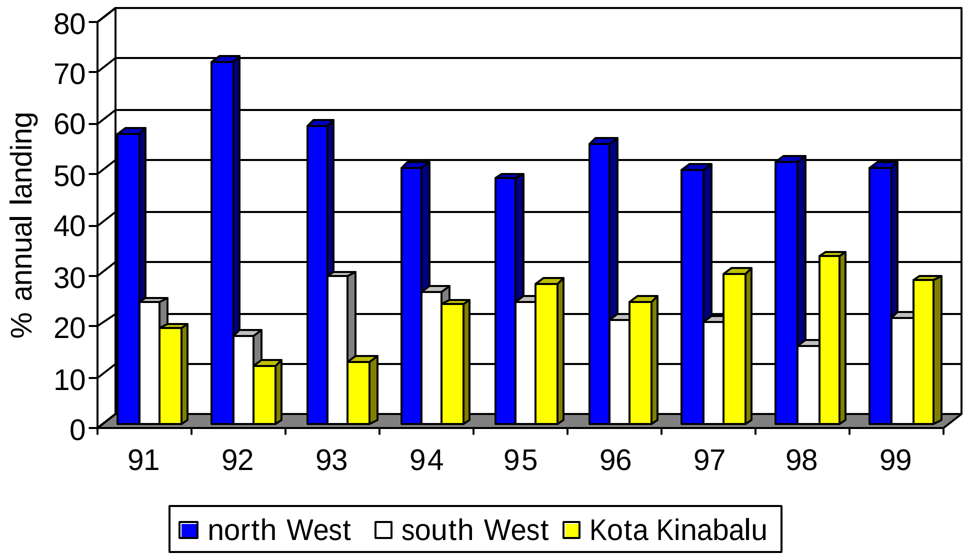


Figure 139d. Temporal distribution of traditional gear landings in Sabah, 1991-1999 (% annual)

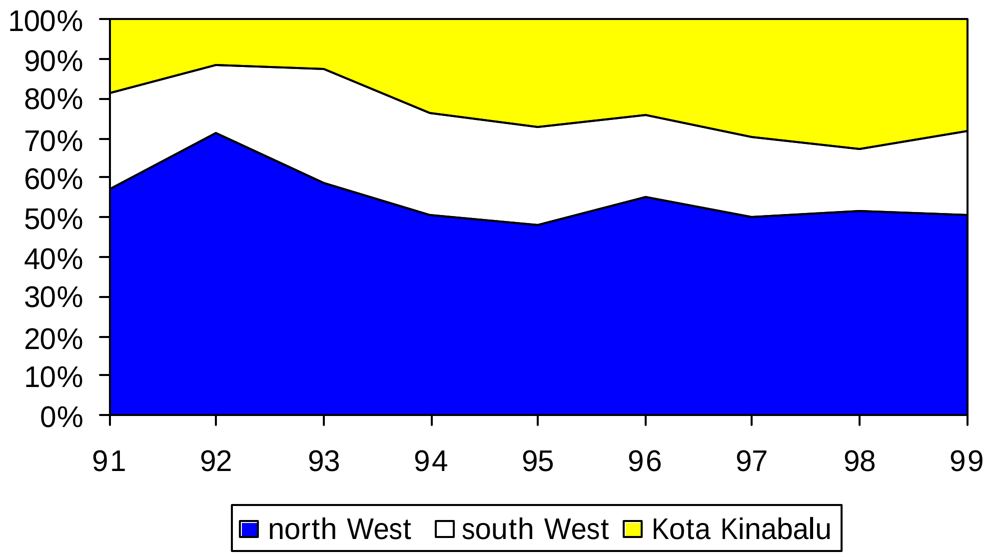


Figure 140a. Temporal distribution breakdown of gear landings in Sabah, 1991-1999

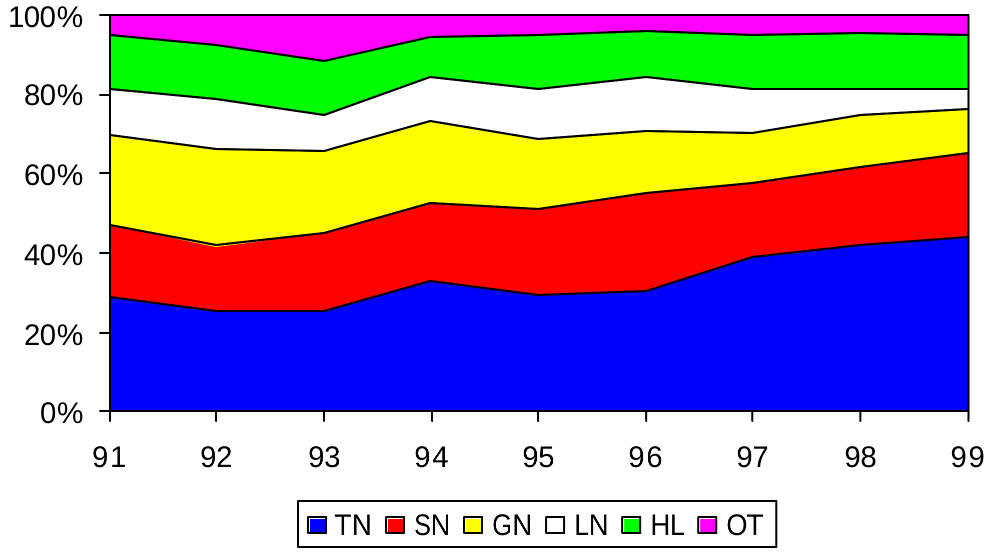


Figure 140b. Temporal distribution breakdown of gear landings in the non-SSME area, 1991-1999

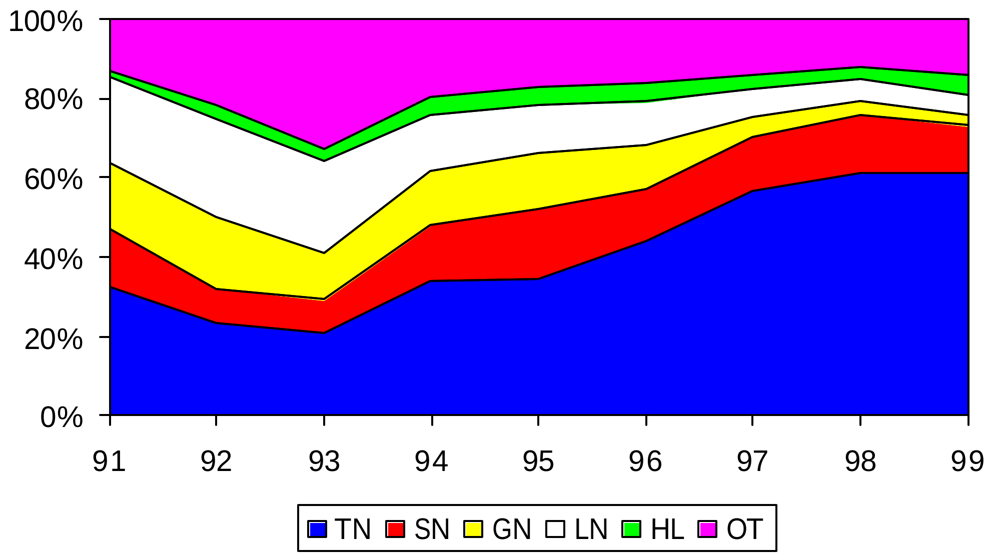


Figure 140c. Temporal distribution breakdown of gear landings in the non-SSME area, 1991-1999 (West Coast North)

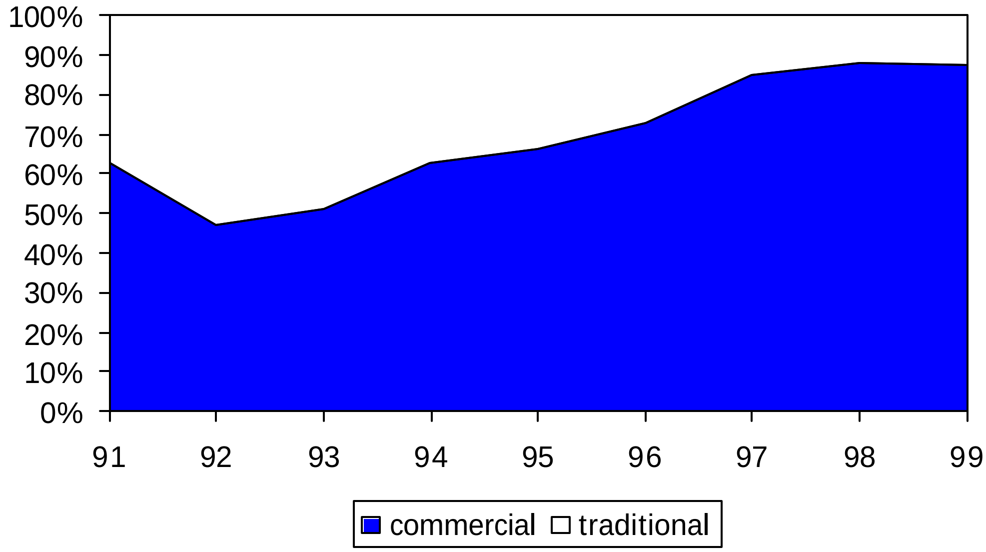


Figure 140d. Temporal distribution breakdown of gear landings in the non-SSME area, 1991-1999 (West Coast North)

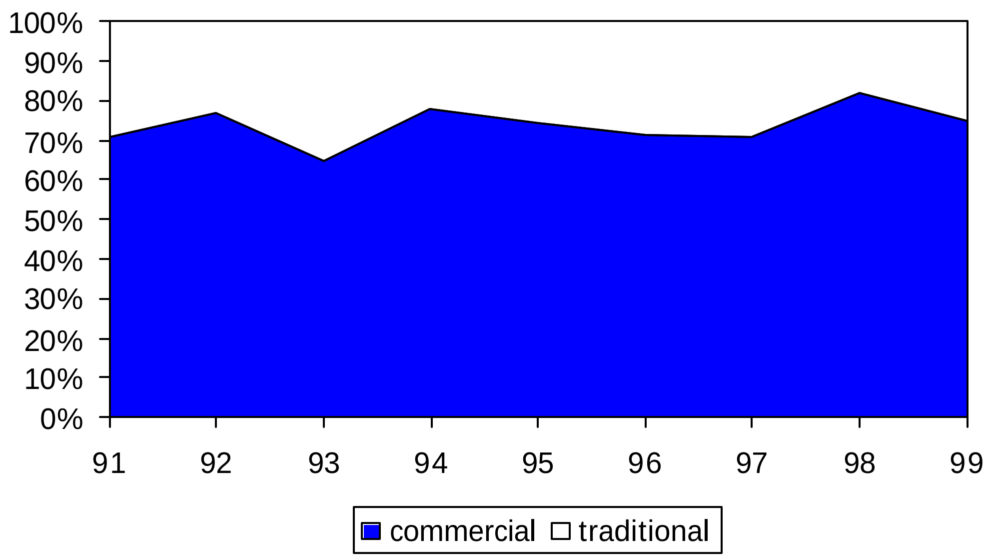


Figure 140e. Temporal distribution breakdown of gear landings in the SSME area, 1991-1999

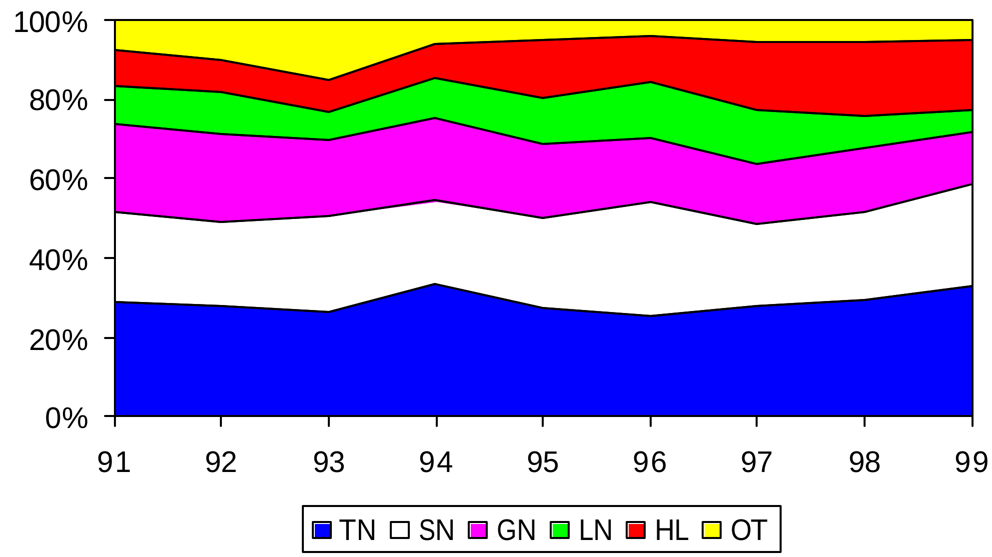


Figure 141. Temporal distribution of commercial gear landings in the SSME area, 1991-1999

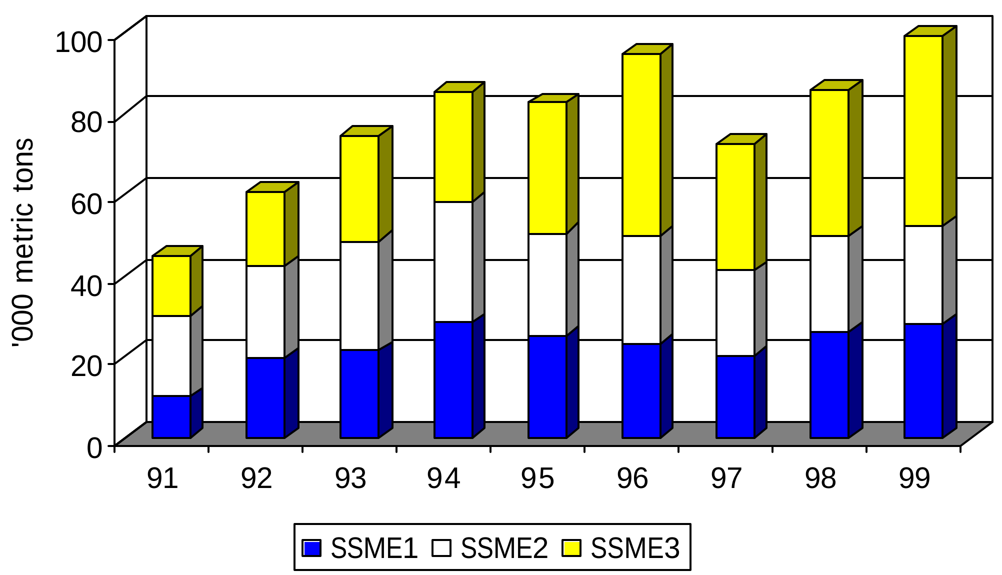


Figure 142. Temporal distribution of commercial gear landings in the SSME area, 1991-1999

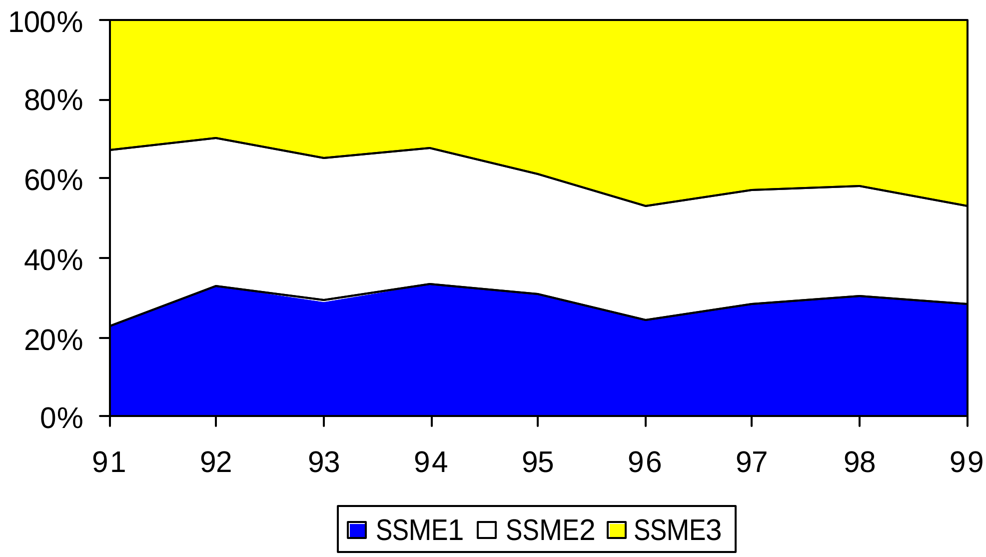


Figure 143. Temporal distribution of commercial gear landings in the SSME area, 1991-1999 period (% annual)

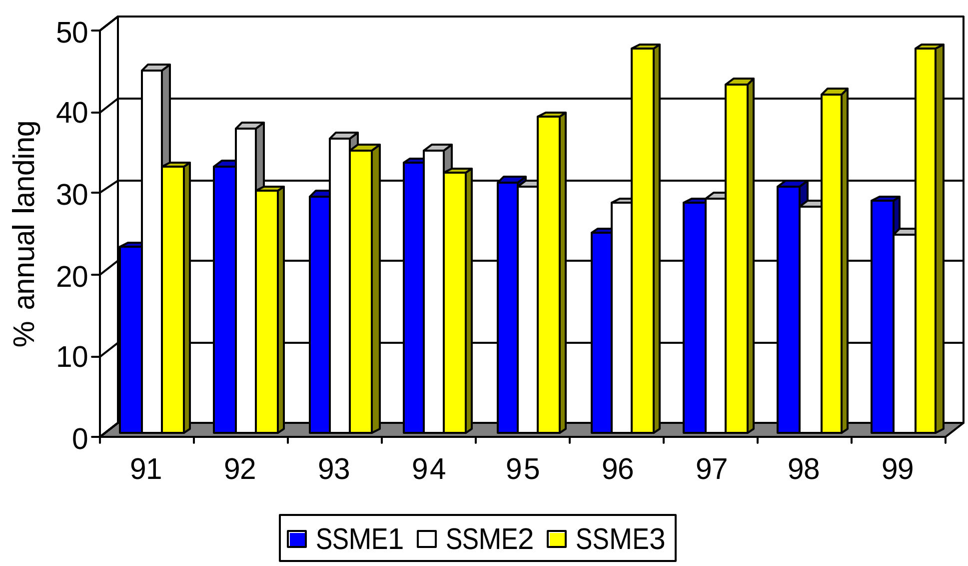


Figure 144. Temporal distribution of commercial gear landings in Sabah, 1991-1999

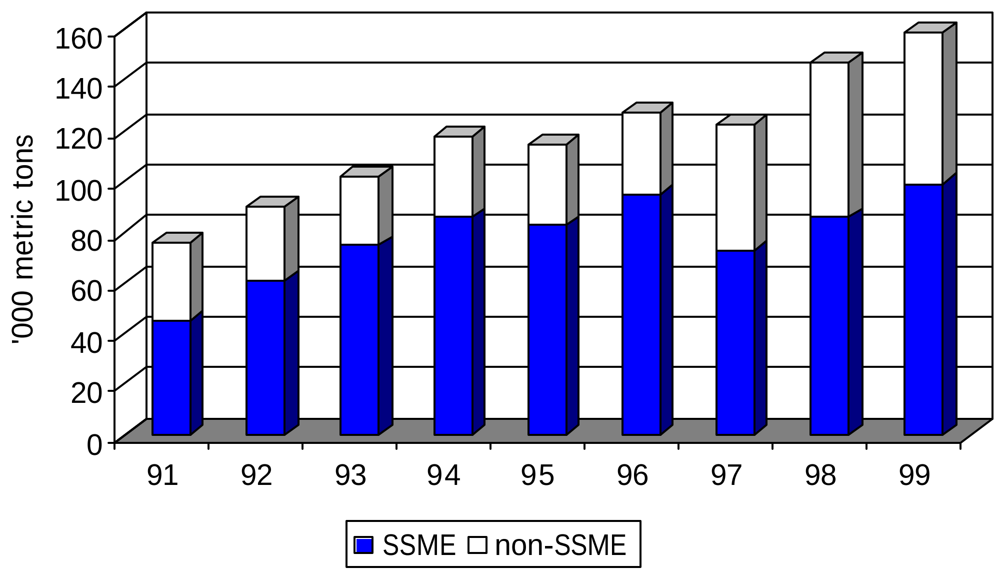


Figure 145. Temporal distribution of commercial gear landings in Sabah, 1991-1999

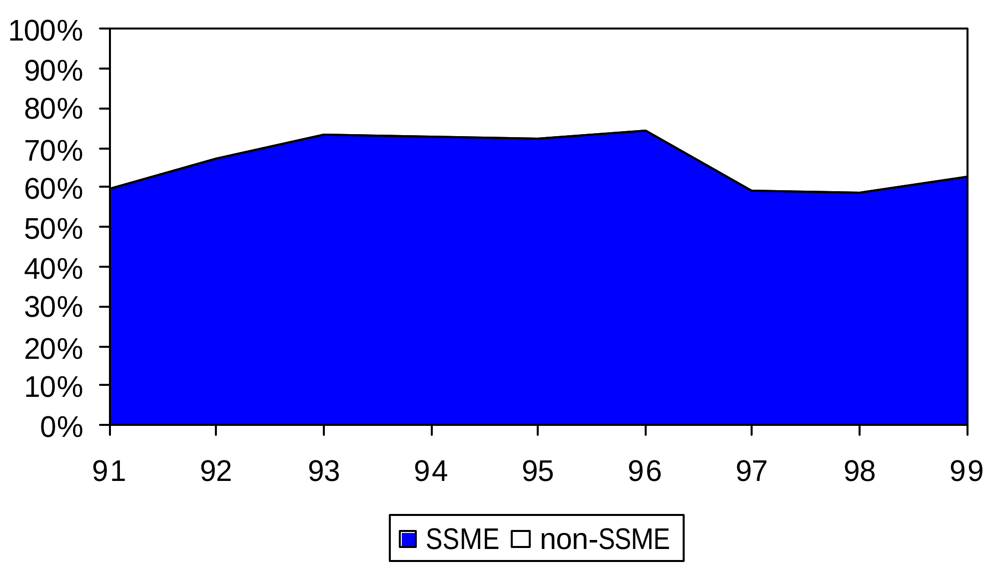


Figure 146a. Temporal distribution of commercial gear landings in Sabah, 1991-1999 (% annual)

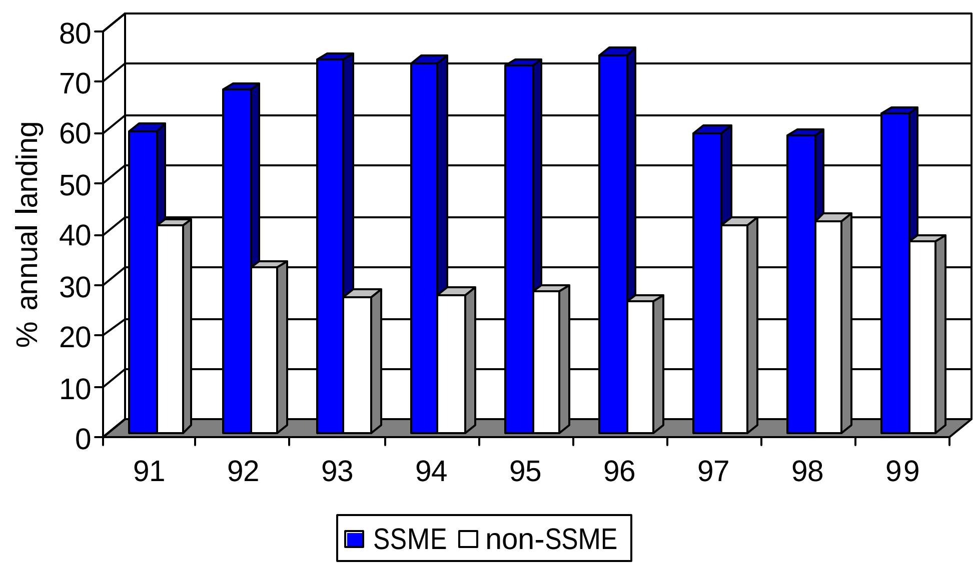


Figure 146b. Temporal distribution of commercial gear landings in the non-SSME area, 1991-1999

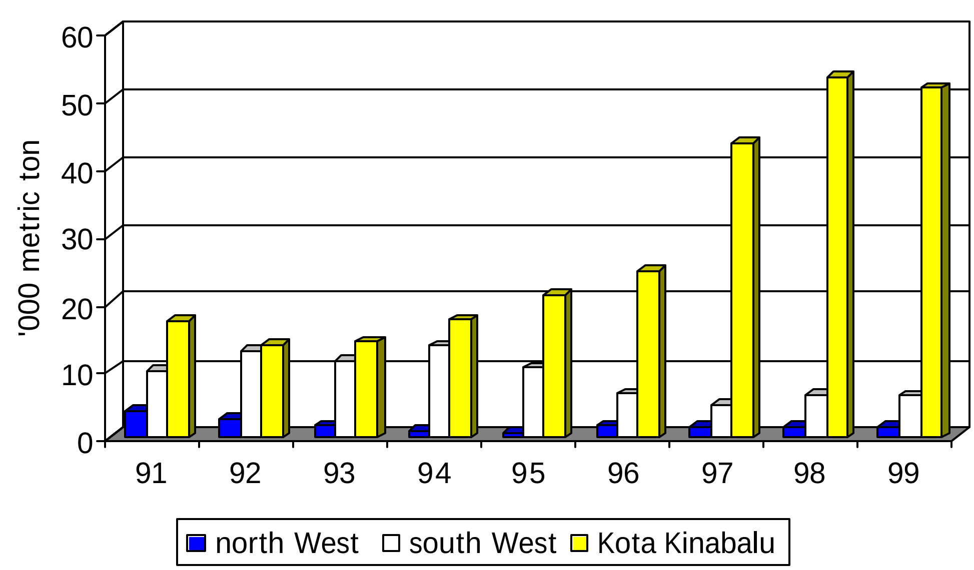


Figure 146c. Temporal distribution of commercial gear landings in the non-SSME area, 1991-1999

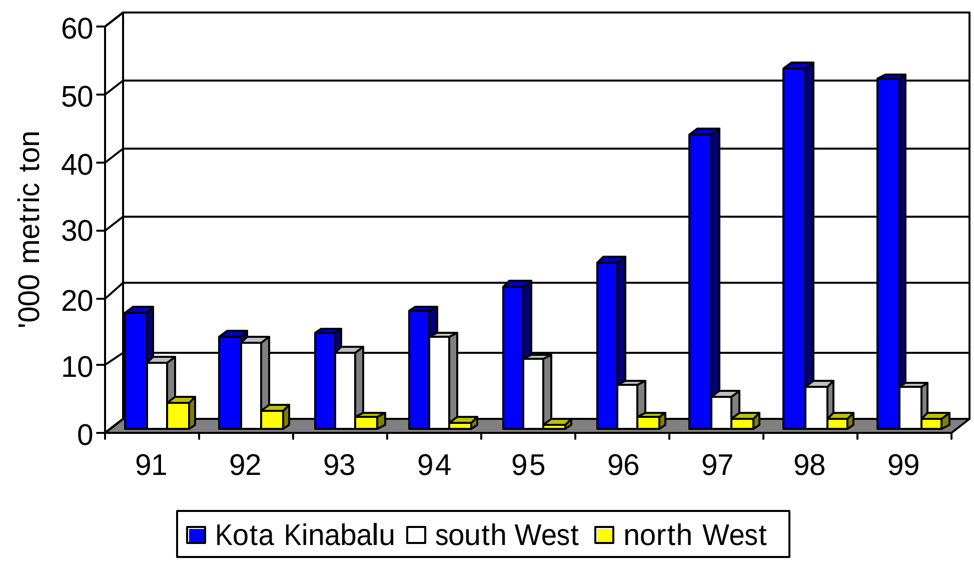


Figure 146d. Temporal distribution of commercial gear landings in the non-SSME area, 1991-1999

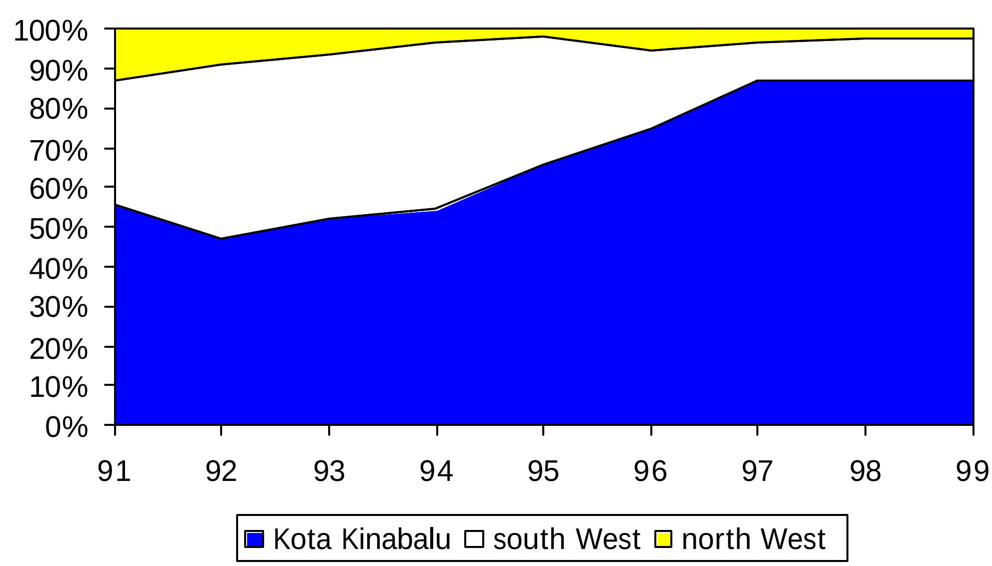


Figure 147. Temporal distribution of marine fish landings by gear group in the SSME area, 1991-1999

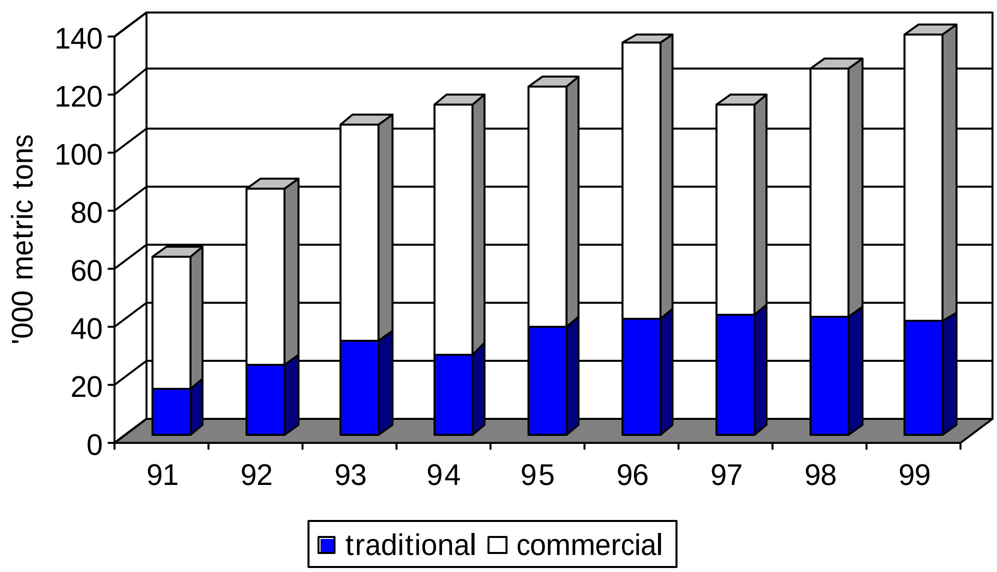


Figure 148. Temporal distribution of marine fish landings by gear group in the SSME area, 1991-1999

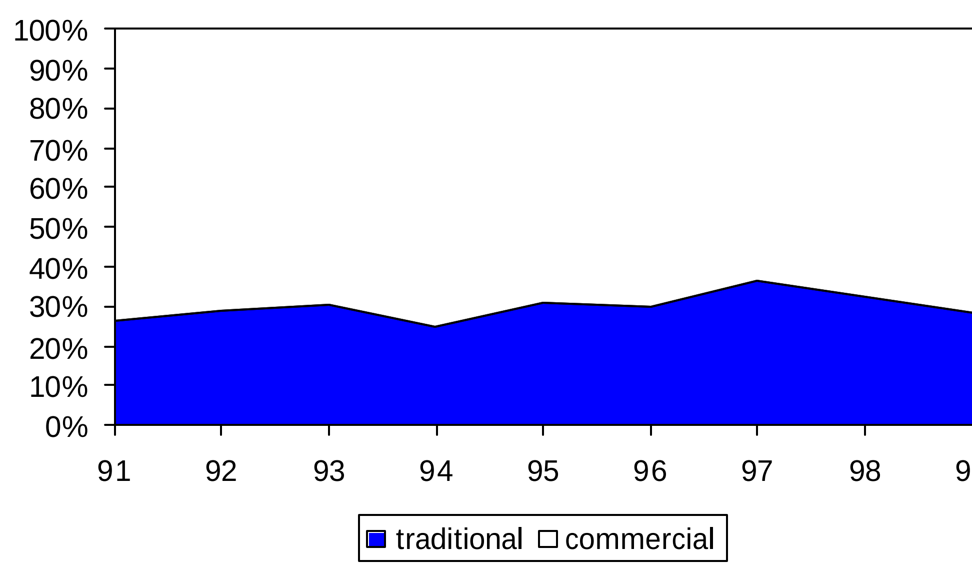


Figure 149. Temporal distribution of marine fish landings by gear group in the SSME area, 1991-1999 (% annual)

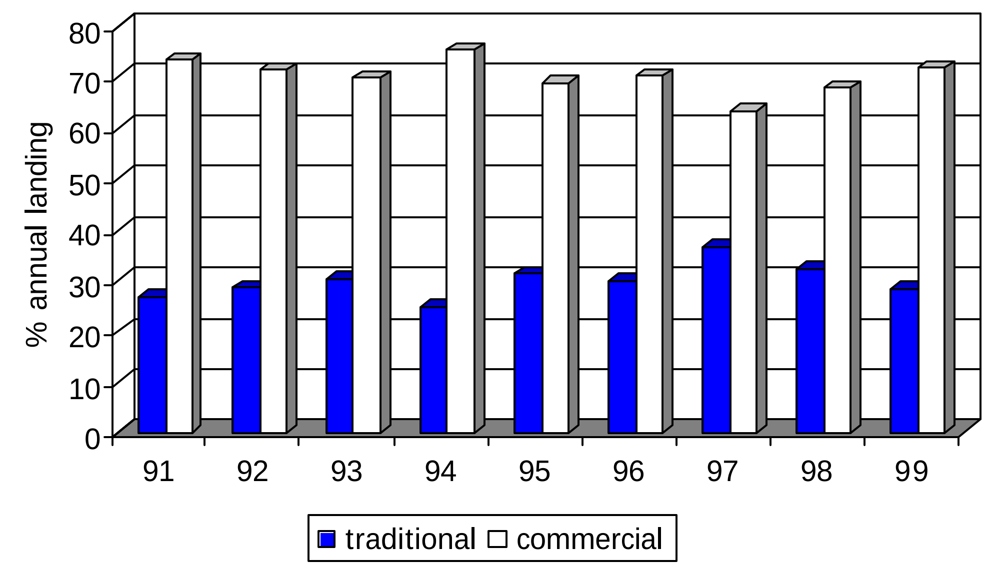


Figure 150. Temporal distribution of marine fish landings by gear group in the non-SSME area, 1991-1999

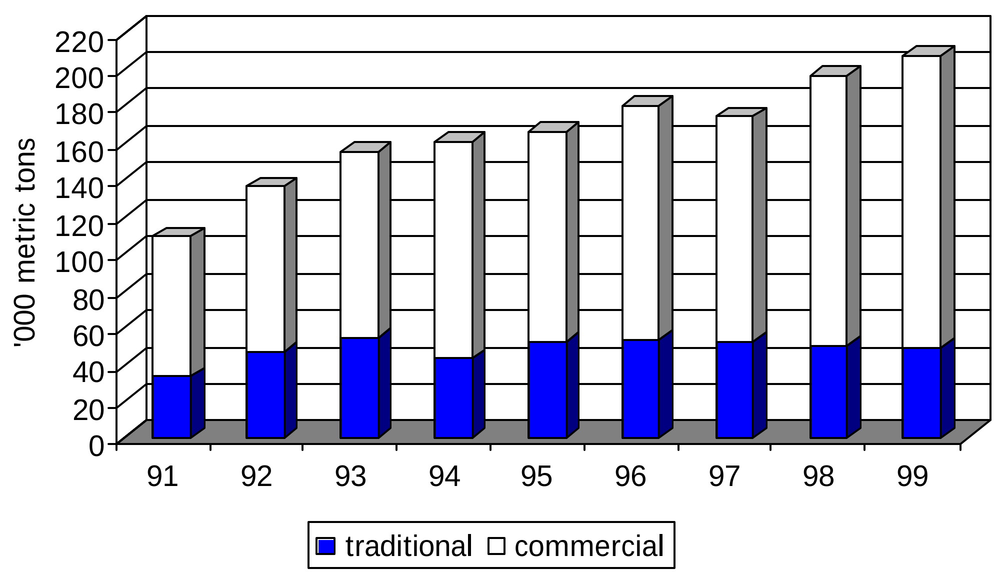


Figure 151. Temporal distribution of marine fish landings by gear group in the non-SSME area, 1991-1999

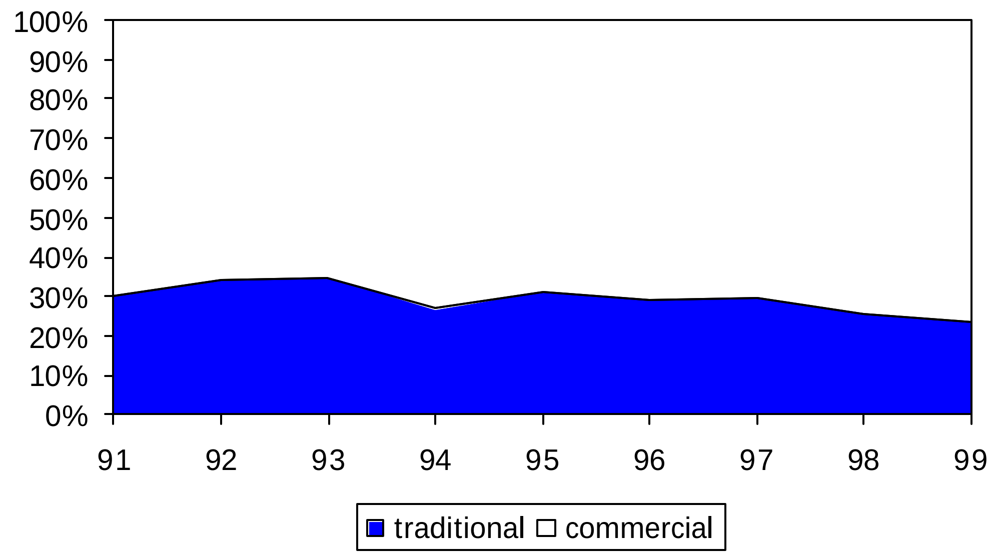


Figure 152. Temporal distribution of marine fish landings by gear group in the non-SSME area, 1991-1999 (% annual)

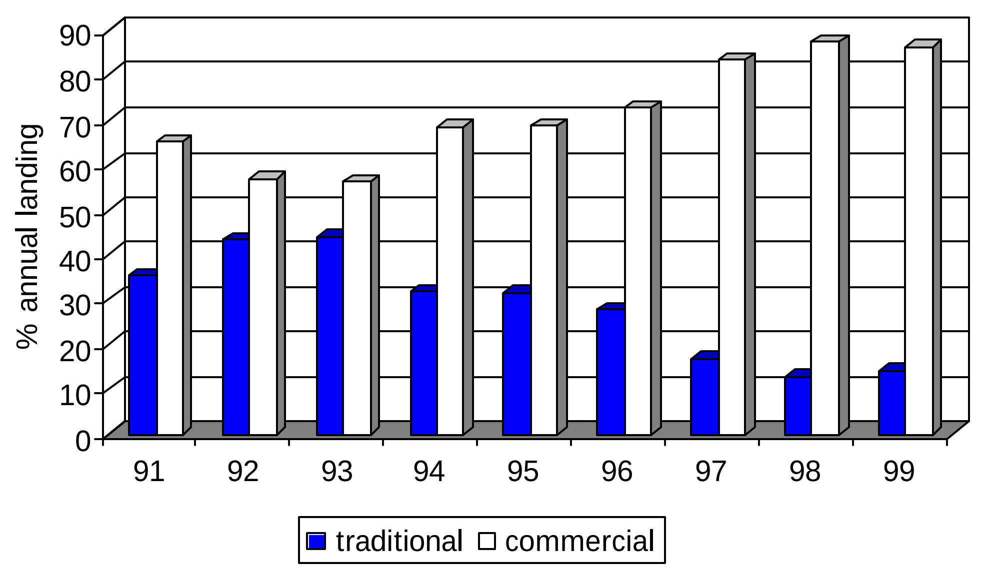


Figure 153. Marine fish landing breakdown by gear group in Sabah (% annual average 1991-1999)

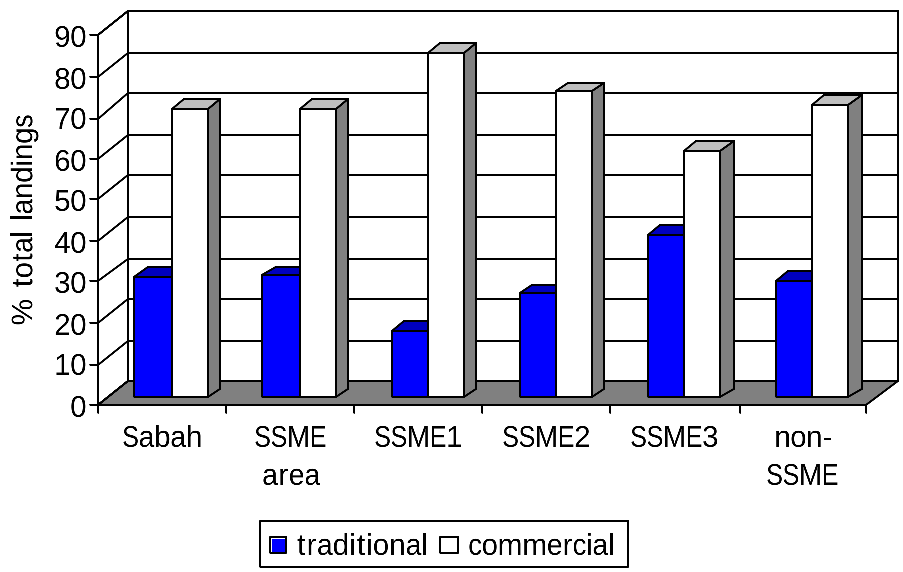


Figure 154. Average regional marine fish landing breakdown, Sabah 1991-1999

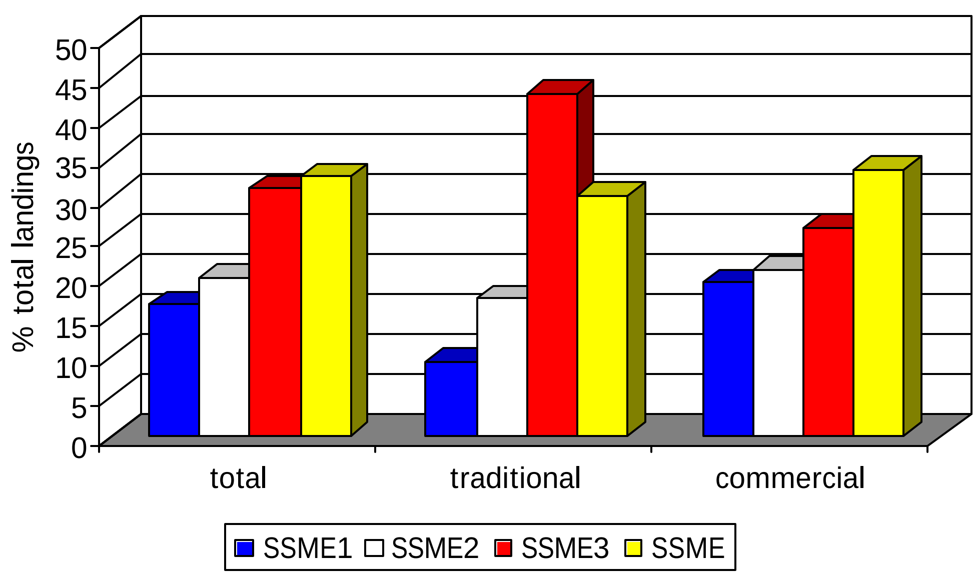


Figure 155. Average regional marine fish landing breakdown in the SSME area, 991-1999

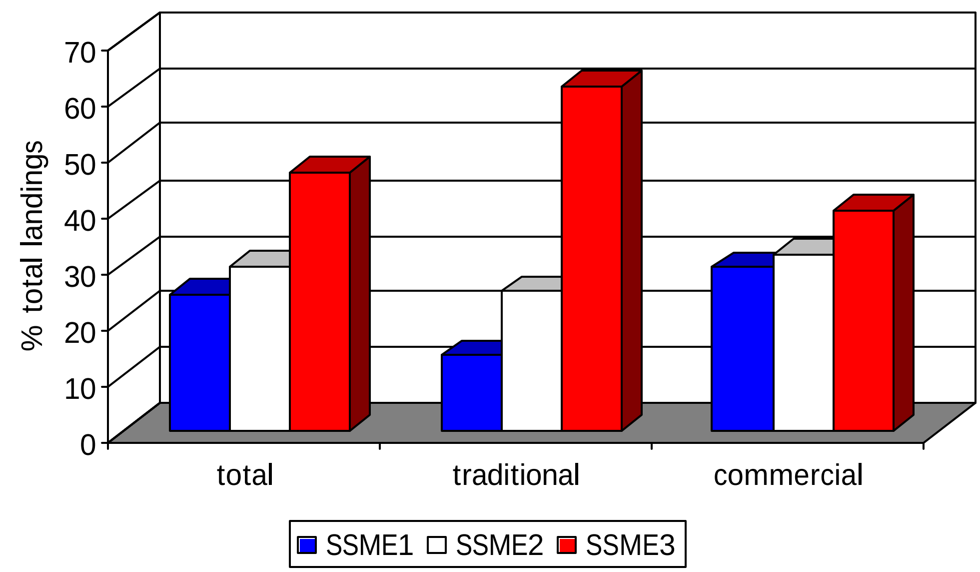


Figure 156. Temporal distribution of marine fish landings in SSME-1 area, 1991-1999

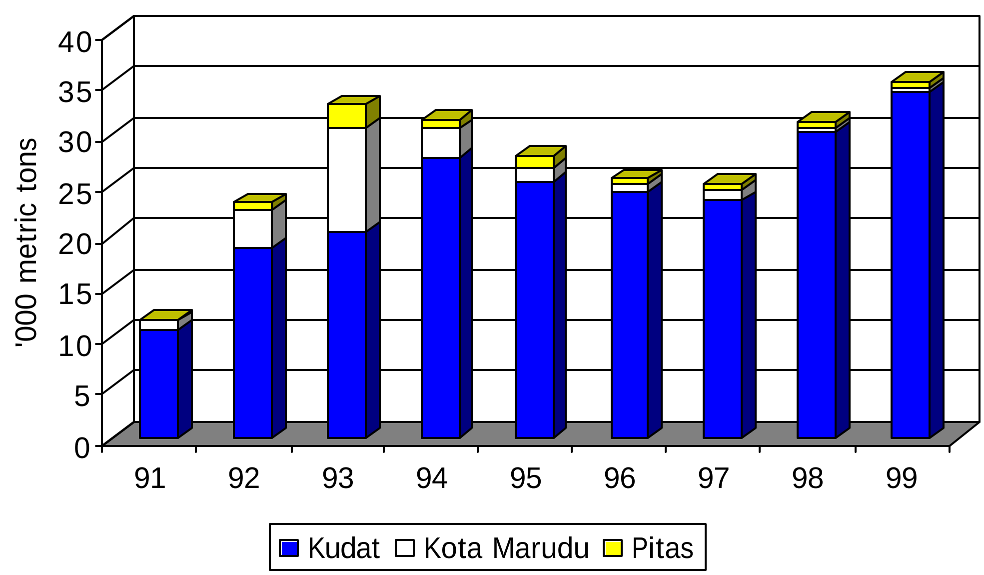


Figure 157. Temporal distribution of marine fish landings in SSME-1 area, 1991-1999

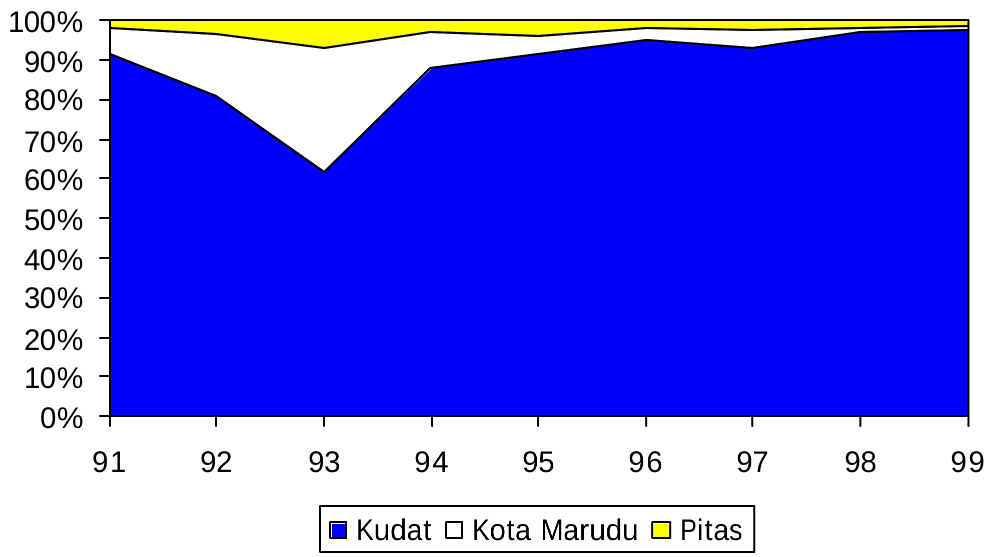


Figure 158. Temporal distribution of marine fish landings in SSME1, 1991-1999 (% annual)

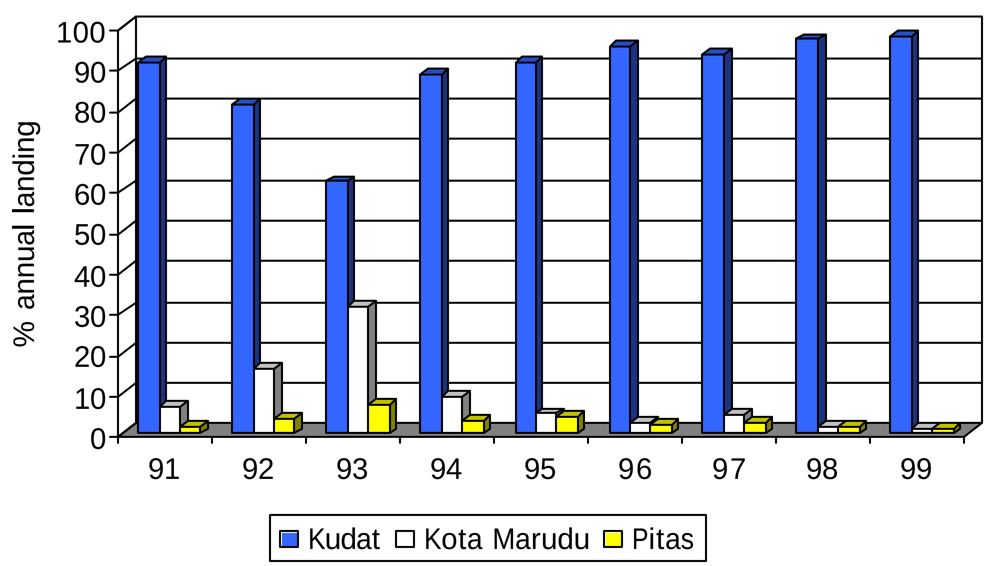


Figure 159. Temporal distribution of traditional gear landings in SSME-1 area, 1991-1999

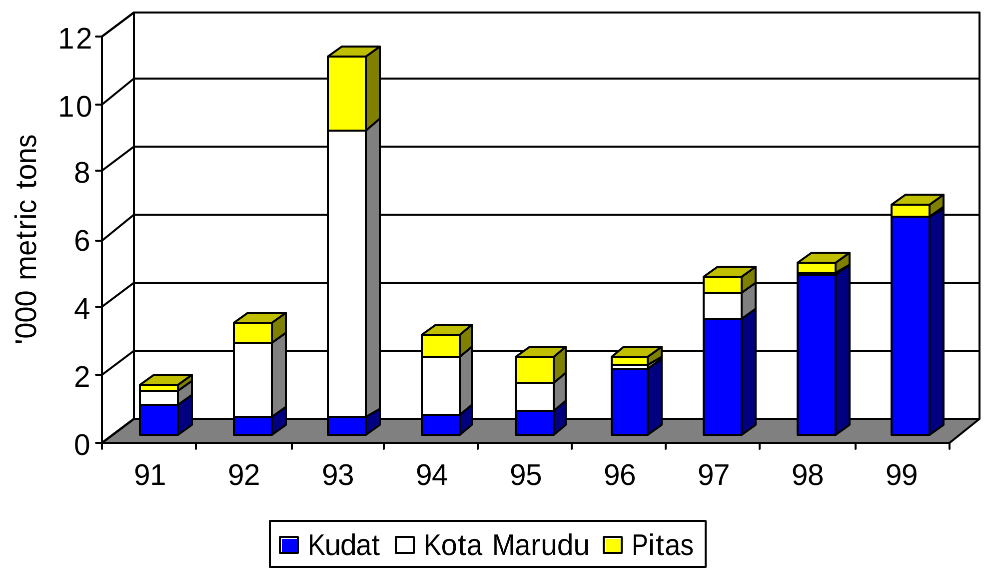


Figure 160. Temporal distribution of traditional gear landings in SSME-1 area, 1991-1999

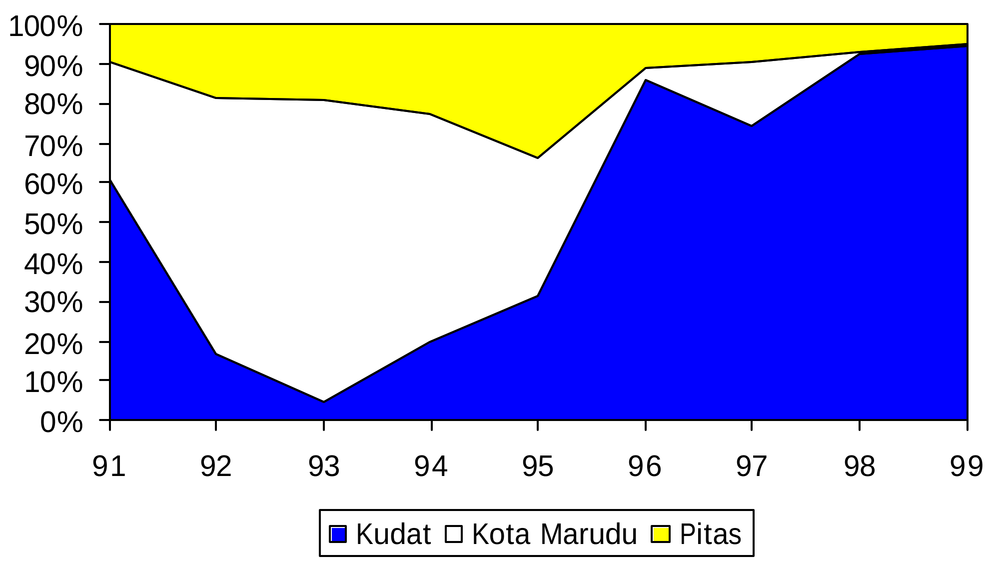


Figure 161. Temporal distribution of traditional gear landings in SSME-1 area, 1991-1999 (% annual)

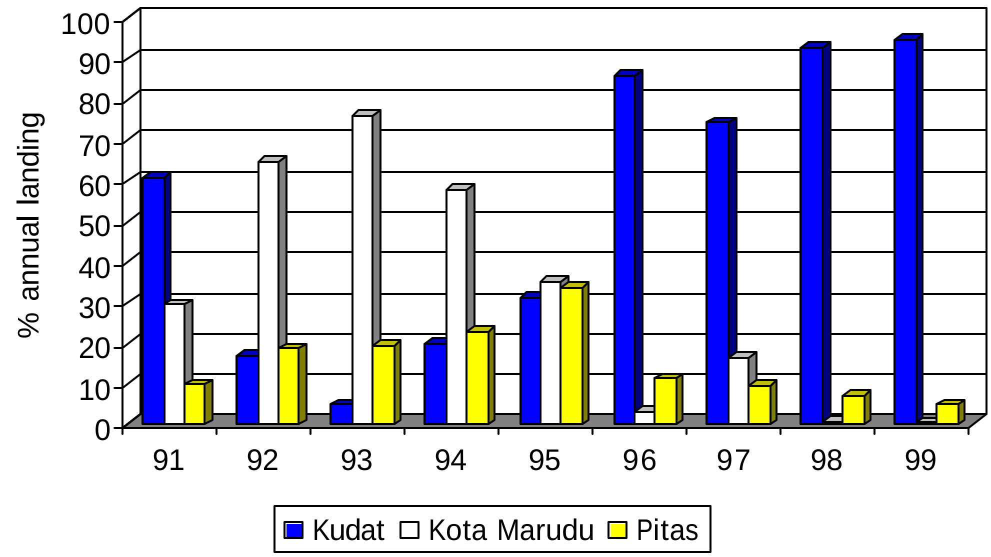


Figure 162. Temporal distribution of commercial gear landings in SSME-1 area, 1991-1999

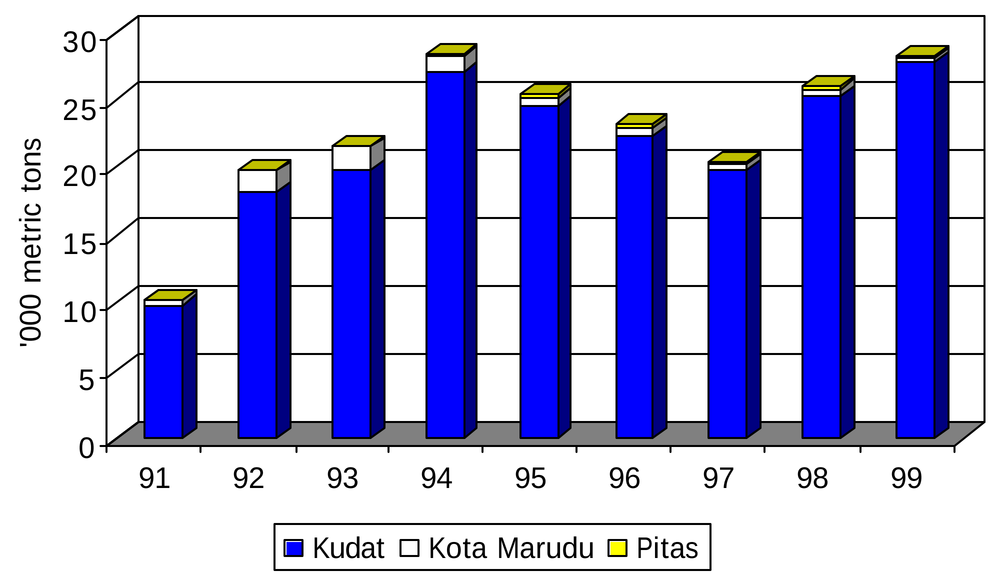


Figure 163. Temporal distribution of commercial gear landings in SSME-1 area, 1991-1999

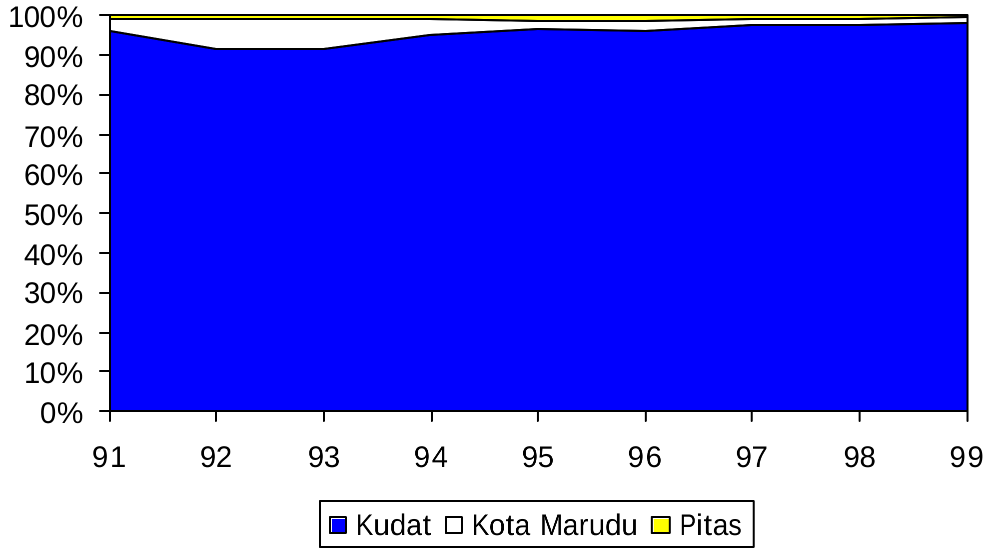


Figure 164. Temporal distribution of commercial gear landings in SSME-1 area, 1991-1999 (% annual)

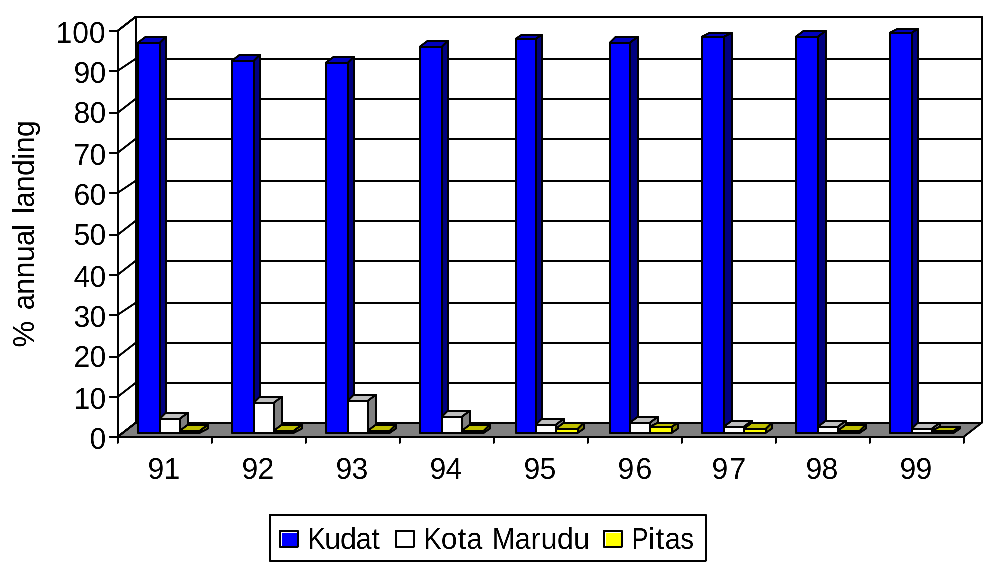


Figure 165. Temporal distribution of marine fish landings by gear group in SSME-1 area, 1991-1999

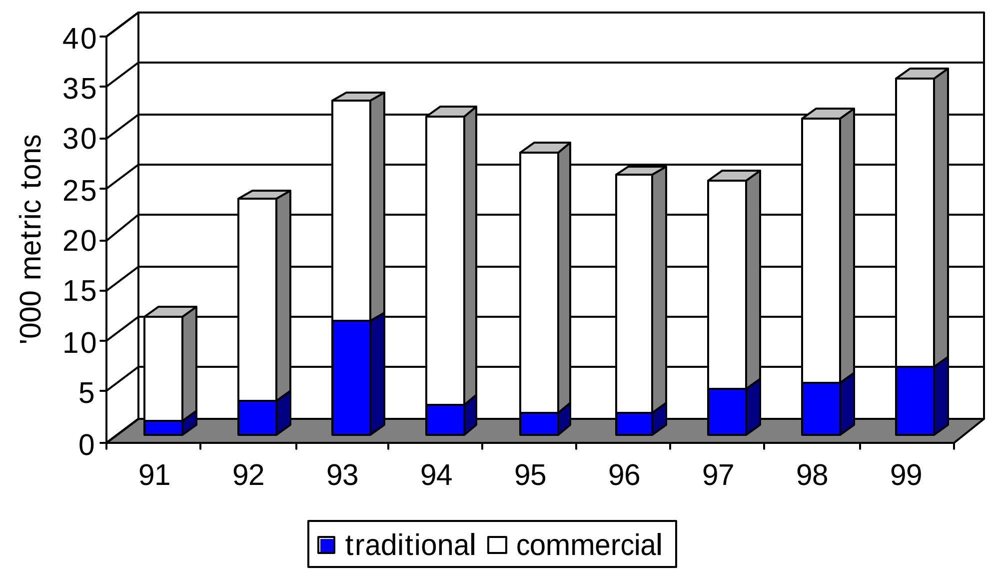


Figure 166. Temporal distribution of marine fish landings by gear group in SSME-1 area, 1991-1999 (% annual)

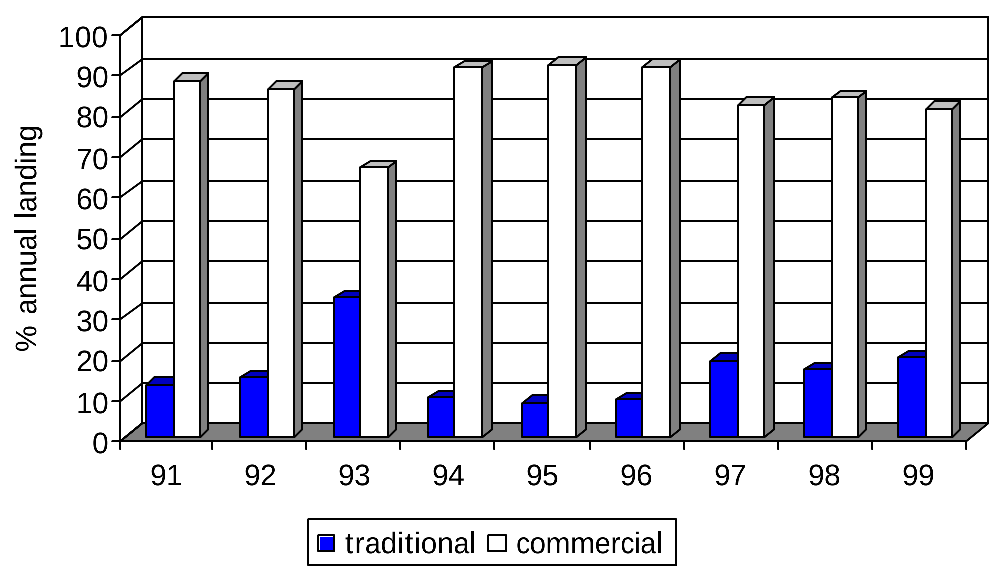


Figure 167. Temporal distribution of marine fish landings by gear group in SSME-1 area, 1991-1999 (% annual)

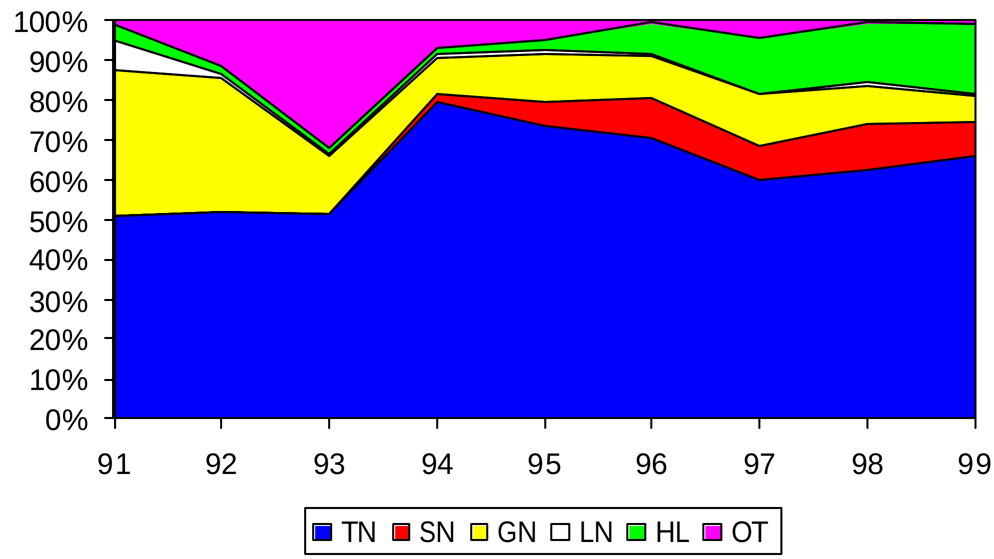


Figure 168. Temporal distribution of marine fish landings by gear group in SSME-1 area, 1991-1999 (% annual)

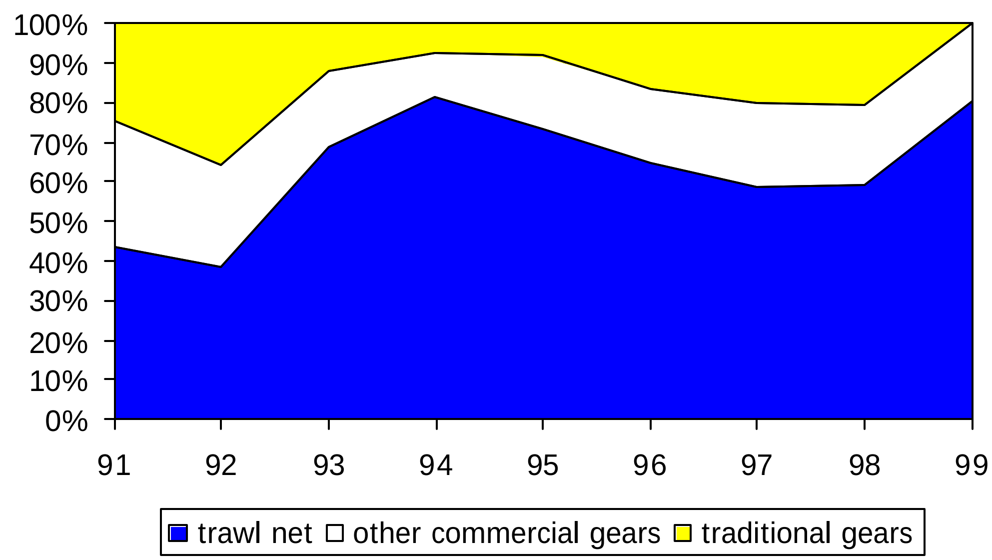


Figure 169. SSME-1 contribution to SSME marine fish landings, 1991-1999 (% annual) - gear group

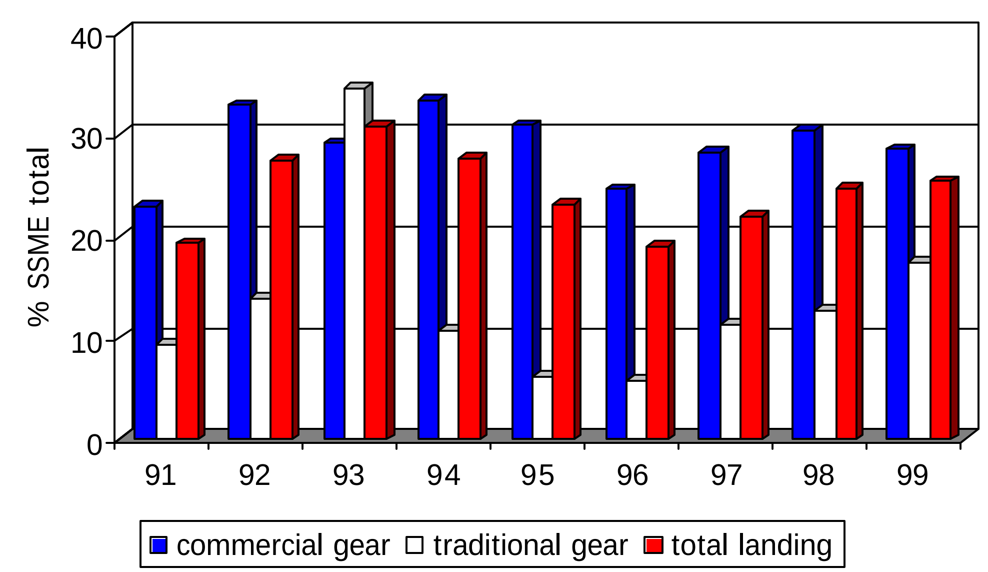


Figure 170. SSME-1 contribution to SSME marine fish landings, 1991-1999 (% annual) - traditional gears

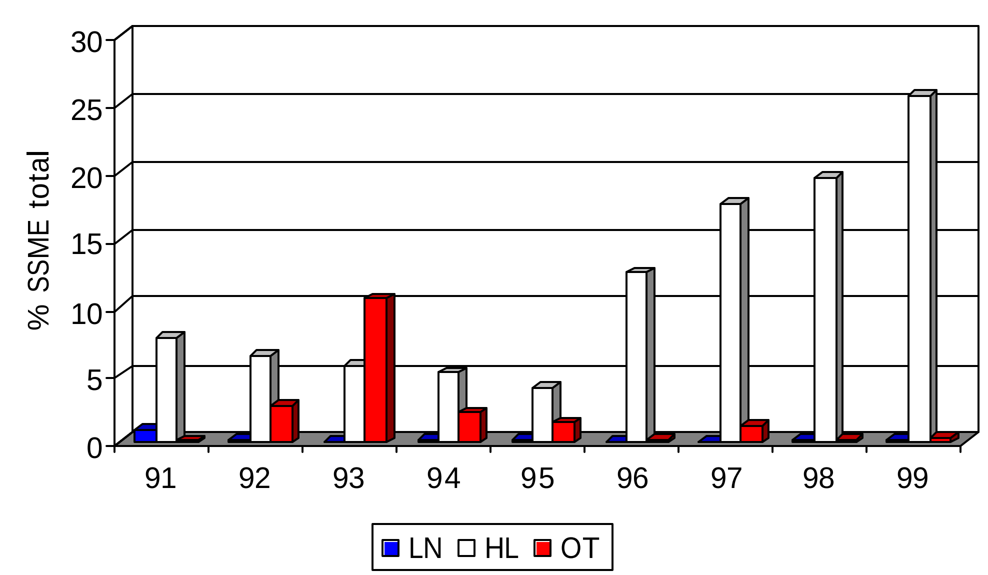


Figure 171. SSME-1 contribution to SSME marine fish landings, 1991-1999 (% annual) - commercial gears

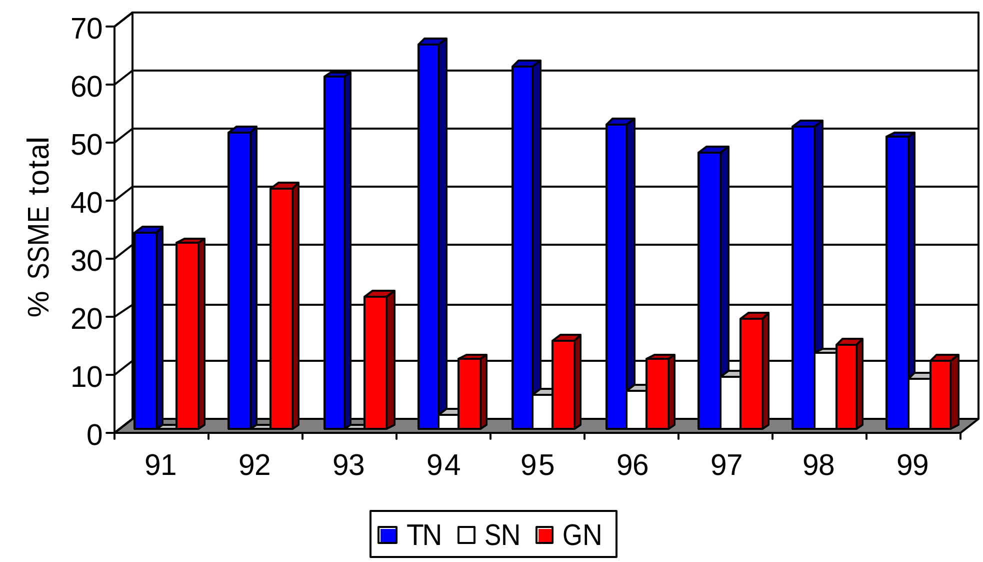


Figure 172. SSME-1 contribution to SSME marine fish landings, 1991-1999 (% annual) - resource group

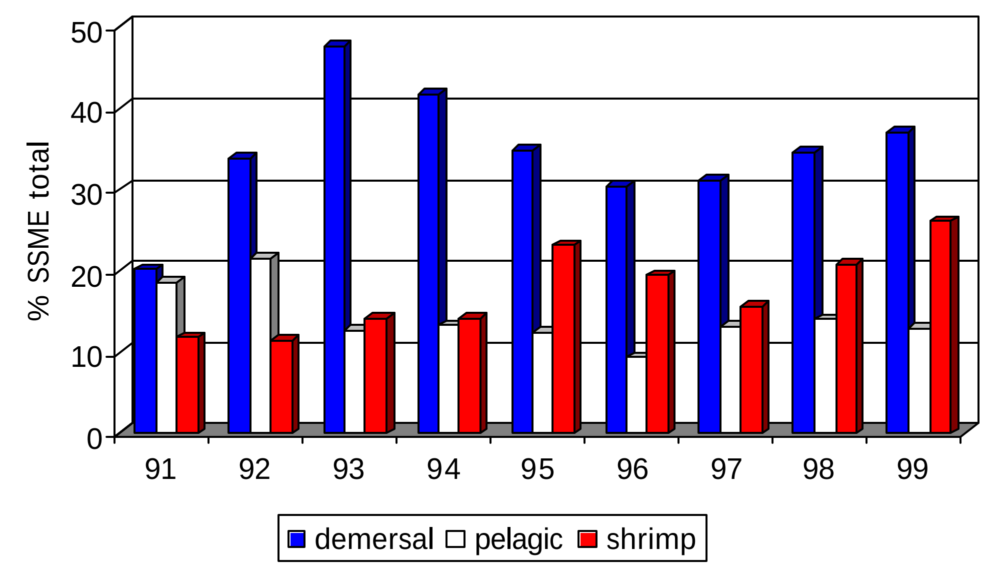


Figure 173. Temporal distribution of marine fish landings by resource group in SSME-1 area, 1991-1999 (% annual)

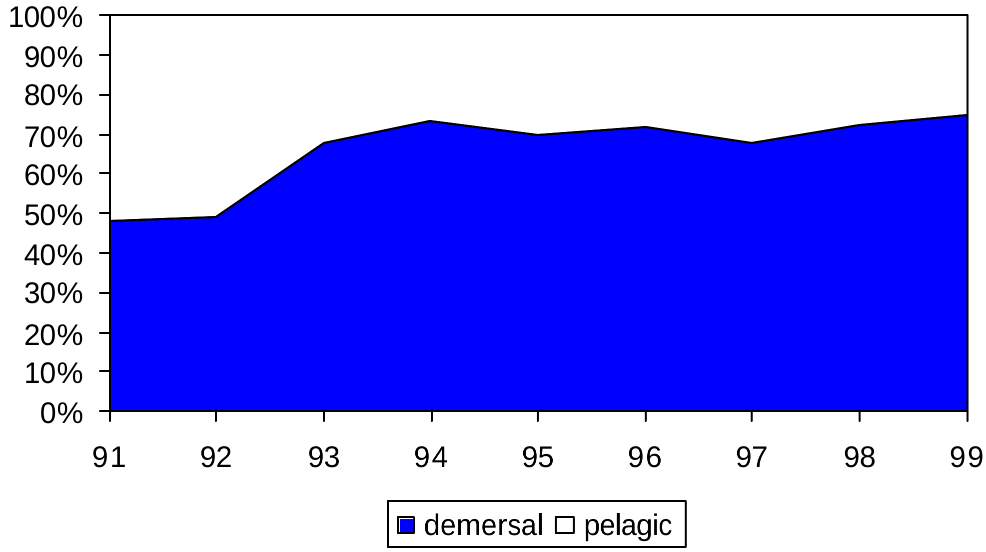


Figure 174. Temporal distribution of marine fish landings in SSME-2 area, 1991-1999

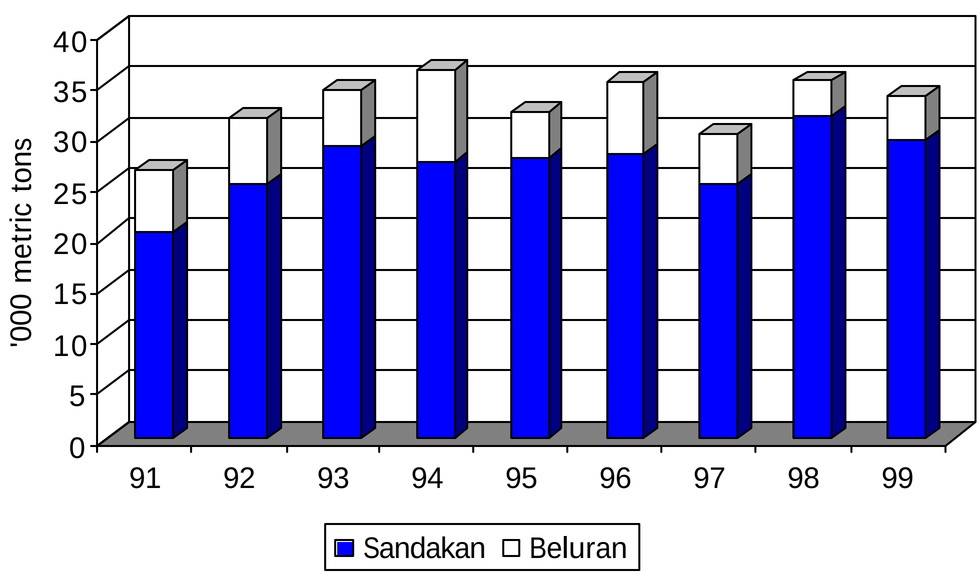


Figure 175. Temporal distribution of marine fish landings in SSME-2 area, 1991-1999

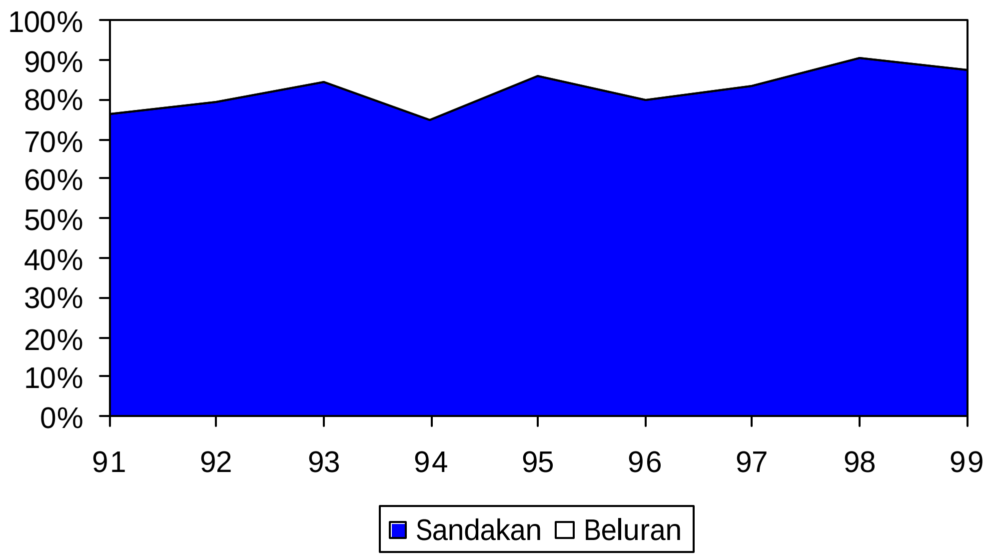


Figure 176. Temporal distribution of marine fish landings in SSME-2 area, 1991-1999 (% annual)

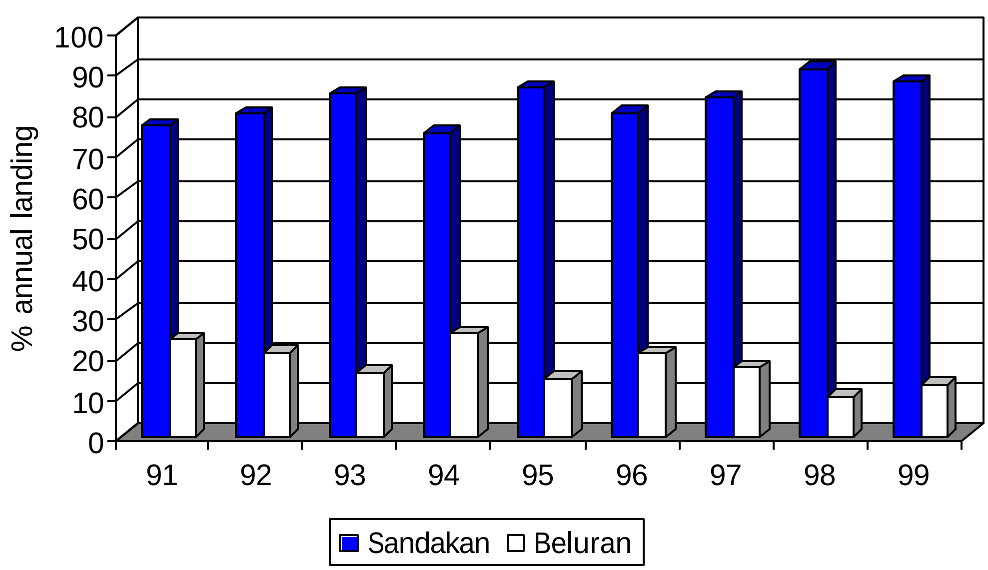


Figure 177. Temporal distribution of traditional gear landings in SSME-2 area, 1991-1999

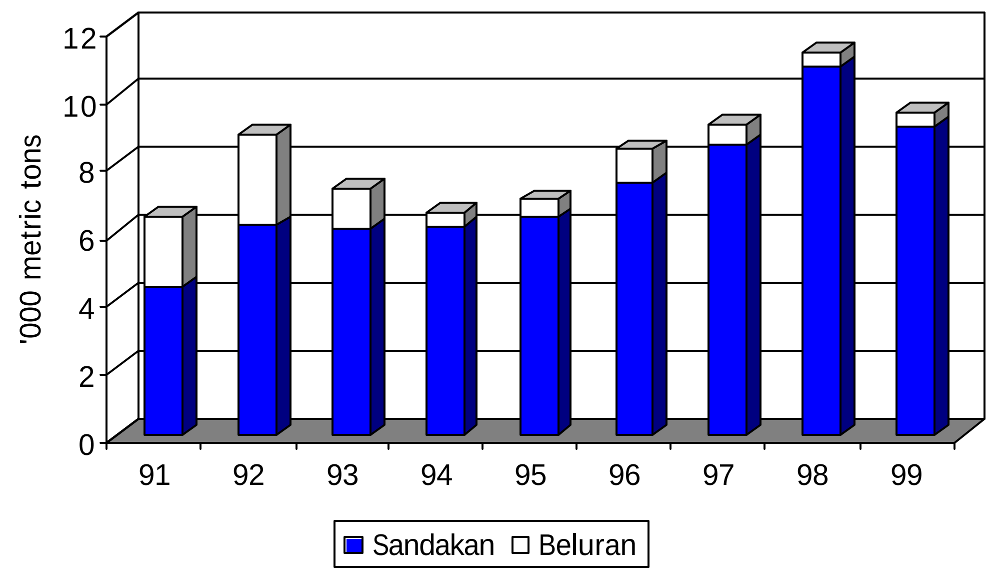


Figure 178. Temporal distribution of traditional gear landings in SSME-2 area, 1991-1999

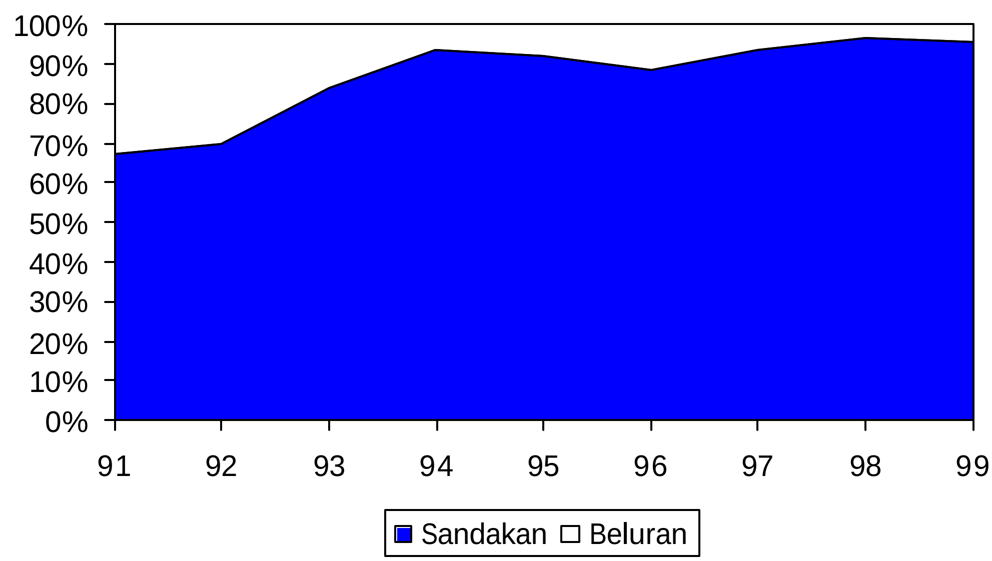


Figure 179. Temporal distribution of traditional gear landings in SSME-2 area, 1991-1999 (% annual)

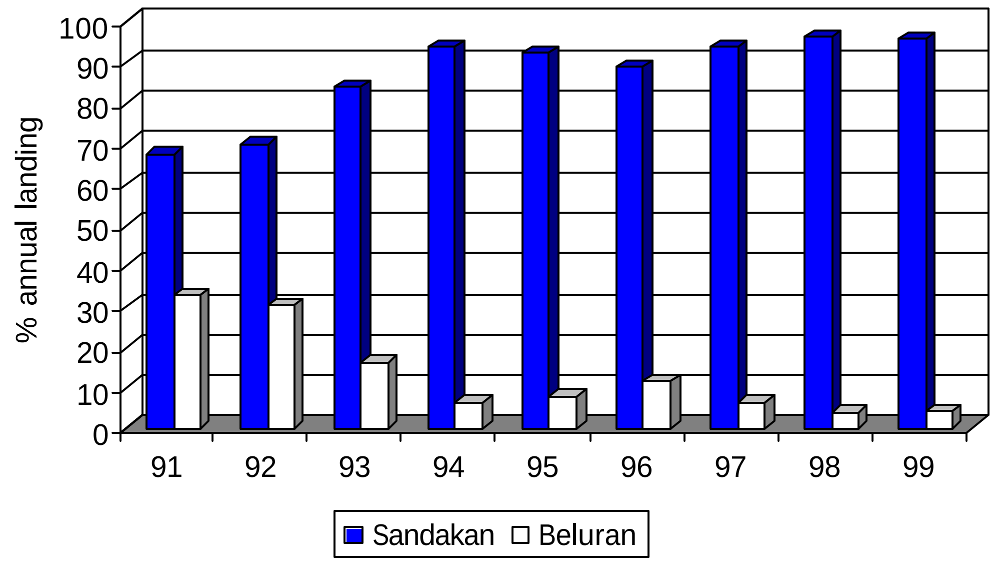


Figure 180. Temporal distribution of commercial gear landings in SSME-2 area, 1991-1999

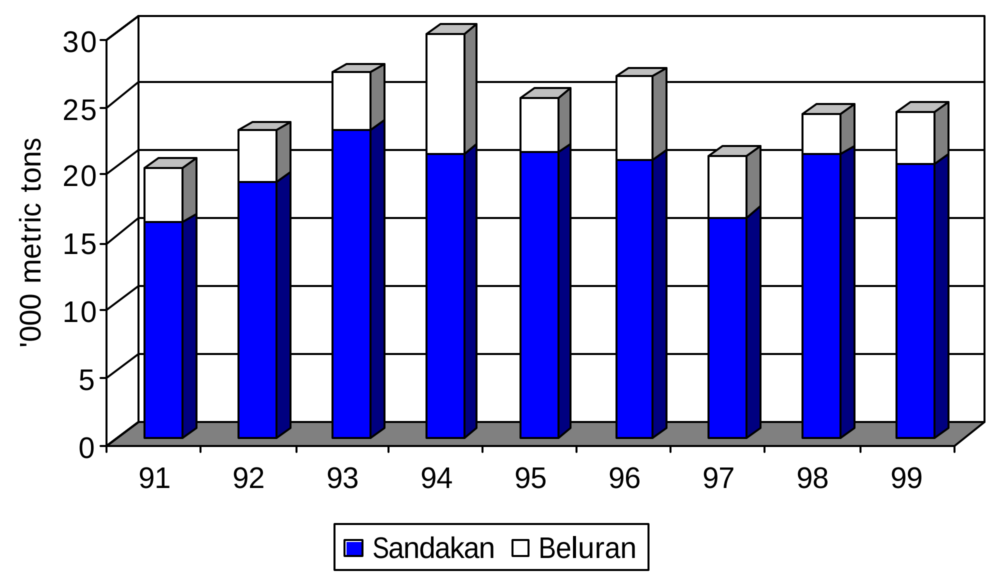


Figure 181. Temporal distribution of commercial gear landings in SSME-2 area, 1991-1999

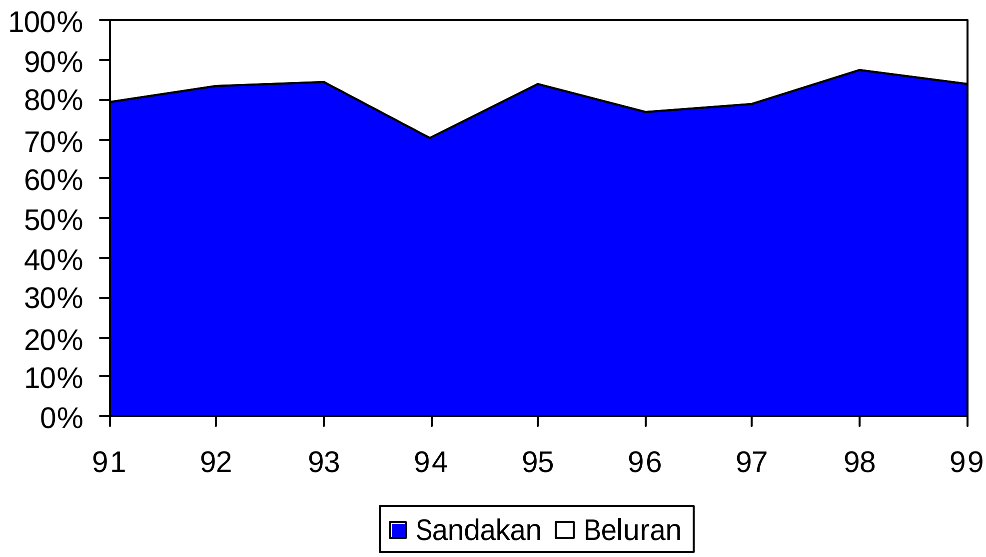


Figure 182. Temporal distribution of commercial gear landings in SSME-2 area, 1991-1999 (% annual)

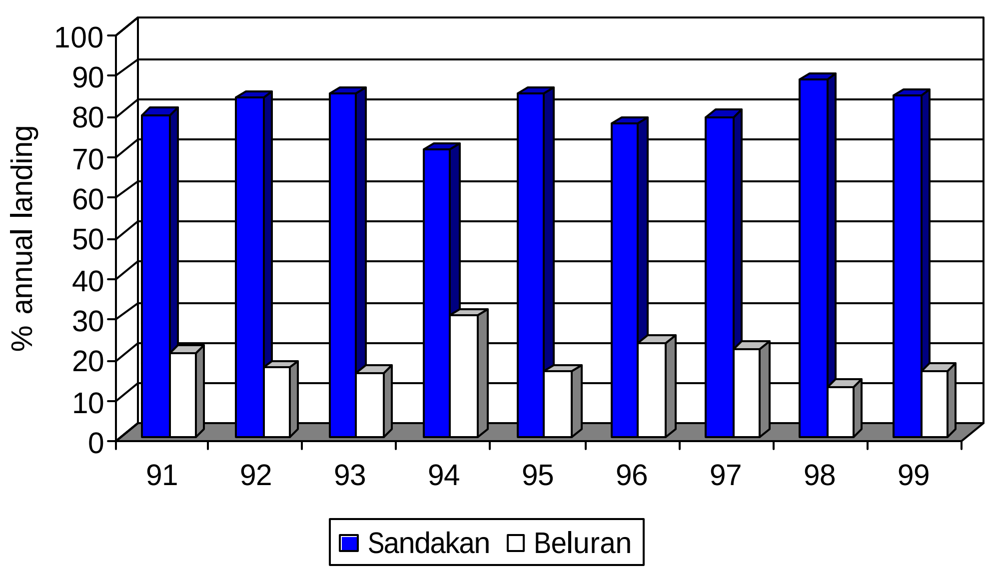


Figure 183. Temporal distribution of marine fish landings by gear group in SSME-2 area, 1991-1999

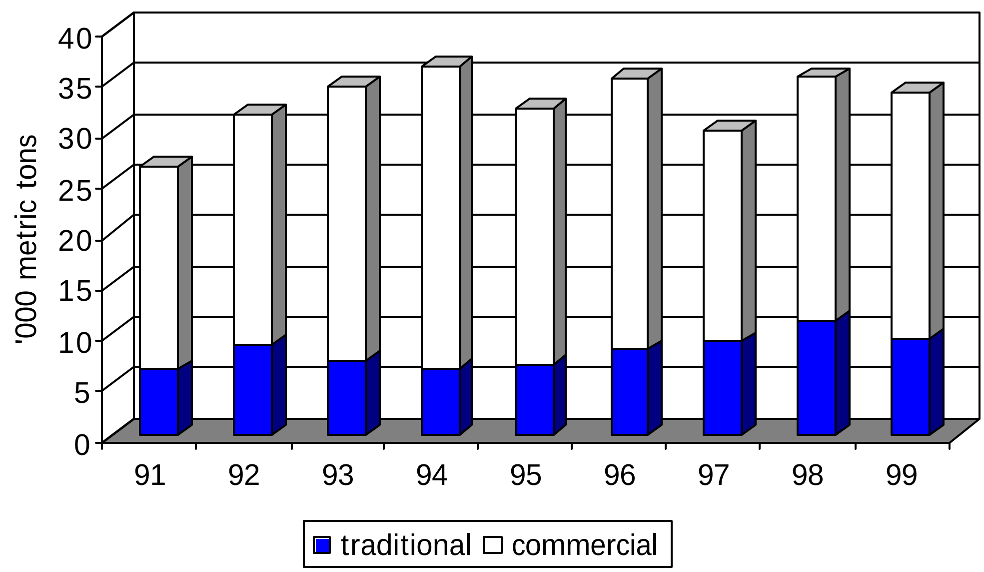


Figure 184. Temporal distribution of marine fish landings by gear group in SSME-2 area, 1991-1999

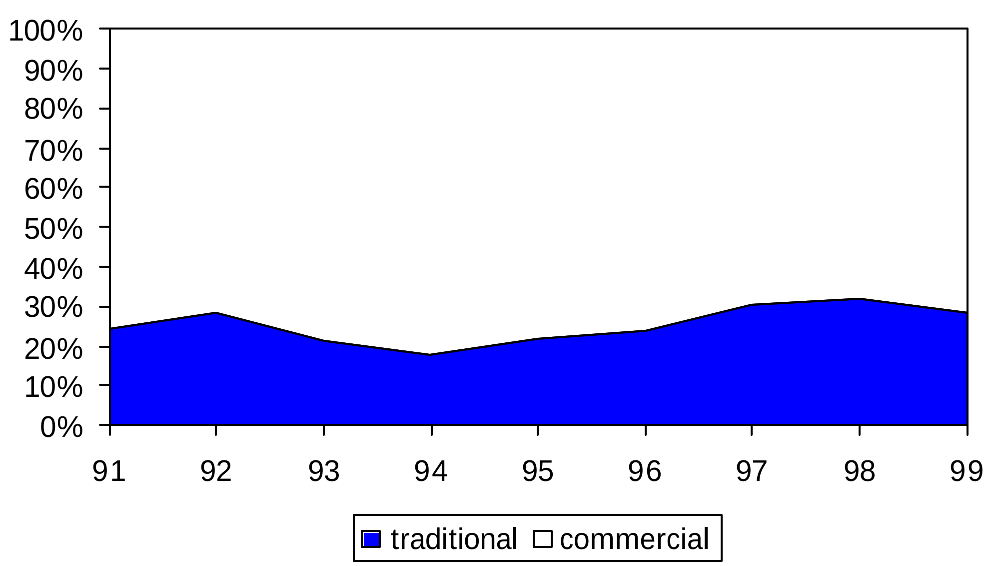


Figure 185. Temporal distribution of marine fish landings by gear group in SSME-2 area, 1991-1999 (% annual)

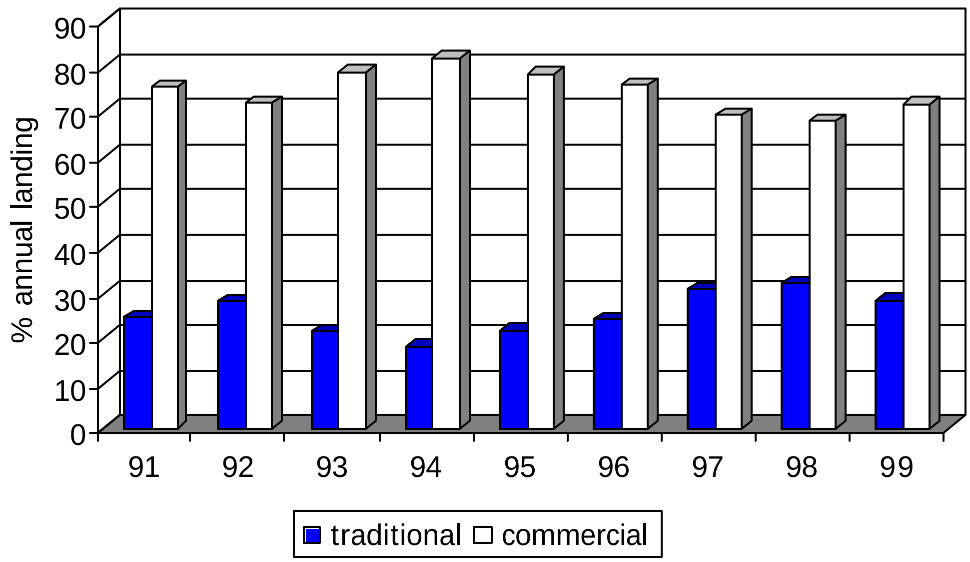


Figure 186. Temporal distribution of marine fish landings by gear type in SSME-2 area, 1991-1999 (% annual)

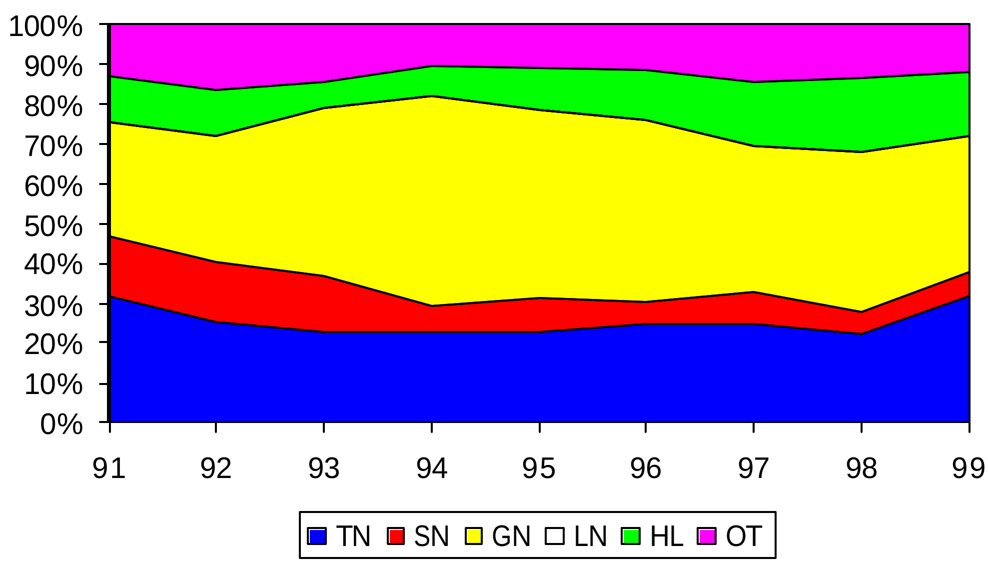


Figure 187. Temporal distribution of marine fish landings by gear type in SSME-2 area, 1991-1999 (% annual)

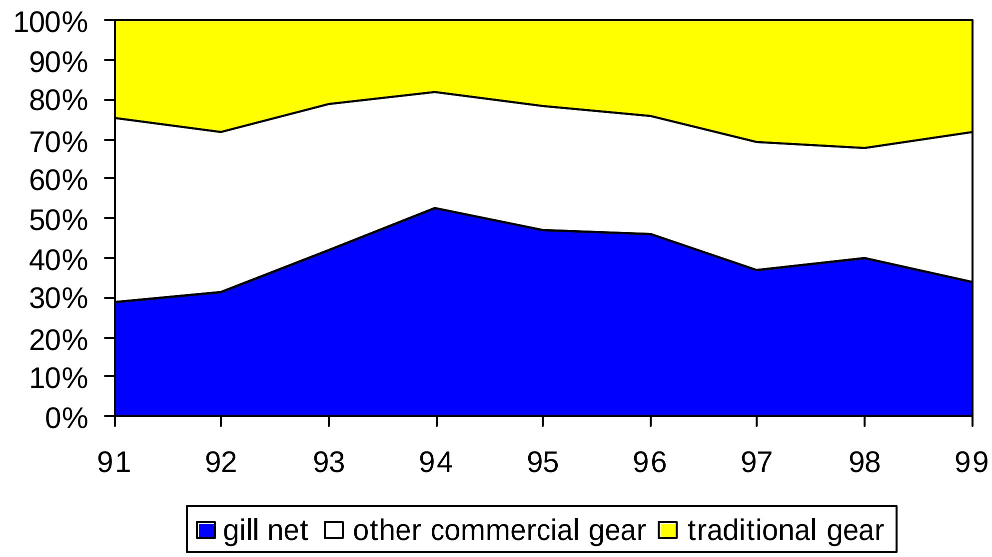


Figure 188. SSME-2 contribution to SSME marine fish landings, 1991-1999 (% annual) - gear group

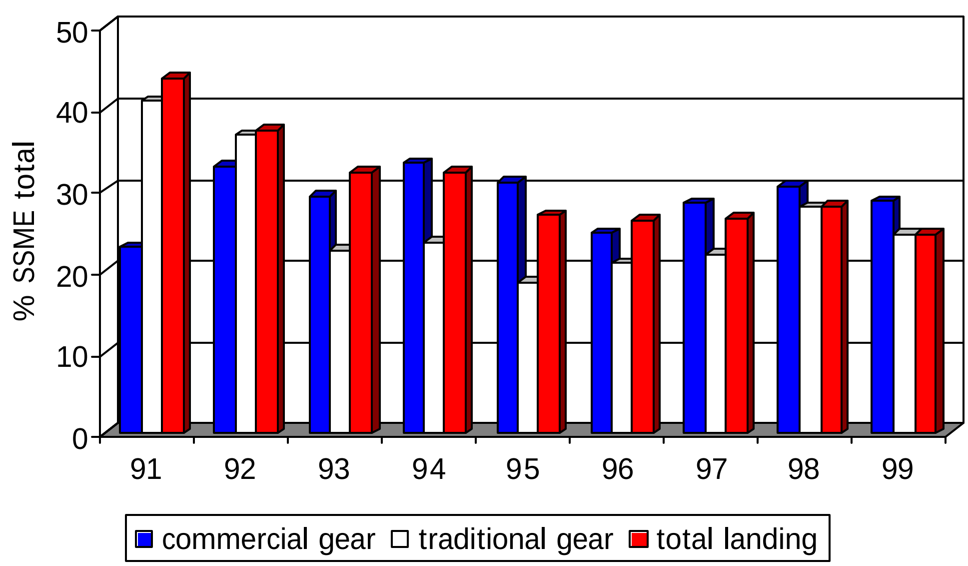


Figure 189. SSME-2 contribution to SSME marine fish landings, 1991-1999 (% annual) - traditional gears

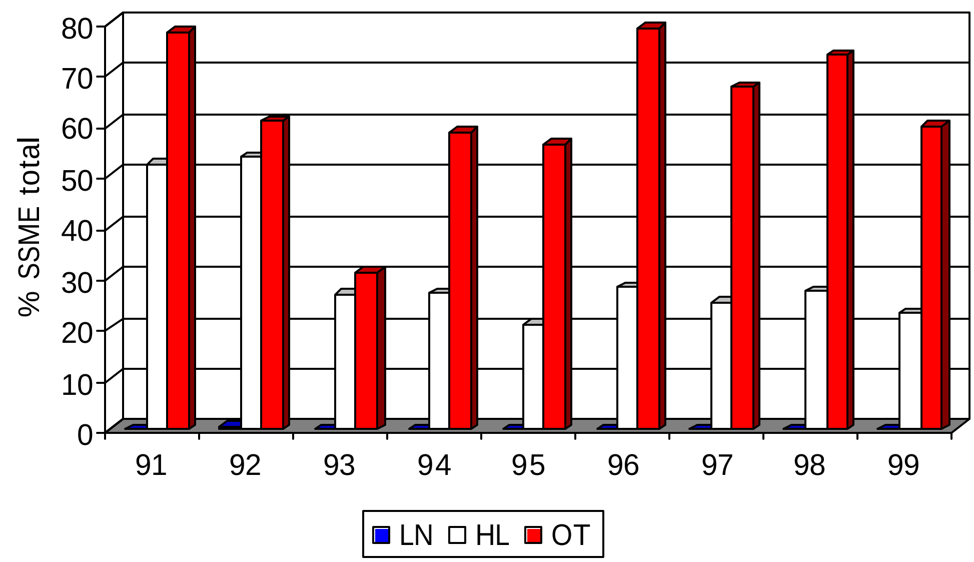


Figure 190. SSME-2 contribution to SSME marine fish landings, 1991-1999 (% annual) - commercial gears

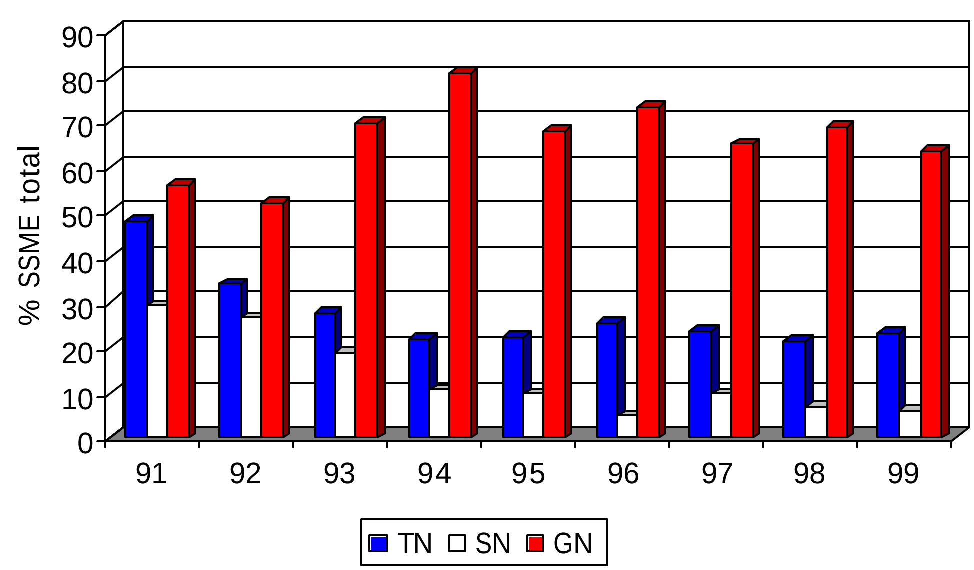


Figure 191. SSME-2 contribution to SSME marine fish landings, 1991-1999 (% annual) - resource group

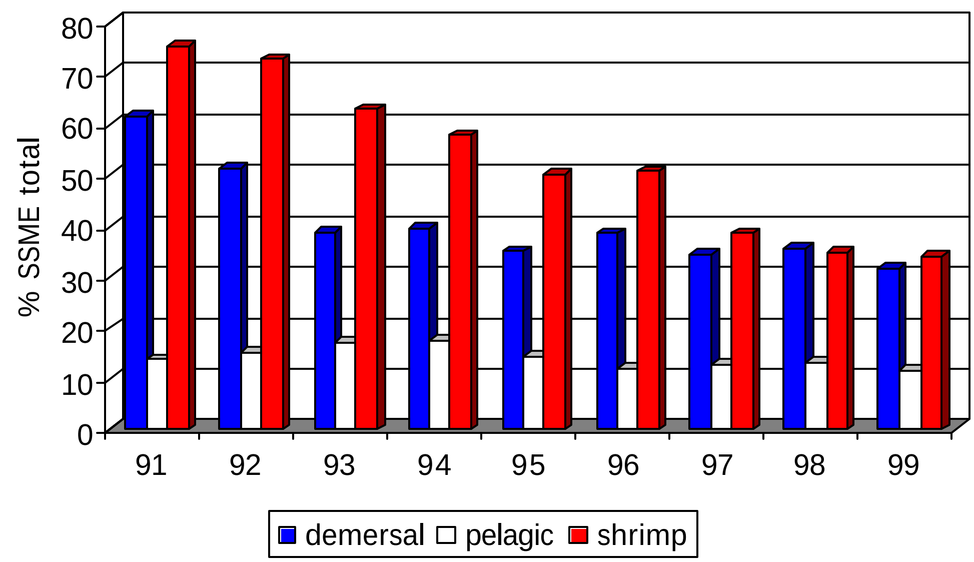


Figure 192. Temporal distribution of marine fish landings by resource group in SSME-2 area, 1991-1999 (% annual)

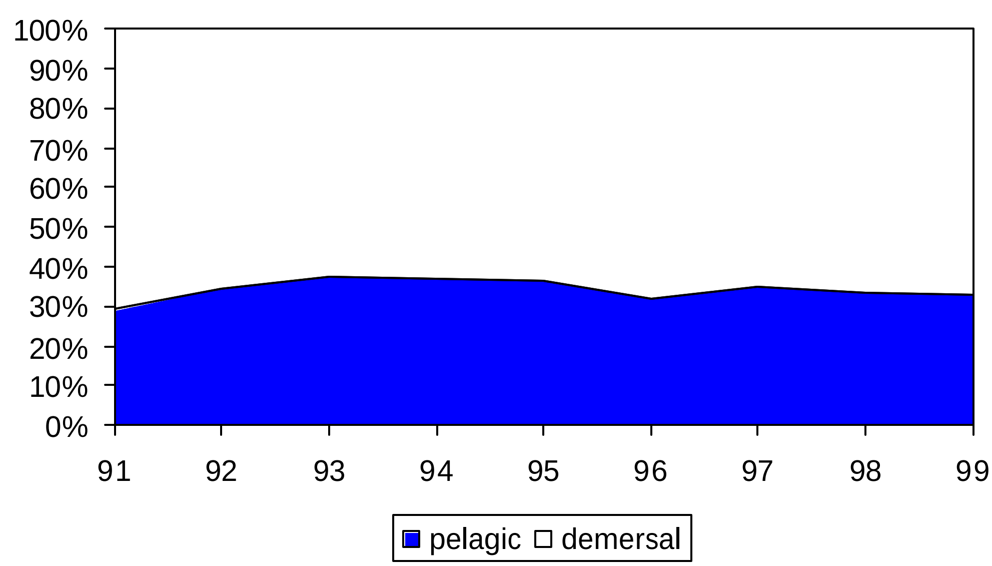


Figure 193. Temporal distribution of marine fish landings in SSME-3 area, 1991-1999

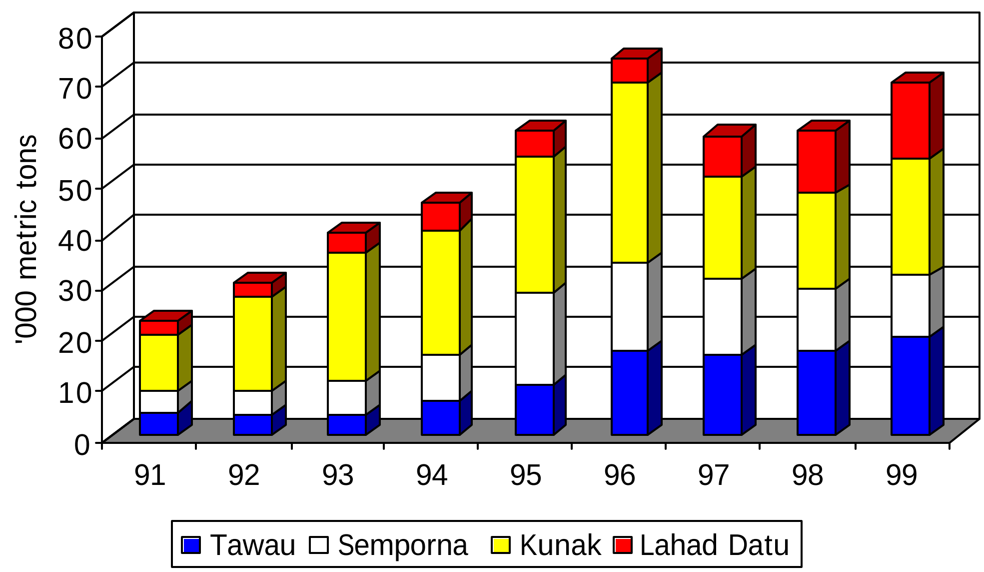


Figure 194. Temporal distribution of marine fish landings in SSME-3 area, 1991-1999

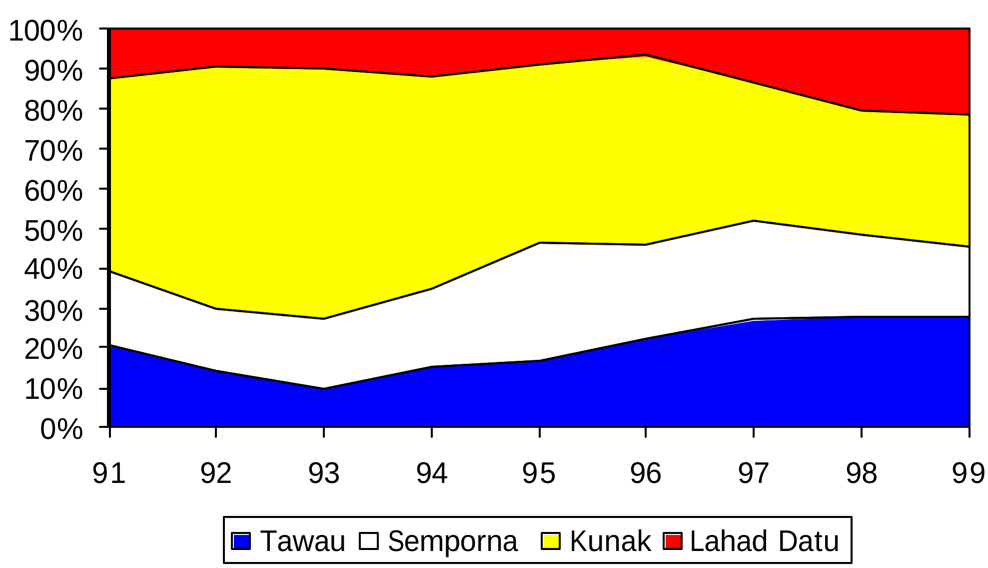


Figure 195. Temporal distribution of marine fish landings in SSME-3 area, 1991-1999 (% annual)

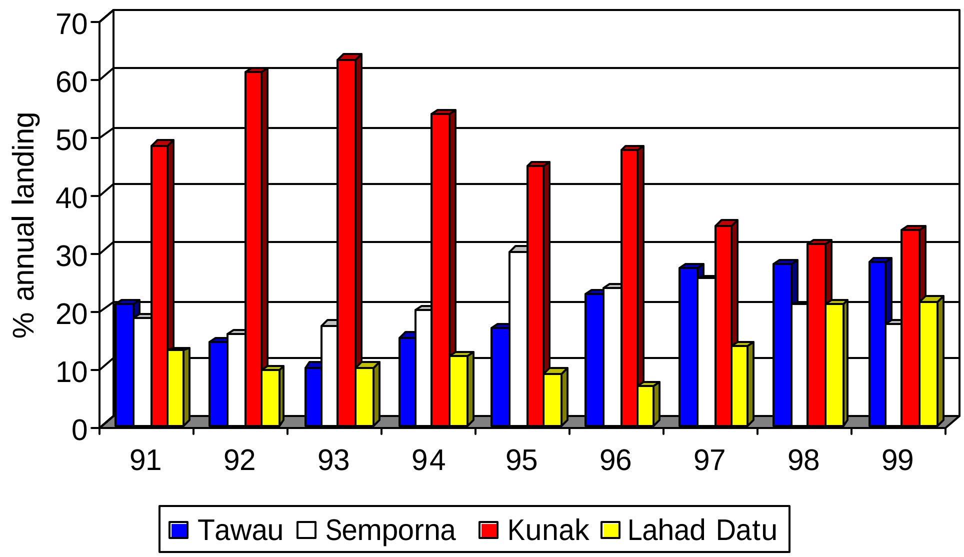


Figure 196. Temporal distribution of traditional gear landings in SSME-3 area, 1991-1999

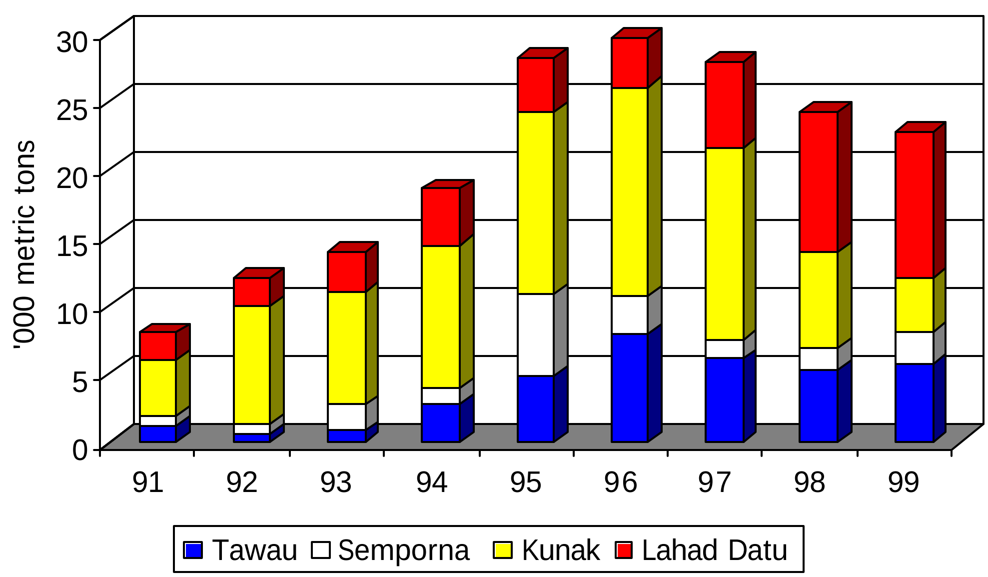


Figure 197. Temporal distribution of traditional gear landings in SSME-3 area, 1991-1999

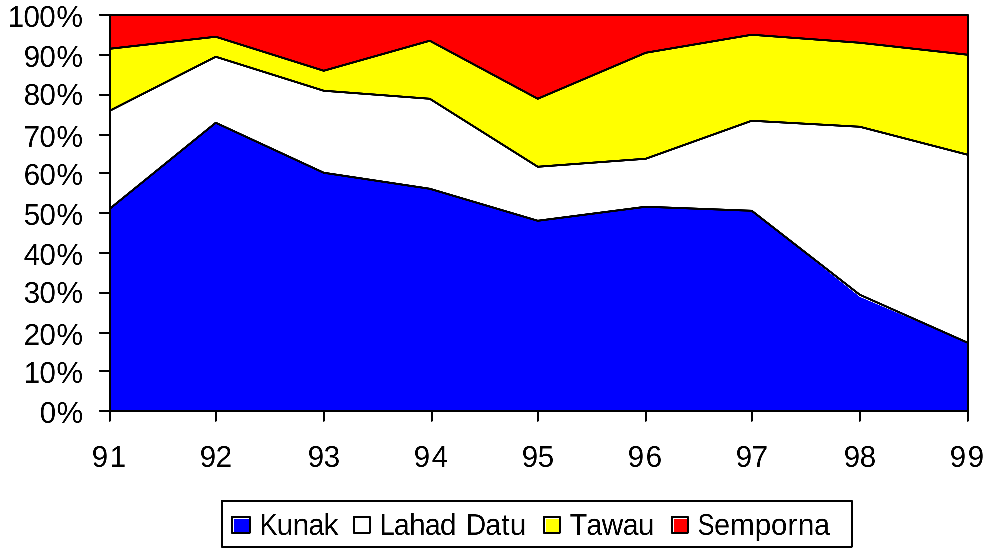


Figure 198 Temporal distribution of traditional gear landings in SSME-3 area, 1991-1999 (% annual)

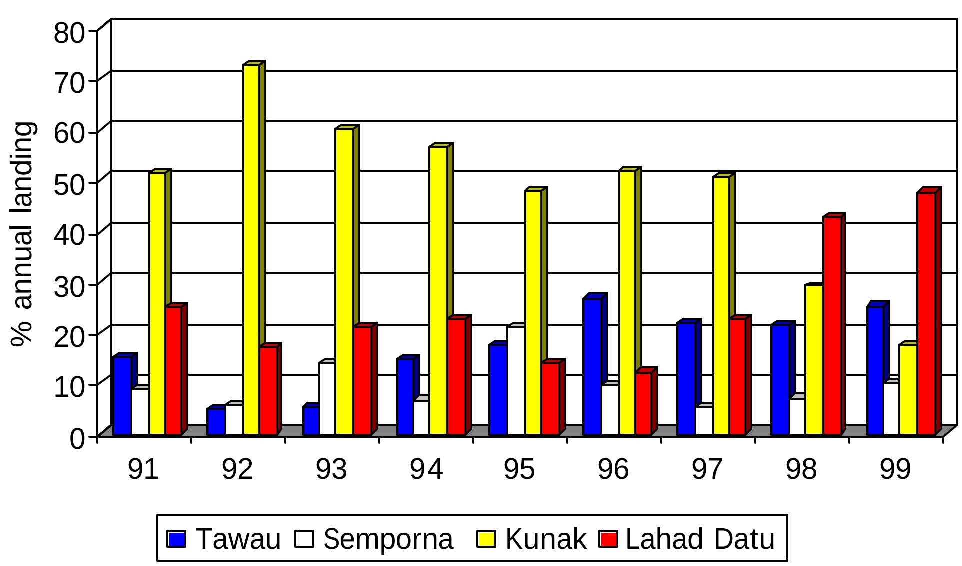


Figure 199. Temporal distribution of commercial gear landings in SSME-3 area, 1991-1999

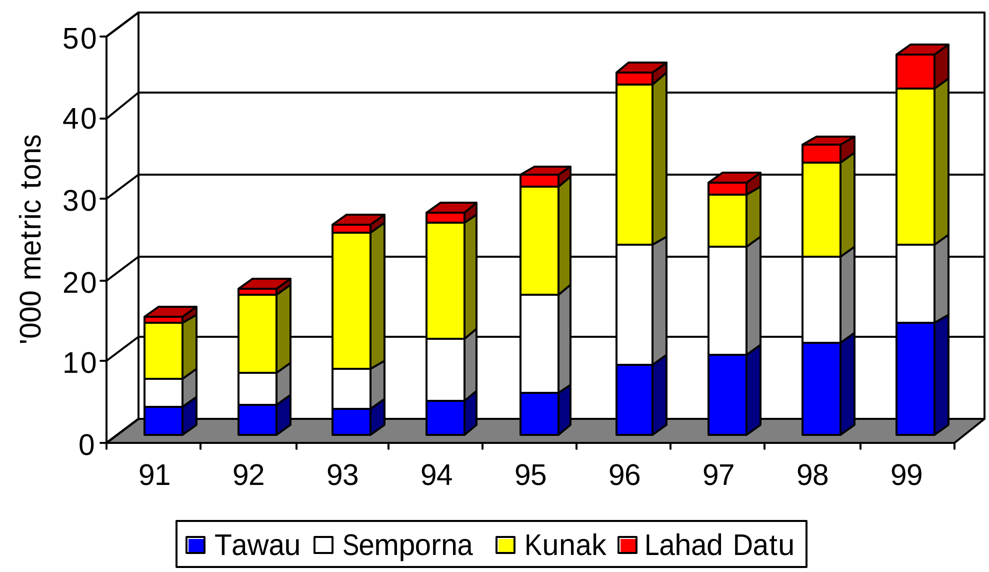


Figure 200. Temporal distribution of commercial gear landings in SSME-3 area, 1991-1999

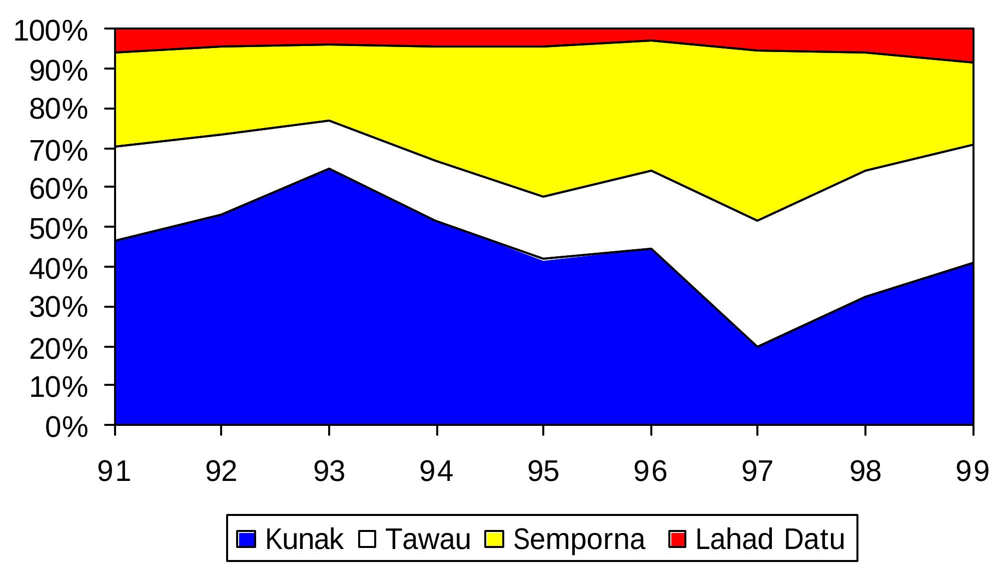


Figure 201. Temporal distribution of commercial gear landings in SSME-3 area, 1991-1999 (% annual)

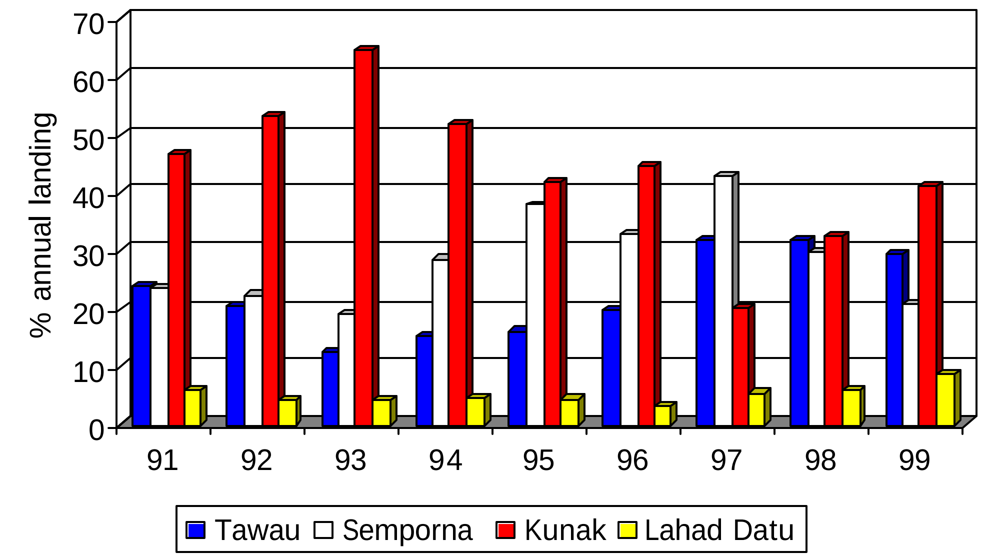


Figure 202. Temporal distribution of marine fish landings by gear group in SSME-3 area, 1991-1999

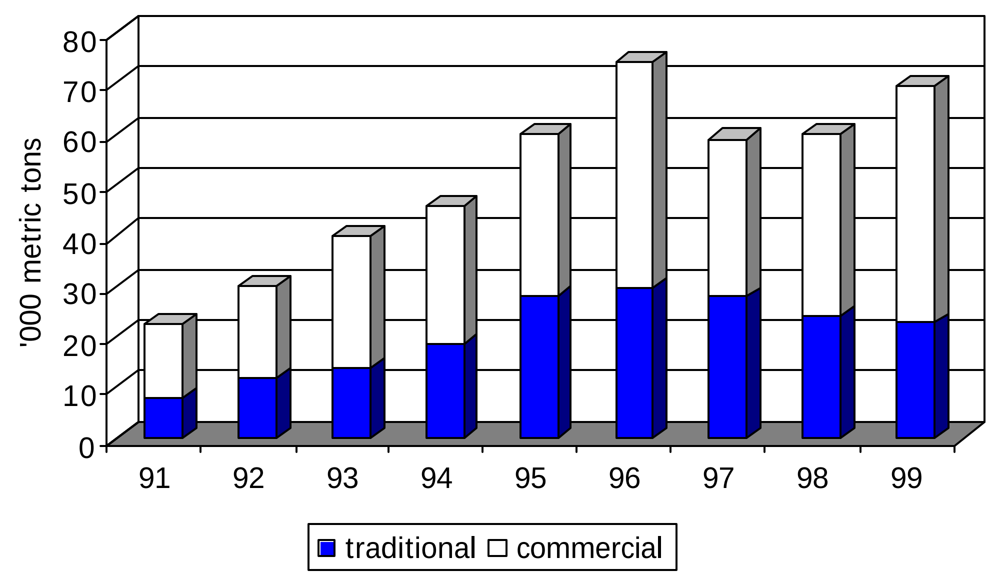


Figure 203. Temporal distribution of marine fish landings by gear group in SSME-3 area, 1991-1999

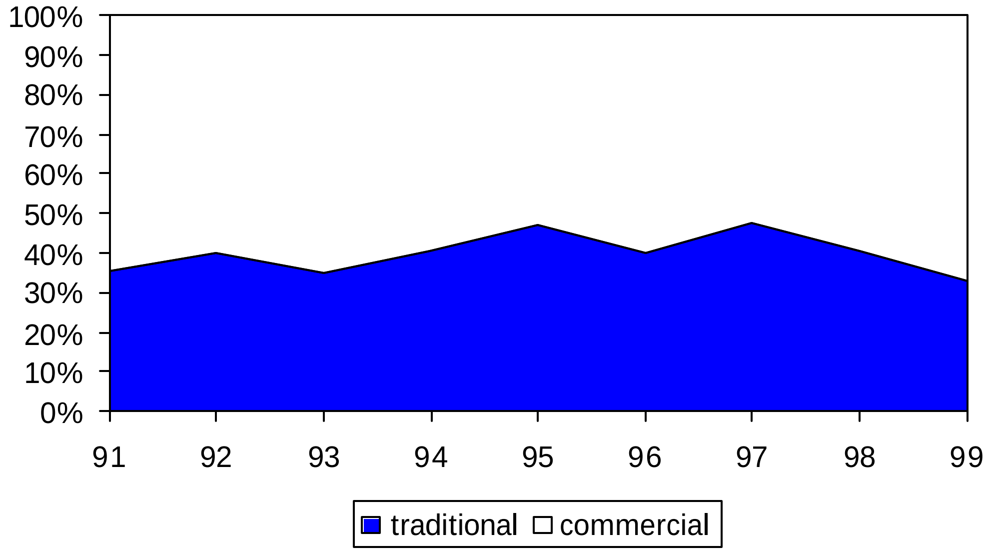
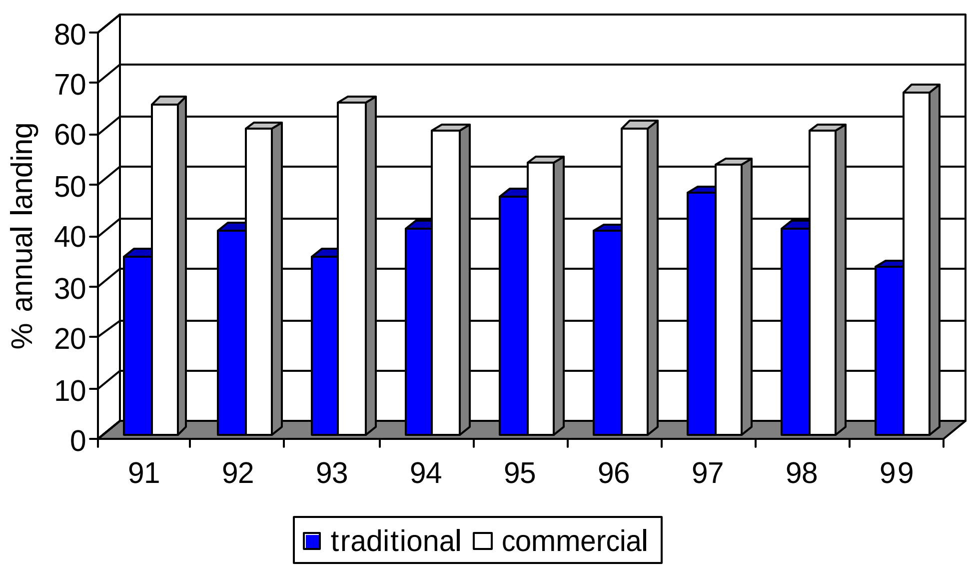


Figure 204. Temporal distribution of marine fish landings by gear group in SSME-3 area, 1991-1999 (% annual)



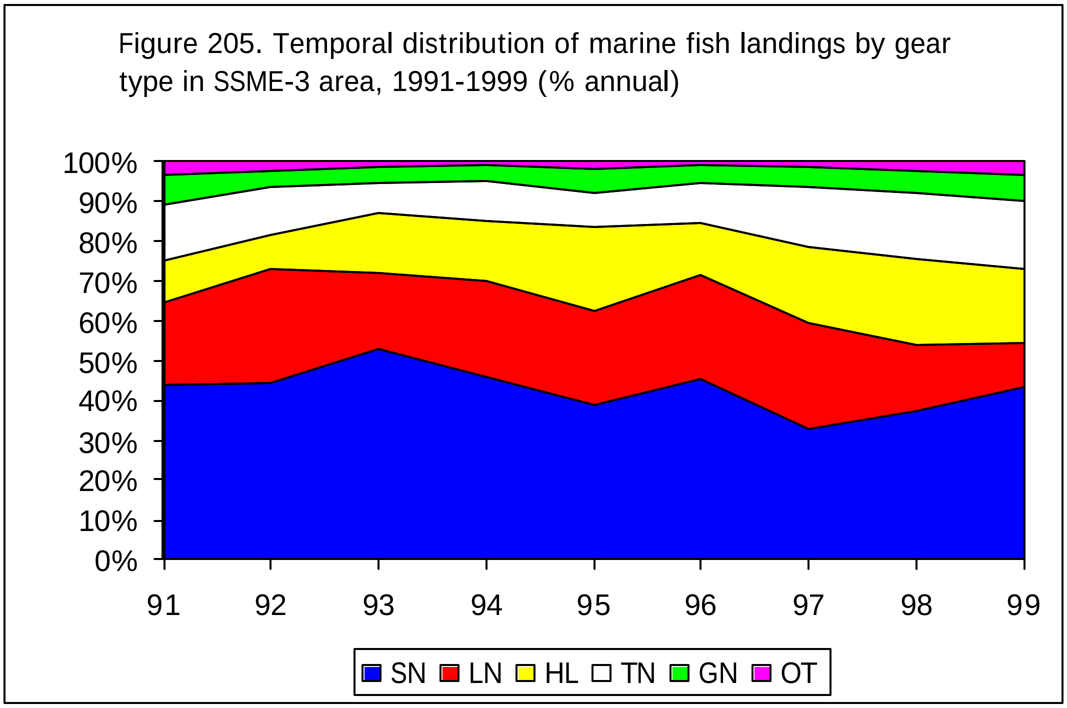


Figure 205. Temporal distribution of marine fish landings by gear type in SSME-3 area, 1991-1999 (% annual)
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
91
92
93
94
95
96
97
98
99
SN LN HL TN GN OT

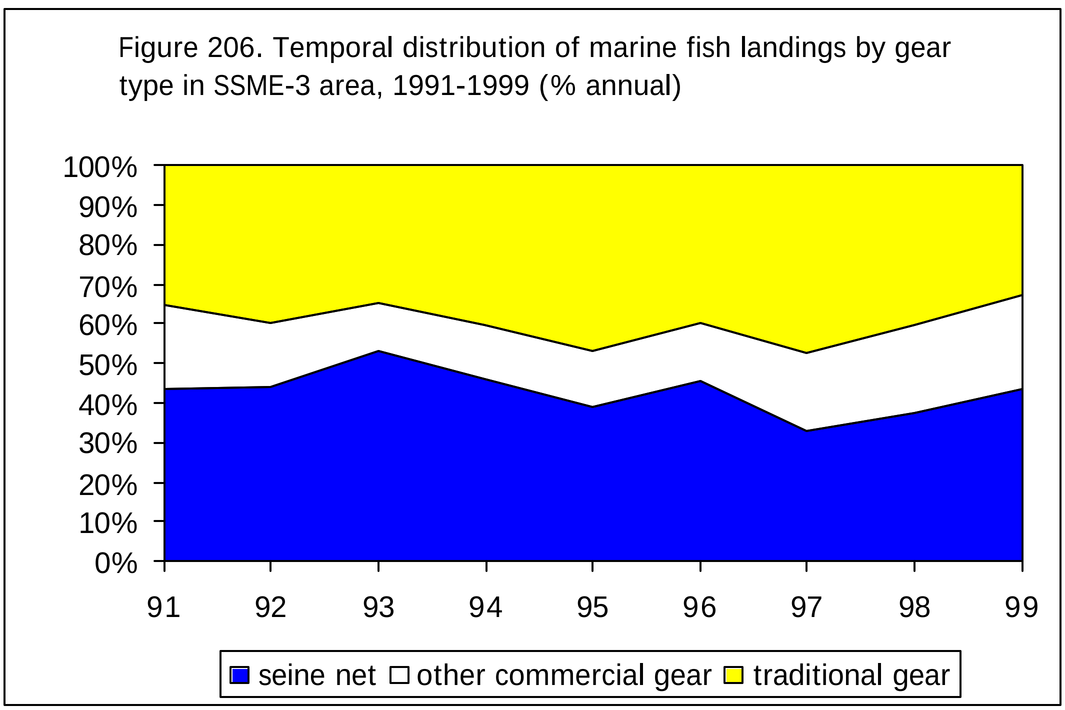


Figure 206. Temporal distribution of marine fish landings by gear type in SSME-3 area, 1991-1999 (% annual)
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
91
92
93
94
95
96
97
98
99
seine net other commercial gear traditional gear

Figure 207. SSME-3 contribution to SSME marine fish landings, 1991-1999 (% annual) - gear group

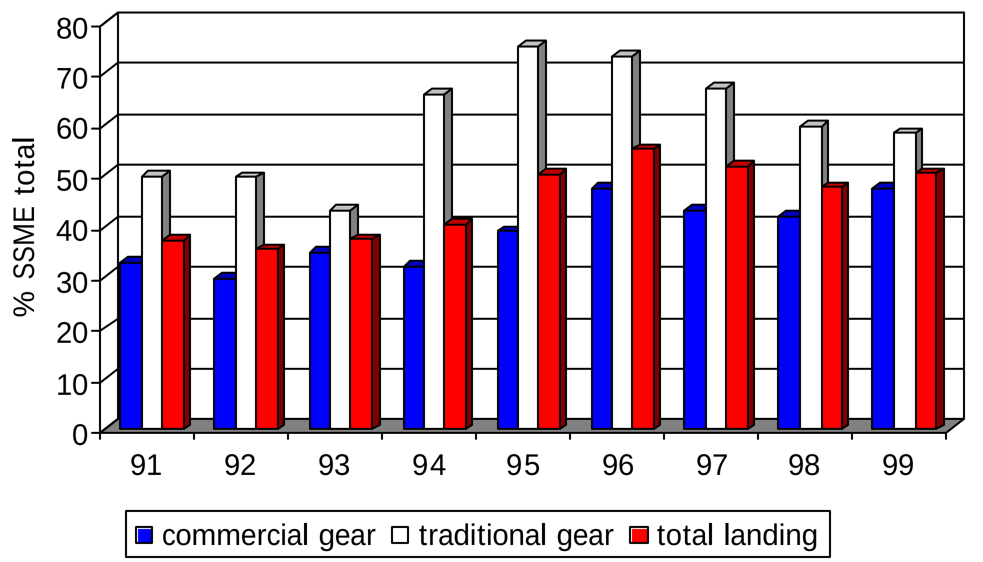


Figure 208. SSME-3 contribution to SSME marine fish landings, 1991-1999 (% annual) - traditional gears

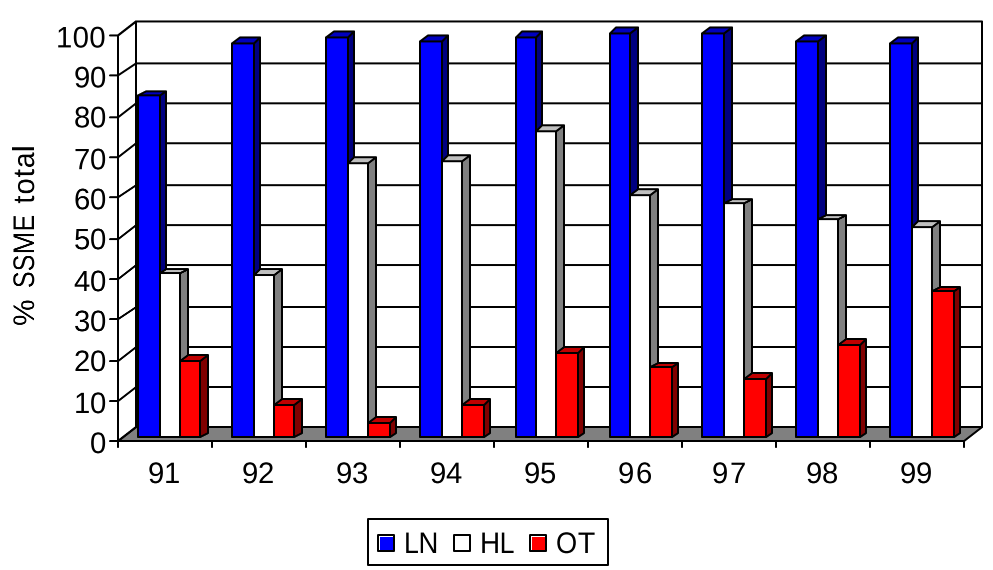


Figure 209. SSME-3 contribution to SSME marine fish landings, 1991-1999 (% annual) - commercial gears

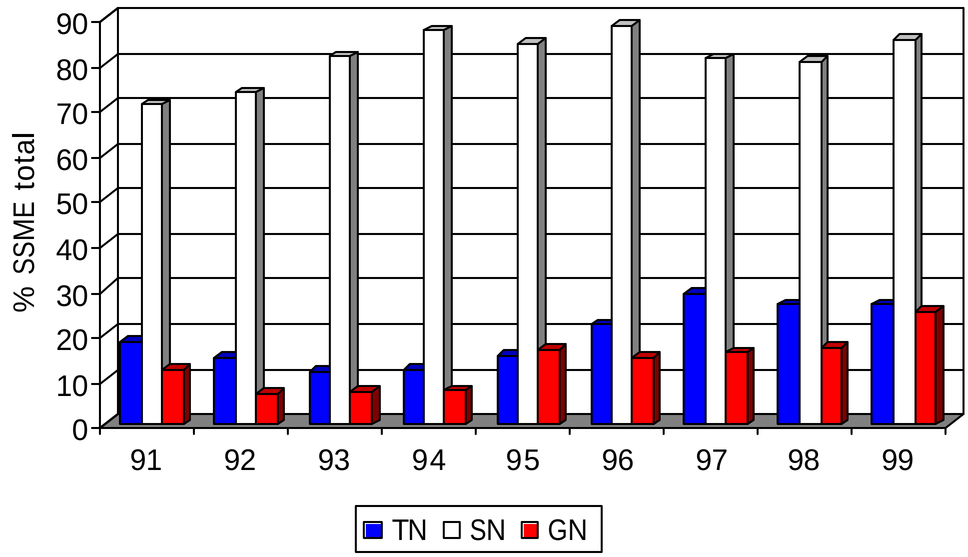


Figure 210. SSME-3 contribution to SSME marine fish landings, 1991-1999 (% annual) - resource group

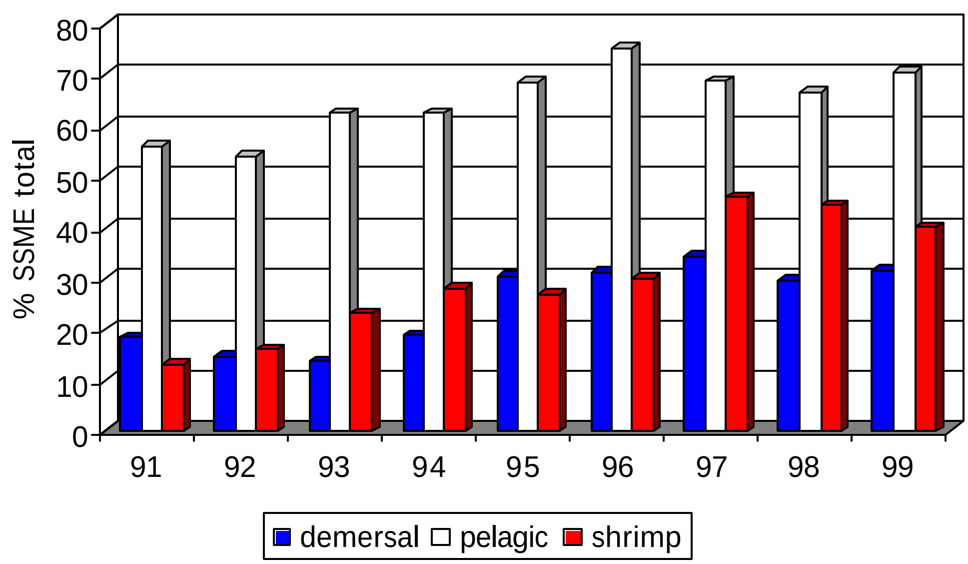


Figure 211. Temporal distribution of marine fish landings by resource group in SSME-3 area, 1991-1999 (% annual)

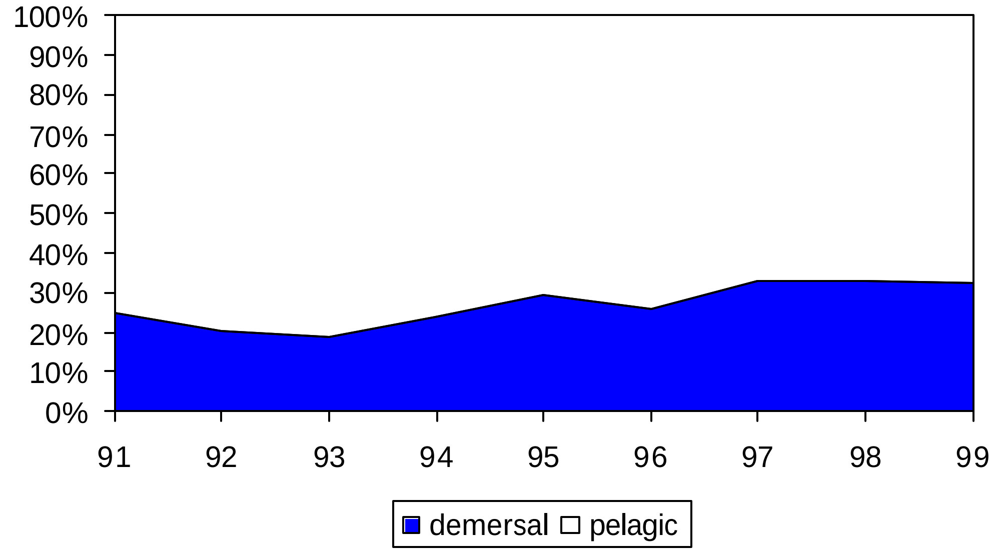


Figure 212. Temporal distribution of trawl net landings in the SSME area, 1991-1999

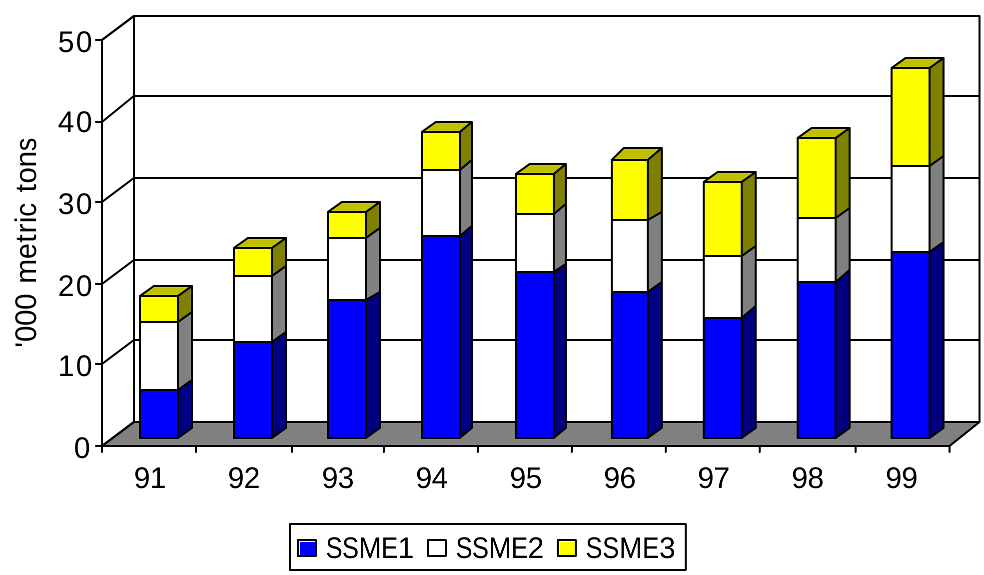


Figure 213. Temporal distribution of trawl net landings in the SSME area, 1991-1999

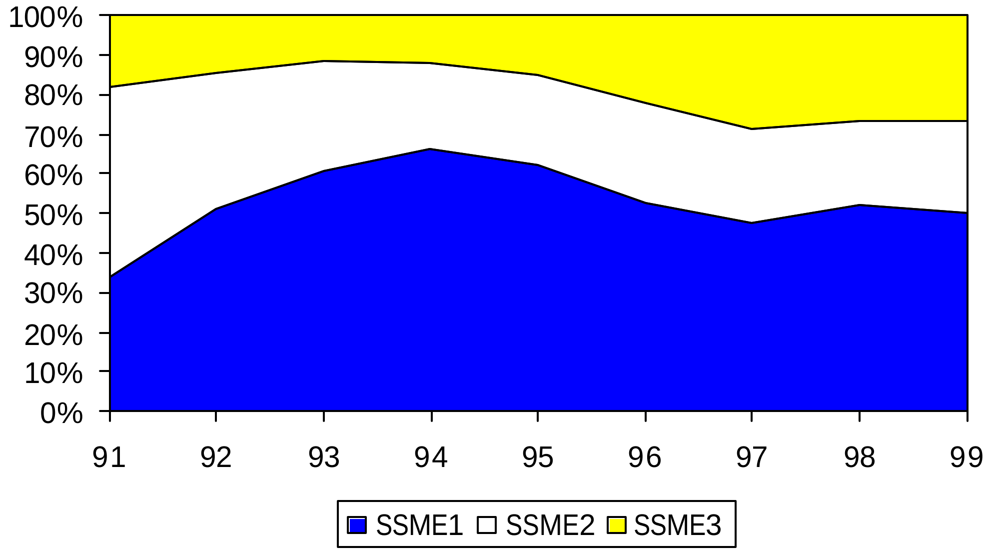


Figure 214. Temporal distribution of trawl net landings in the SSME area, 1991-1999 (% annual)

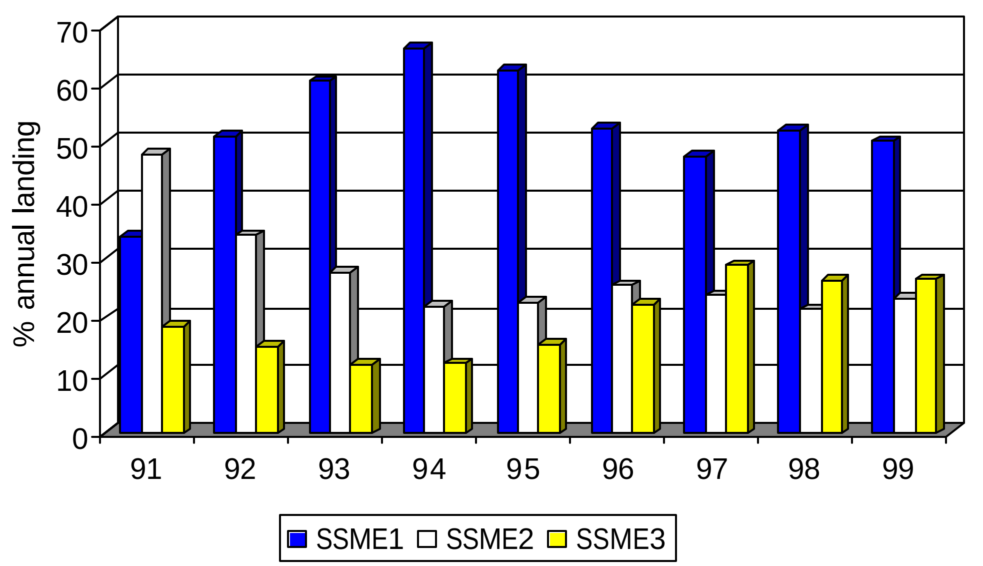


Figure 215. Temporal distribution of trawl net landings in Sabah, 1991-1999

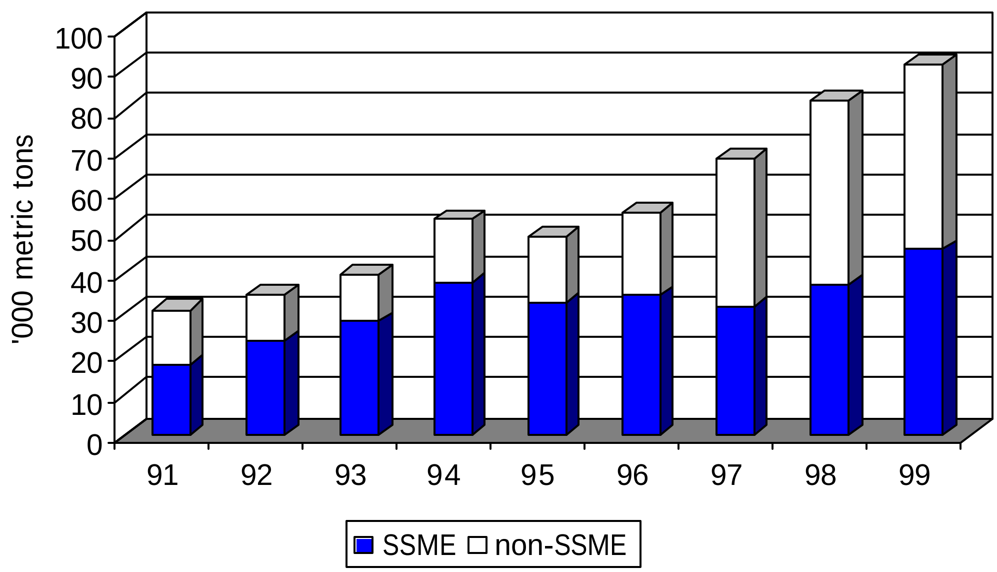


Figure 216a. Temporal distribution of trawl net landings in Sabah, 1991-1999

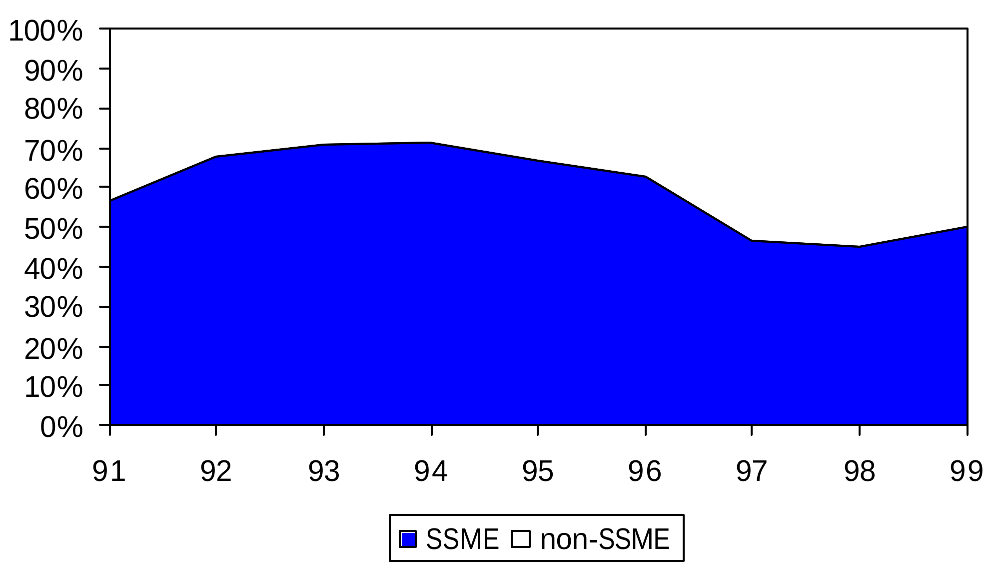


Figure 216b. Temporal distribution of trawl net landings in Sabah, 1991-1999 (% annual)

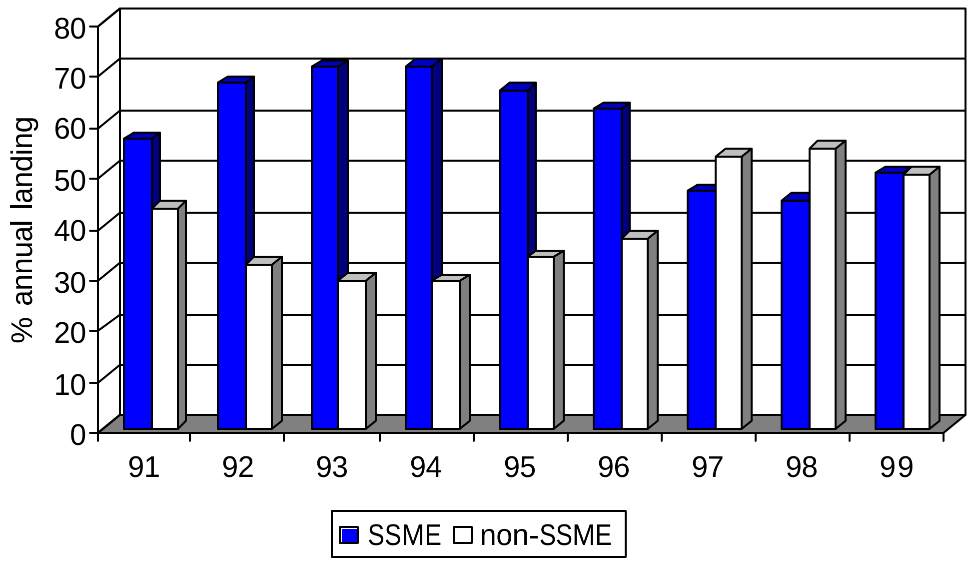


Figure 217a. Temporal distribution of trawl net contribution to the commercial gear landings in Sabah, 1991-1999

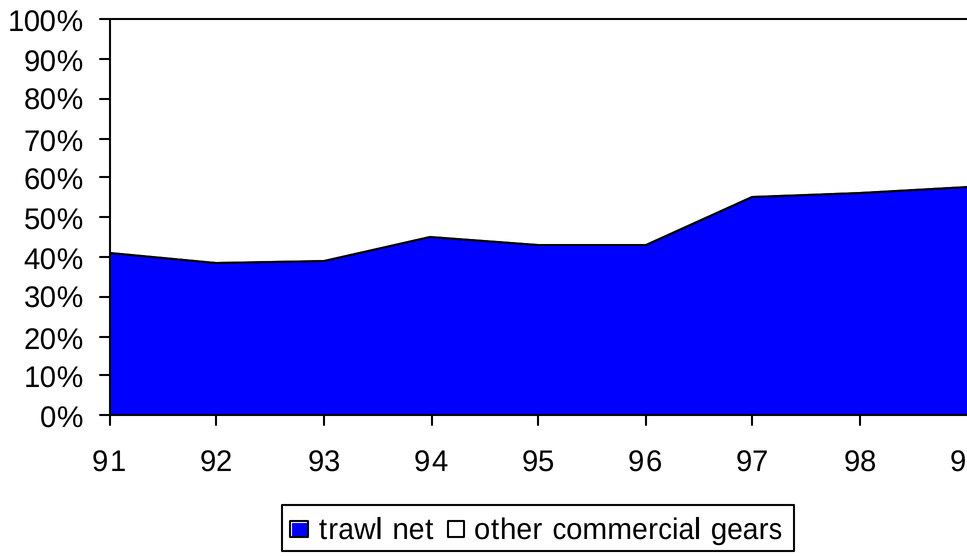


Figure 217b. Temporal distribution of trawl net contribution to the commercial gear landings in the non-SSME area, 1991-1999

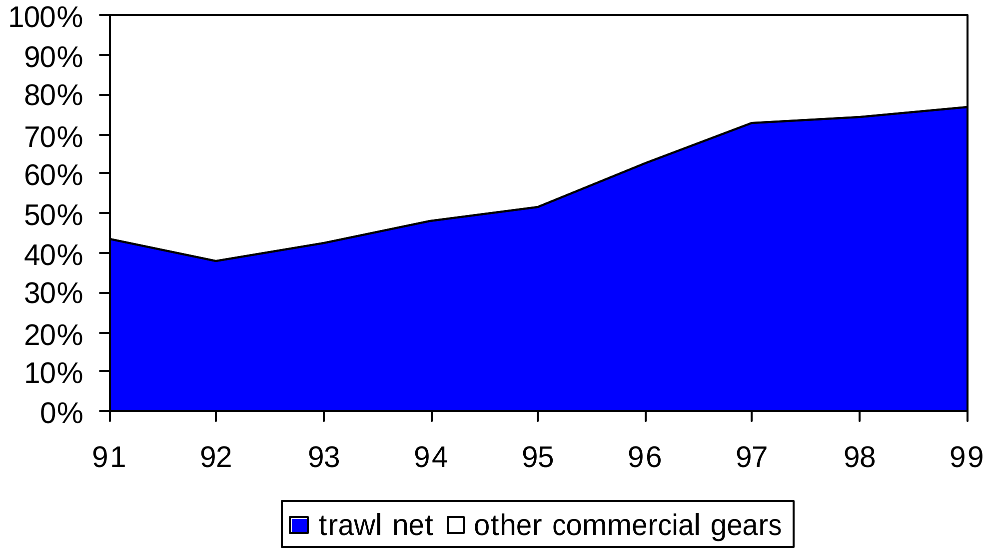


Figure 217c. Temporal distribution of trawl net contribution to the commercial gear landings in the SSME area, 1991-1999

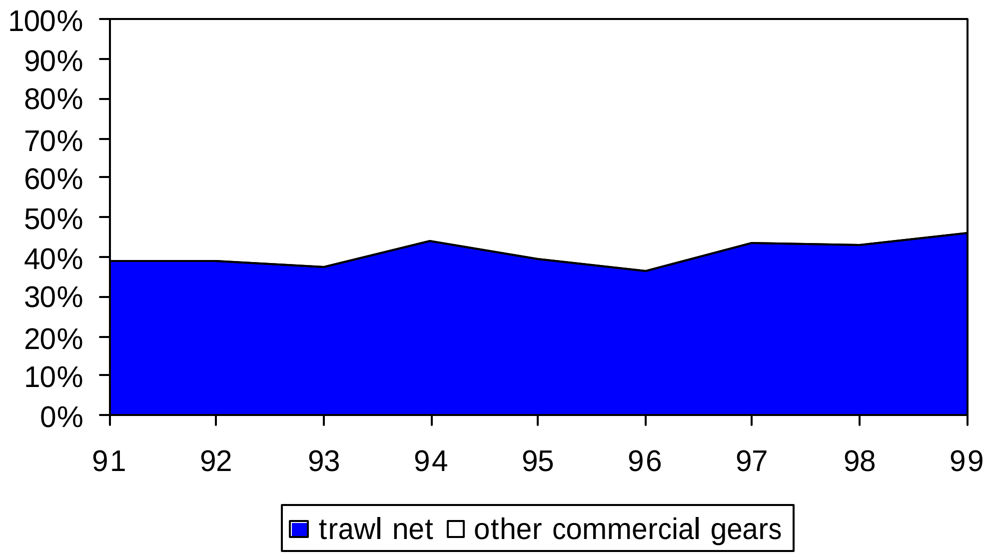


Figure 217d. Temporal distribution of trawl net contribution to the commercial gear landings in the SSME-1 area, 1991-1999

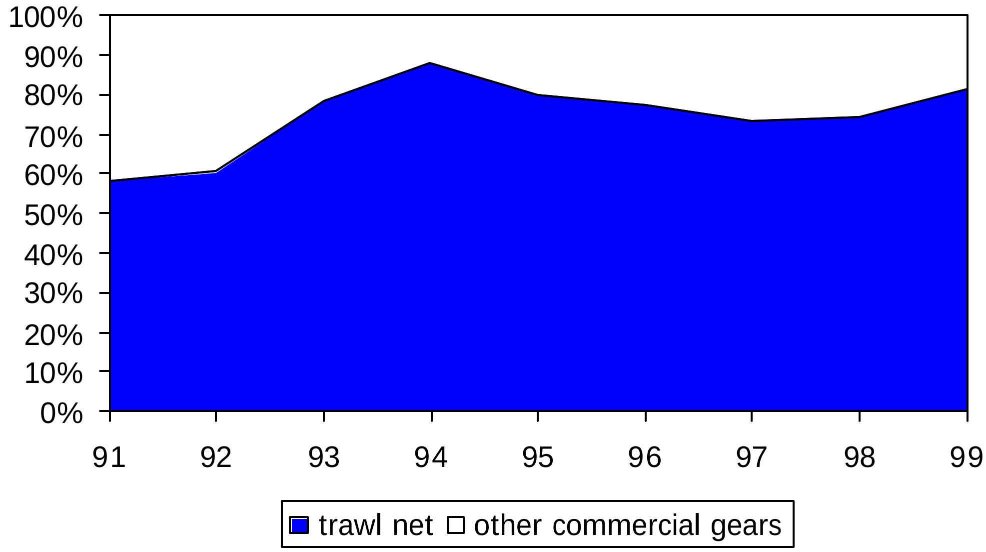


Figure 217e. Temporal distribution of trawl net contribution to the commercial gear landings in the SSME-2 area, 1991-1999

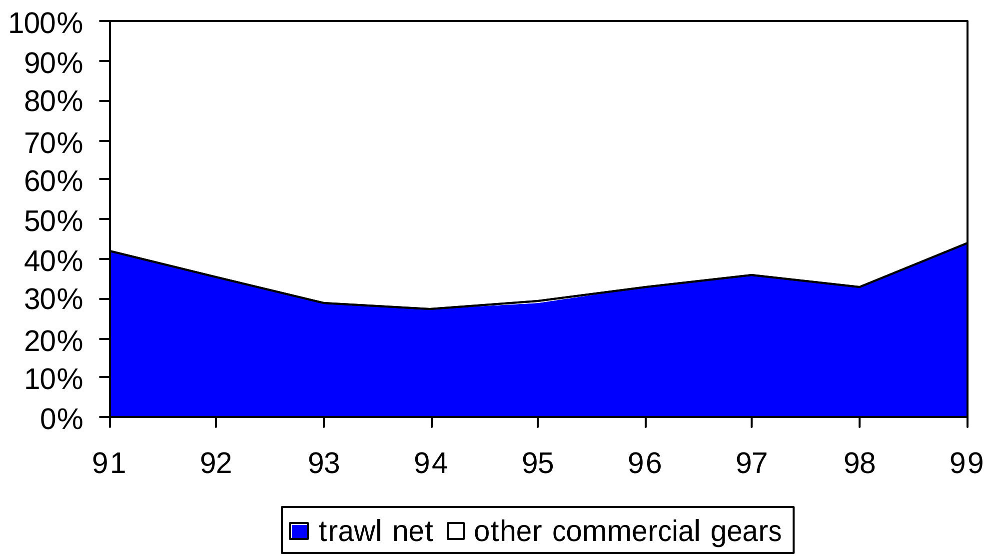


Figure 217f. Temporal distribution of trawl net contribution to the commercial gear landings in the SSME-3 area, 1991-1999

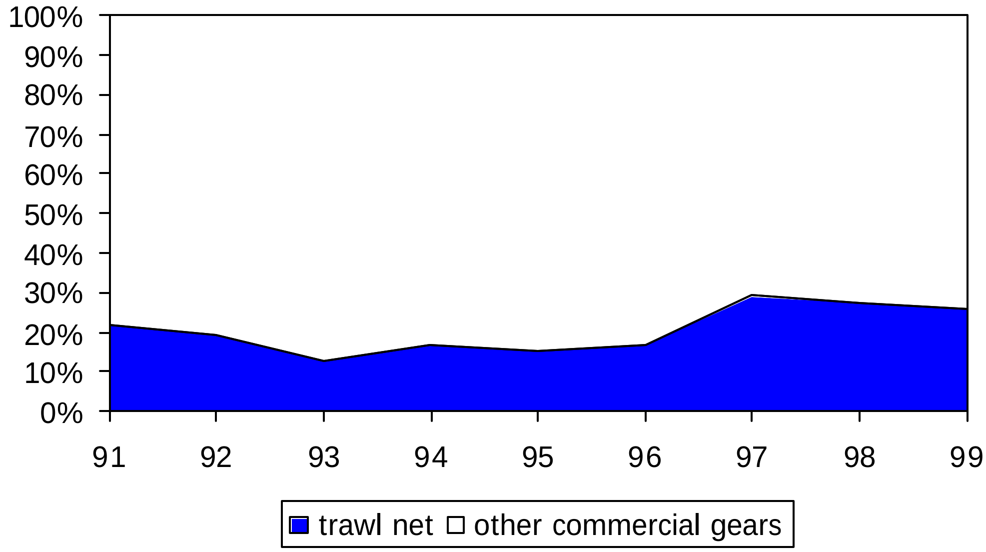


Figure 218. Temporal distribution of seine net landings in the SSME area, 1991-1999

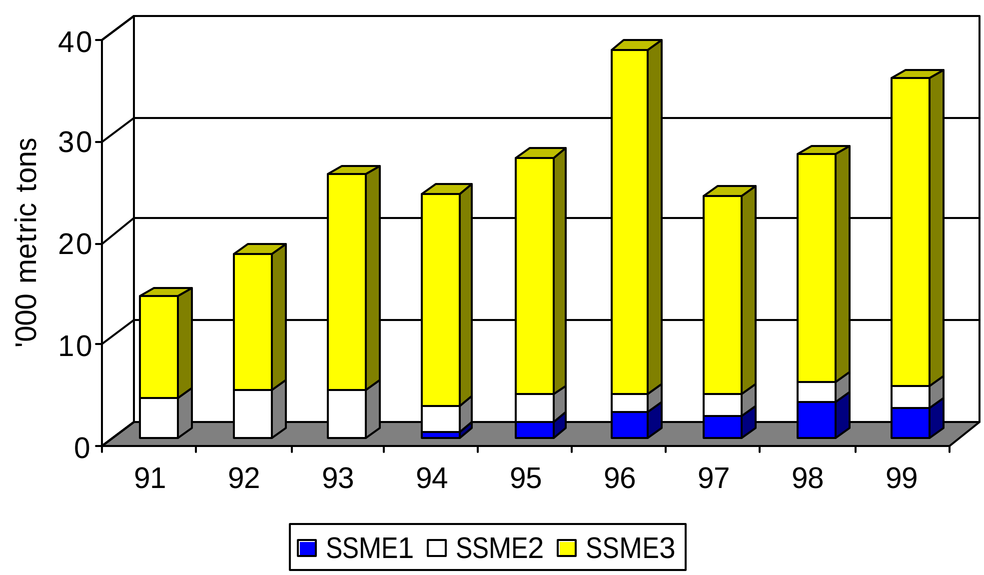


Figure 219. Temporal distribution of seine net landings in the SSME area, 1991-1999

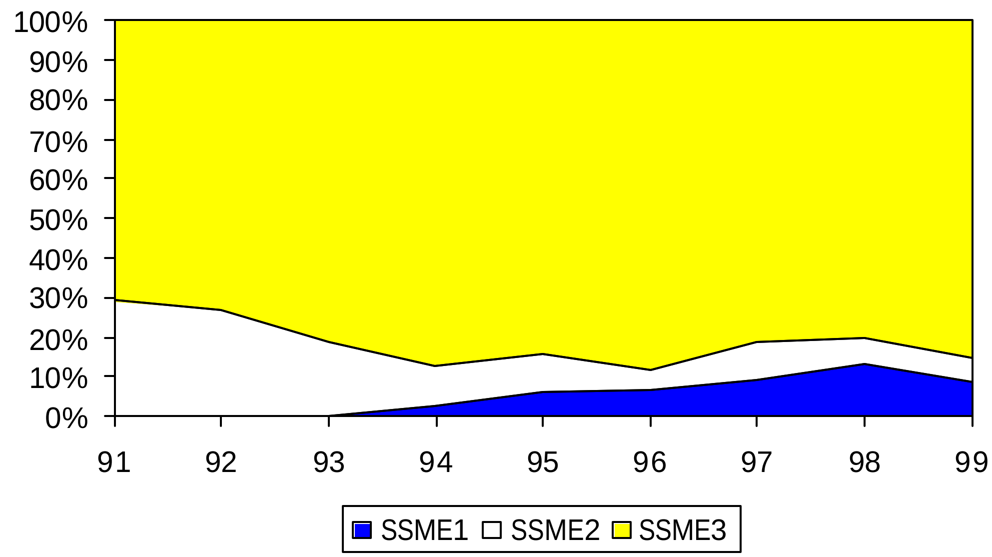


Figure 220. Temporal distribution of seine net landings in the SSME area, 1991-1999 (% annual)

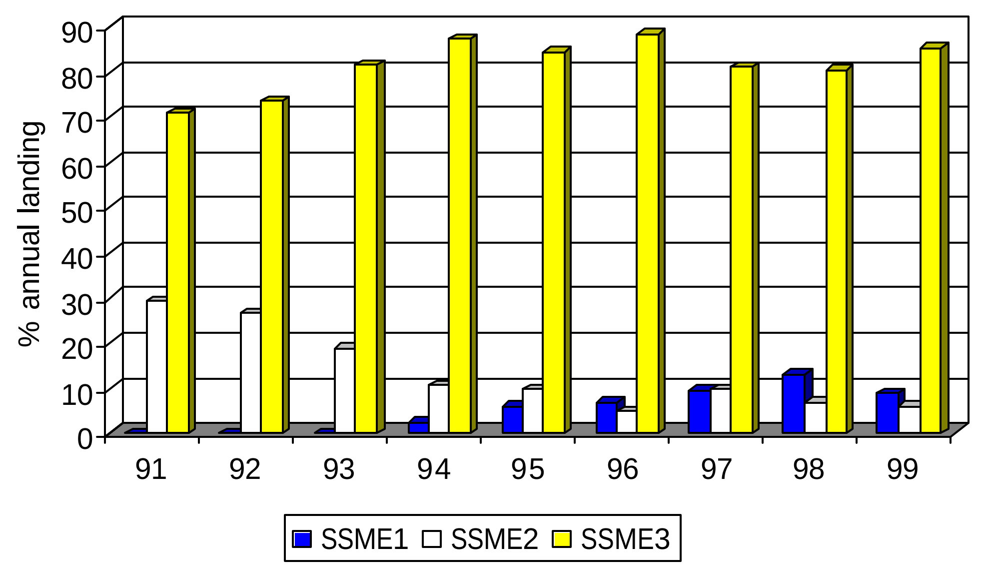


Figure 221. Temporal distribution of seine net landings in Sabah, 1991-1999

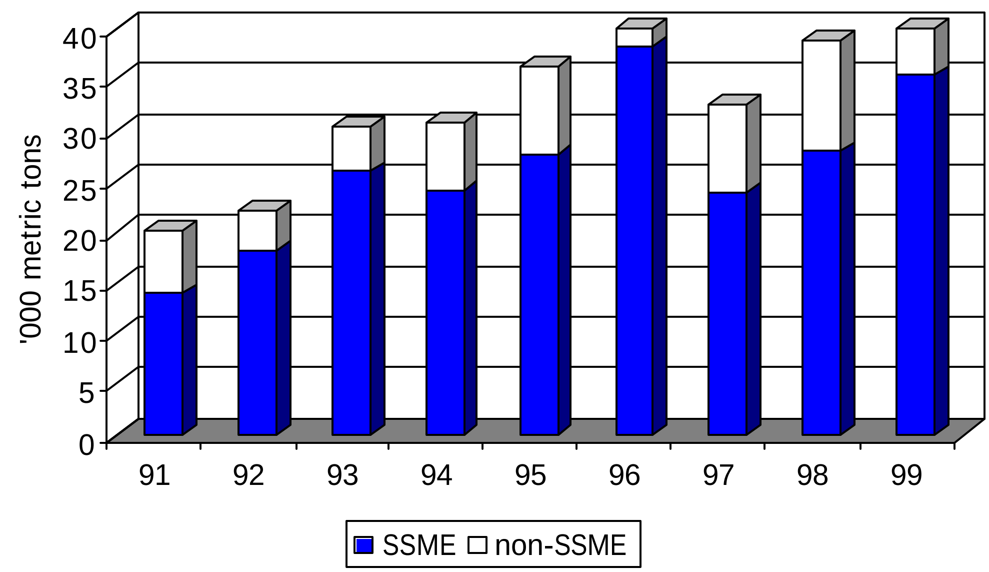


Figure 222a. Temporal distribution of seine net landings in Sabah, 1991-1999

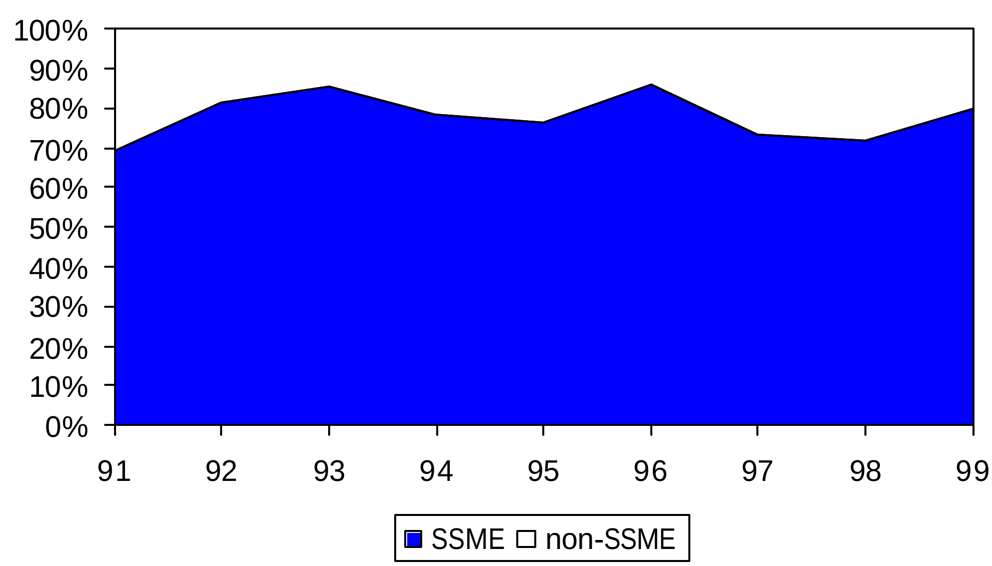


Figure 222b. Temporal distribution of seine net landings in Sabah, 1991-1999 (% annual)

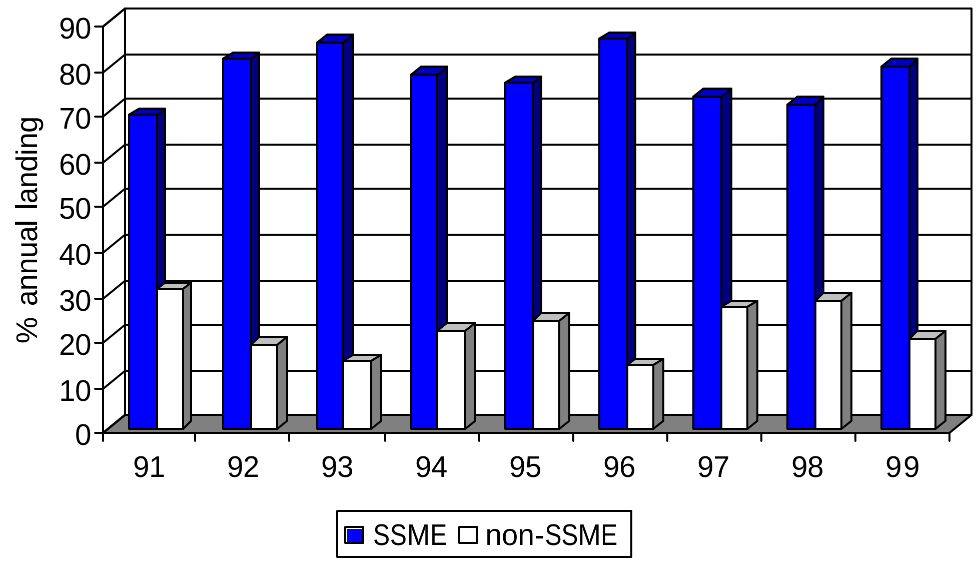


Figure 223a. Temporal distribution of seine net contribution to the commercial gear landings in Sabah, 1991-1999

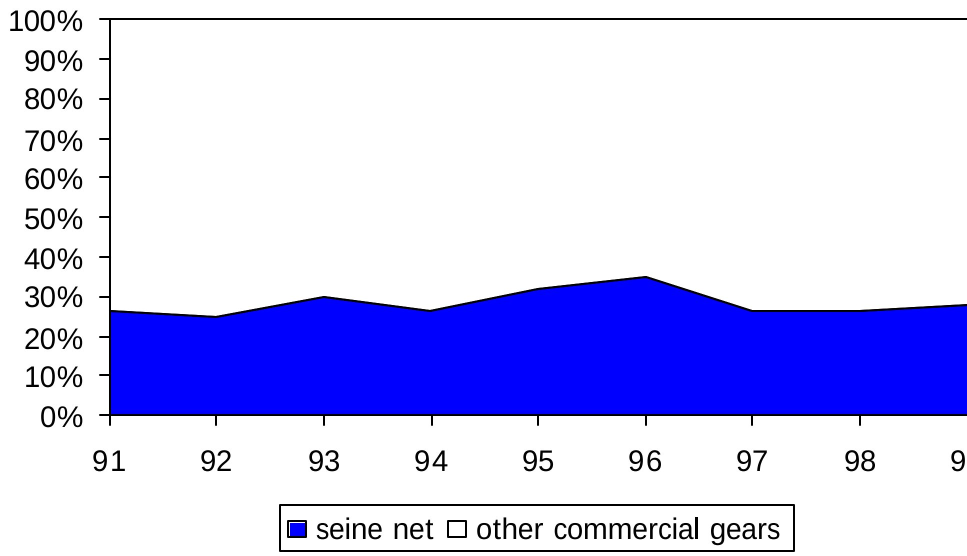


Figure 223b. Temporal distribution of seine net contribution to the commercial gear landings in the non-SSME area, 1991-1999

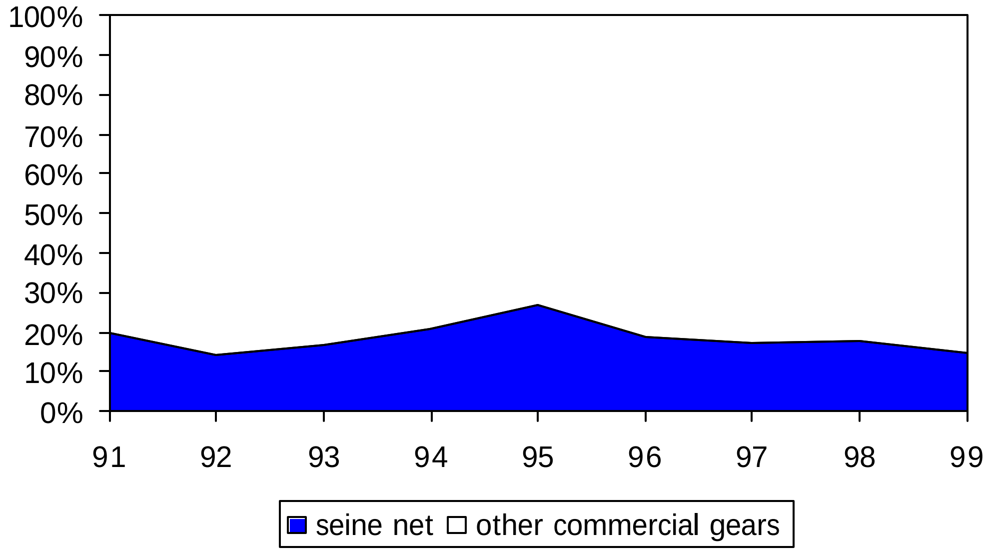


Figure 223c. Temporal distribution of seine net contribution to the commercial gear landings in the SSME area, 1991-1999

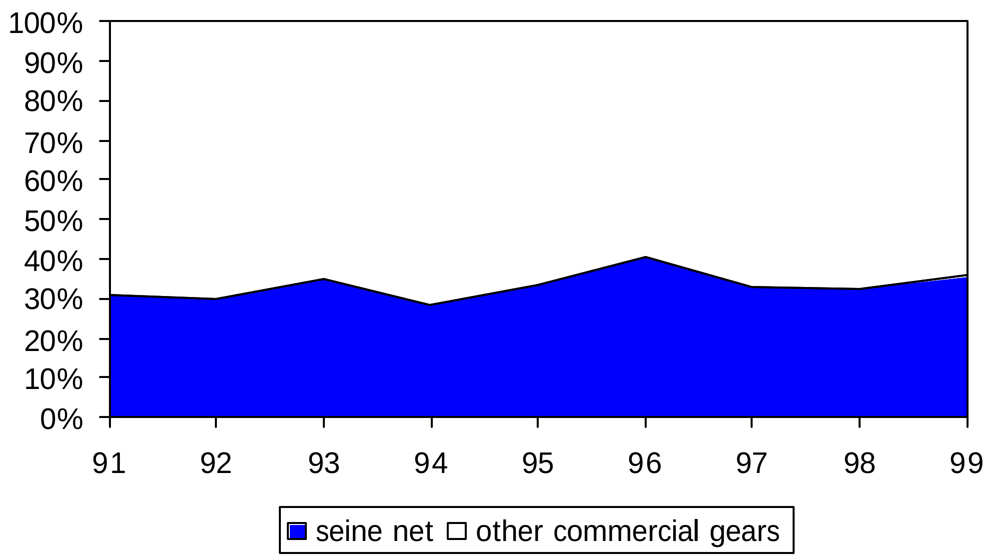


Figure 223d. Temporal distribution of seine net contribution to the commercial gear landings in the SSME-1 area, 1991-1999

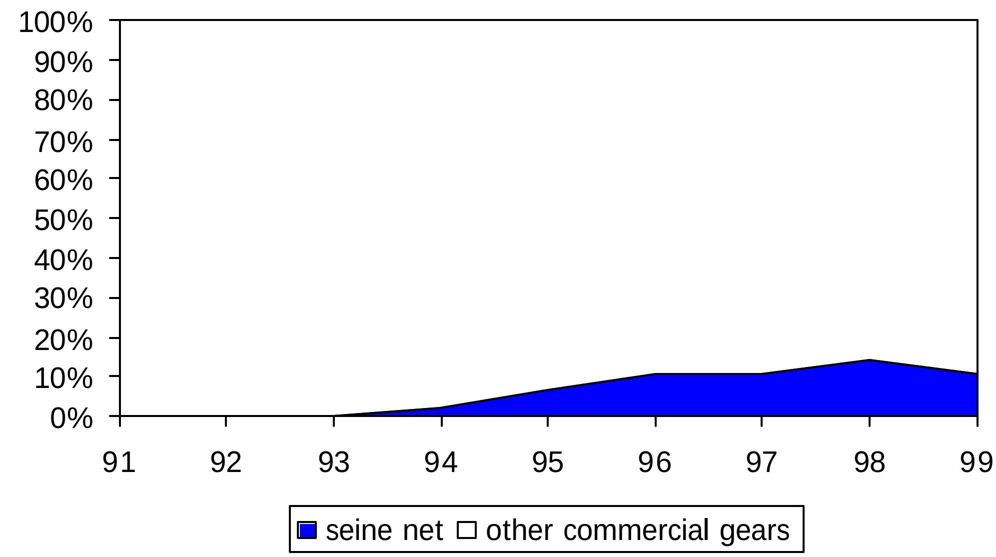


Figure 223e. Temporal distribution of seine net contribution to the commercial gear landings in the SSME-2 area, 1991-1999

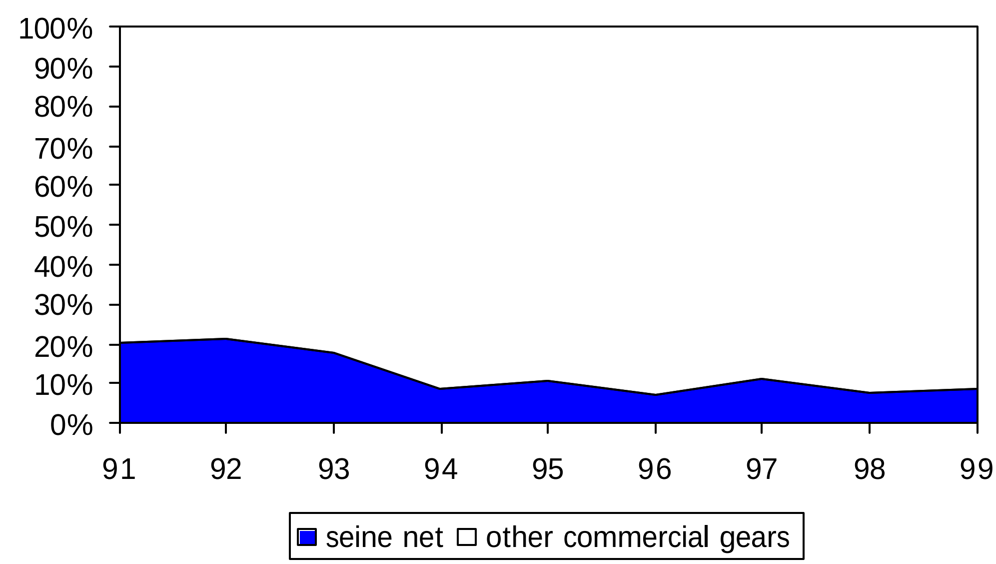


Figure 223f. Temporal distribution of seine net contribution to the commercial gear landings in the SSME-3 area, 1991-1999

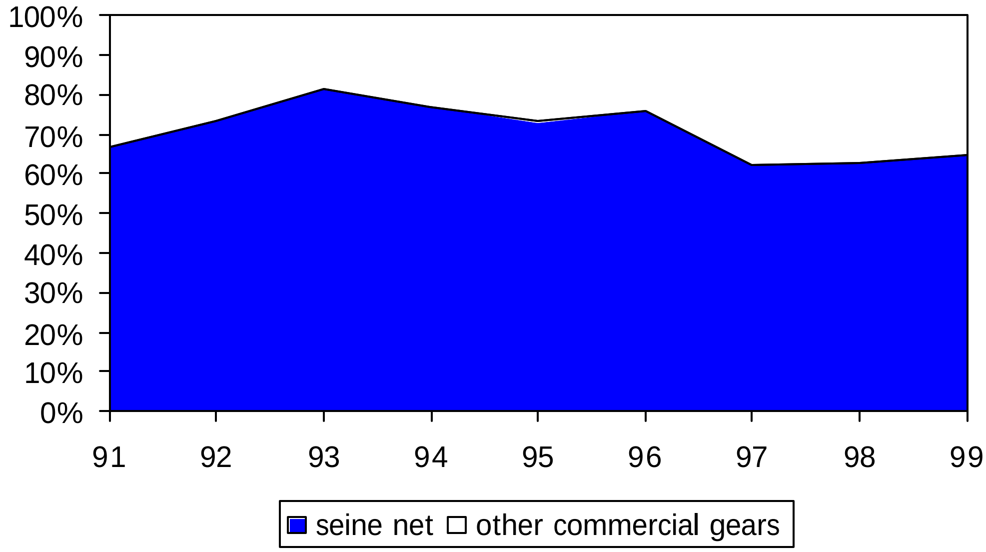


Figure 224. Temporal distribution of gill net landings in the SSME area, 1991-1999

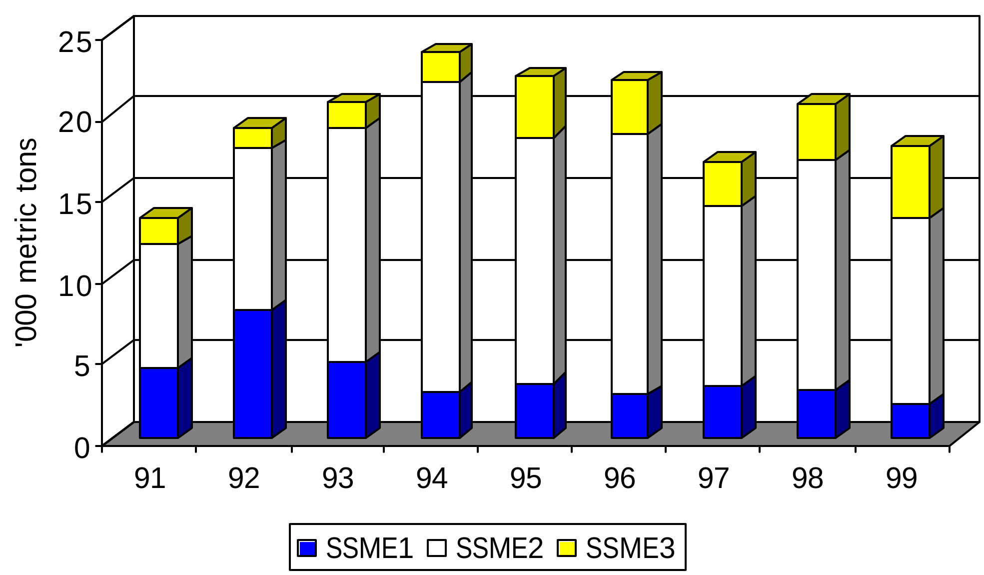


Figure 225. Temporal distribution of gill net landings in the SSME area, 1991-1999

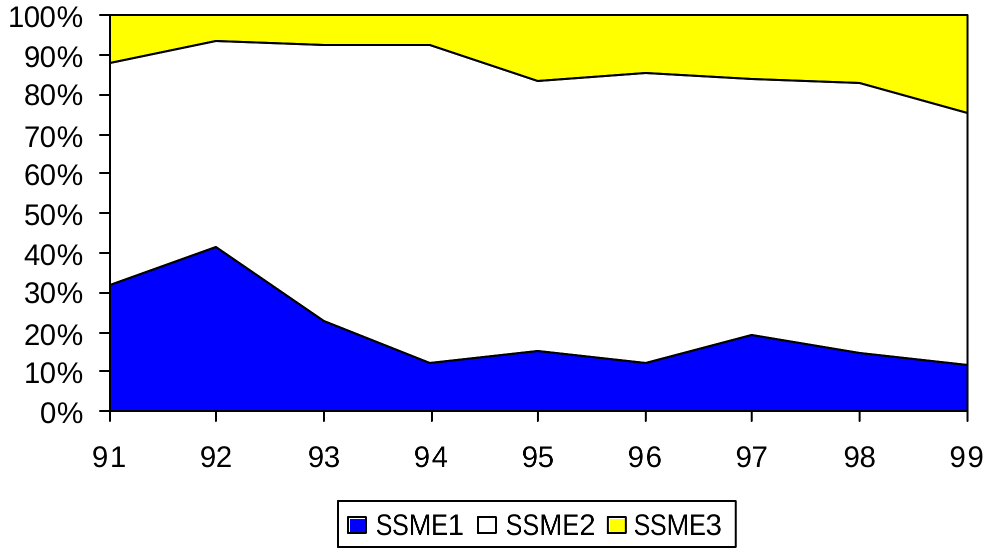


Figure 226. Temporal distribution of gill net landings in the SSME area, 1991-1999 (% annual)

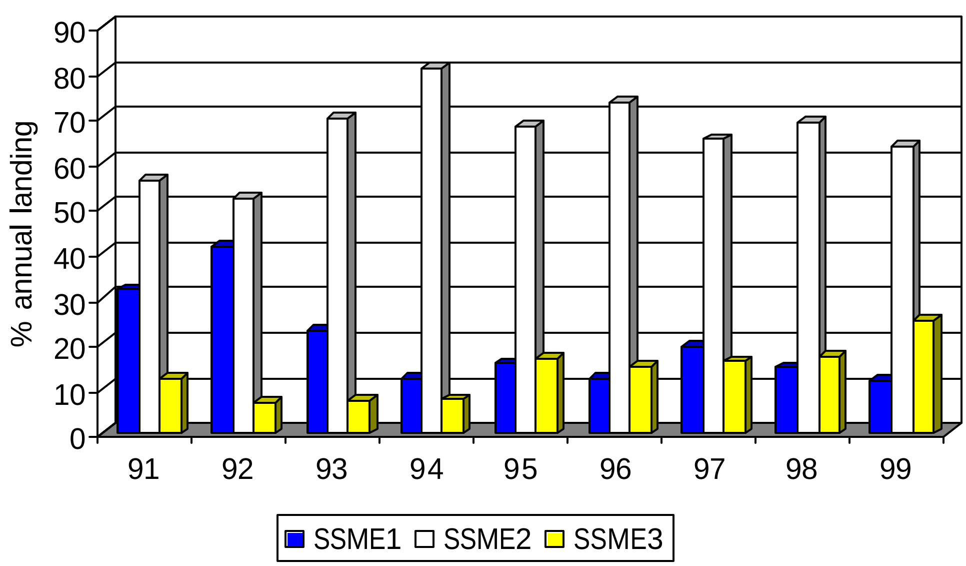


Figure 227. Temporal distribution of gill net landings in Sabah, 1991-1999

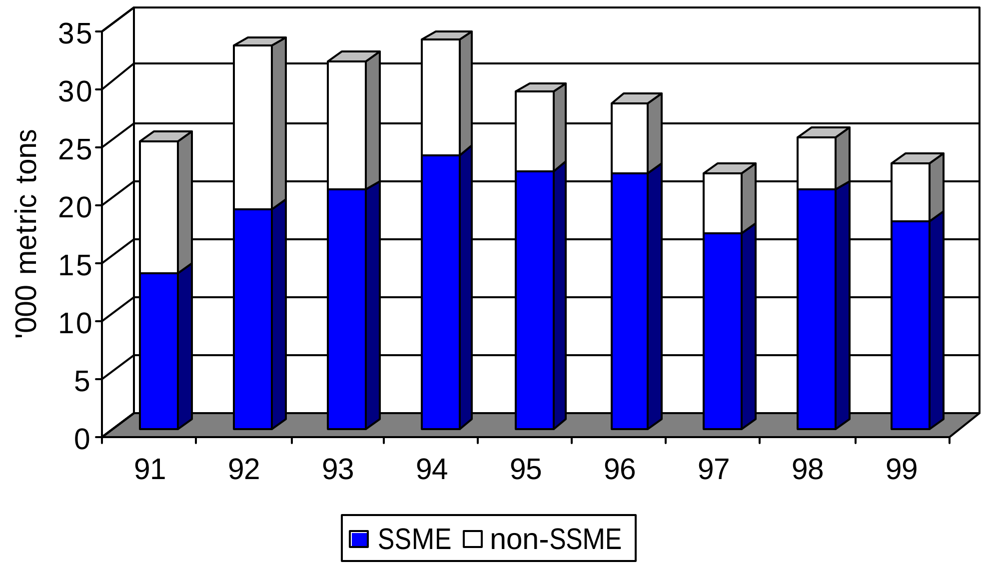


Figure 228a. Temporal distribution of gill net landings in Sabah, 1991-1999

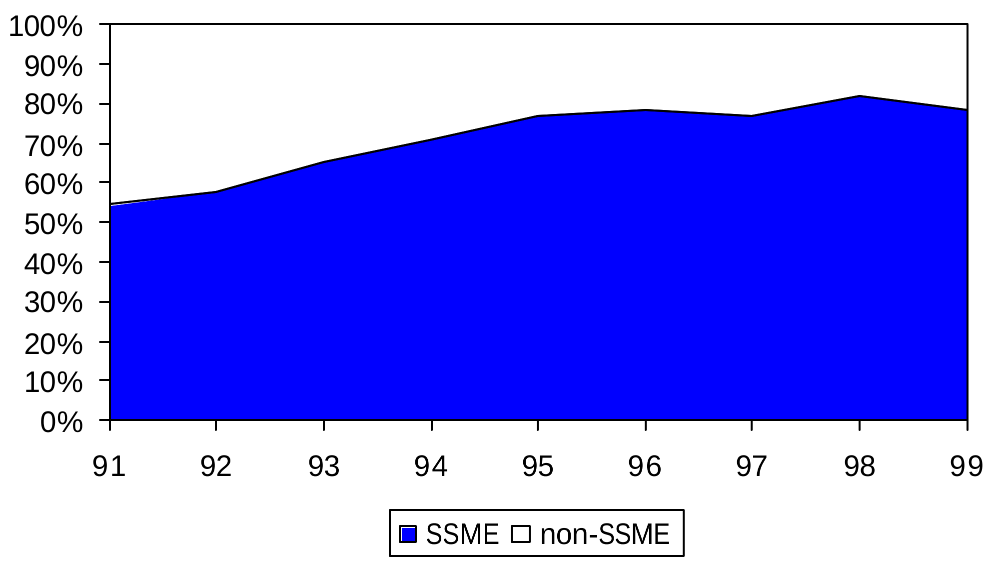


Figure 228b. Temporal distribution of lift net landings in Sabah, 1991-1999 (% annual)

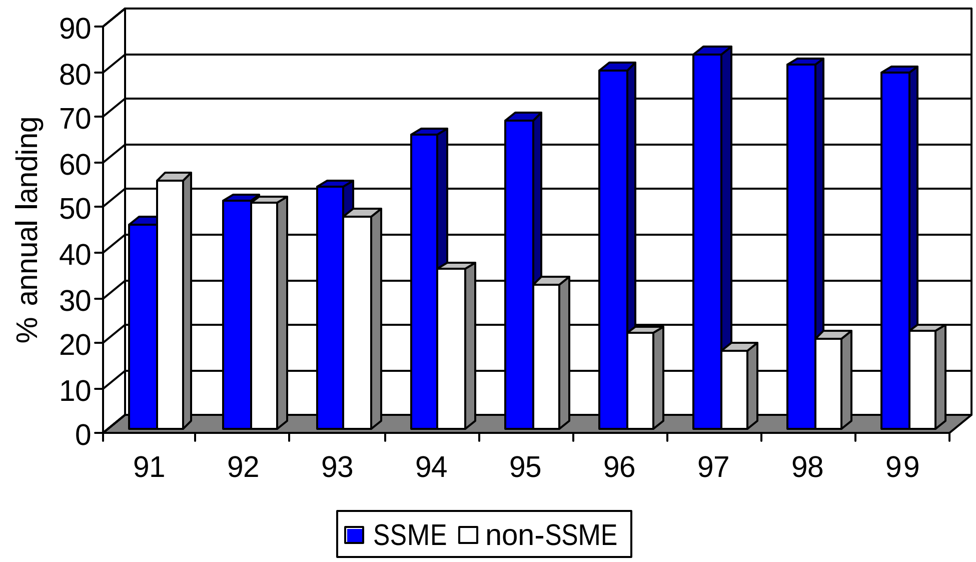


Figure 229a. Temporal distribution of gill net contribution to the commercial gear landings in Sabah, 1991-1999

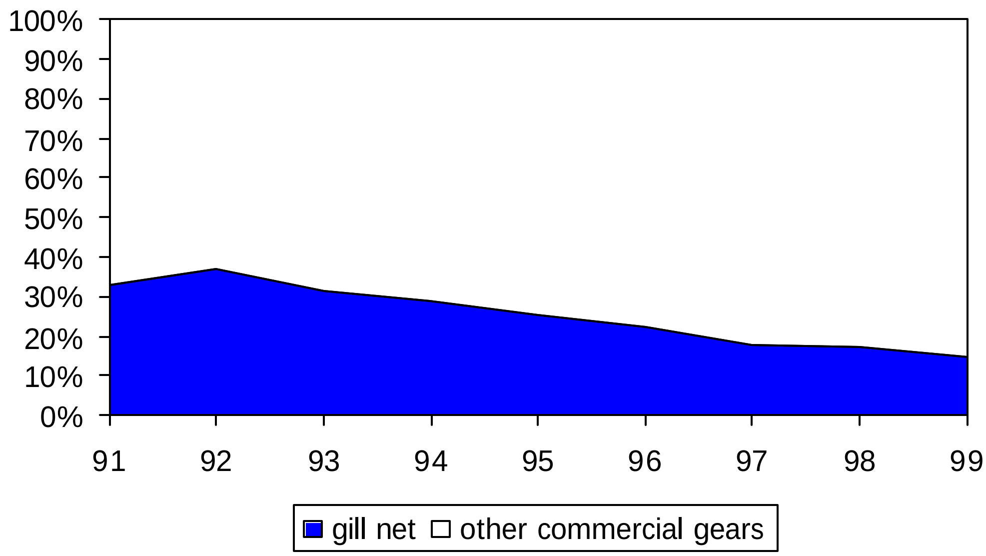


Figure 229b. Temporal distribution of gill net contribution to the commercial gear landings in the non-SSME area, 1991-1999

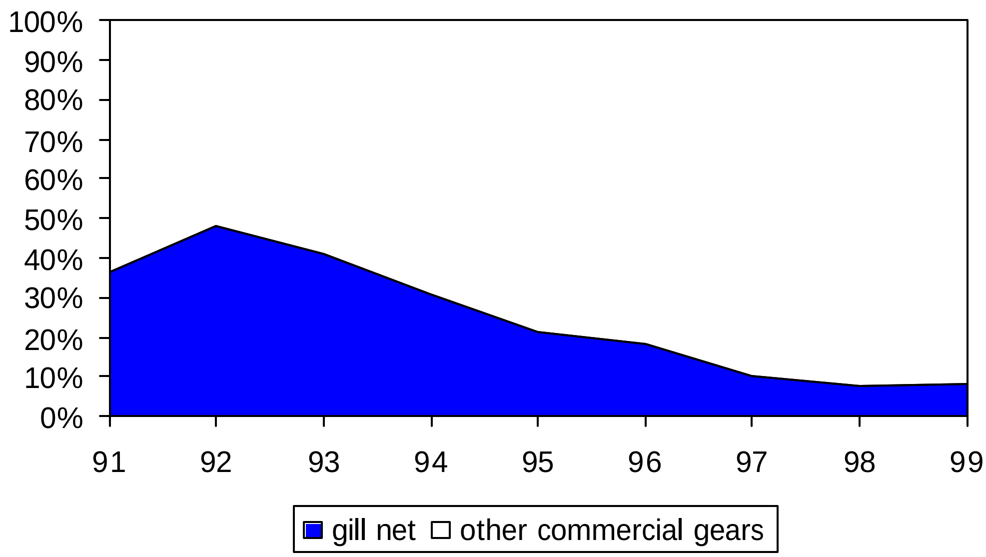


Figure 229c. Temporal distribution of gill net contribution to the commercial gear landings in the SSME area, 1991-1999

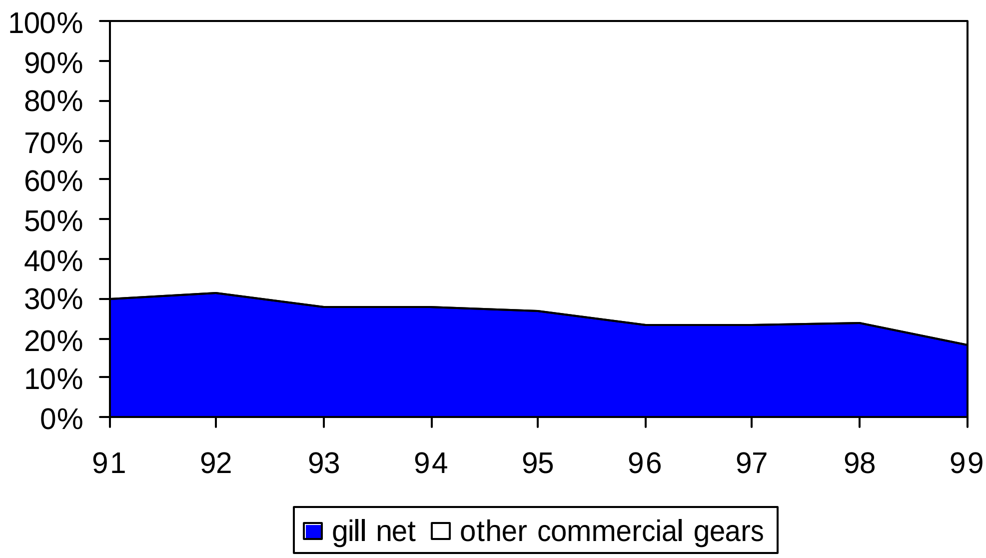


Figure 229d. Temporal distribution of gill net contribution to the commercial gear landings in the SSME-1 area, 1991-1999

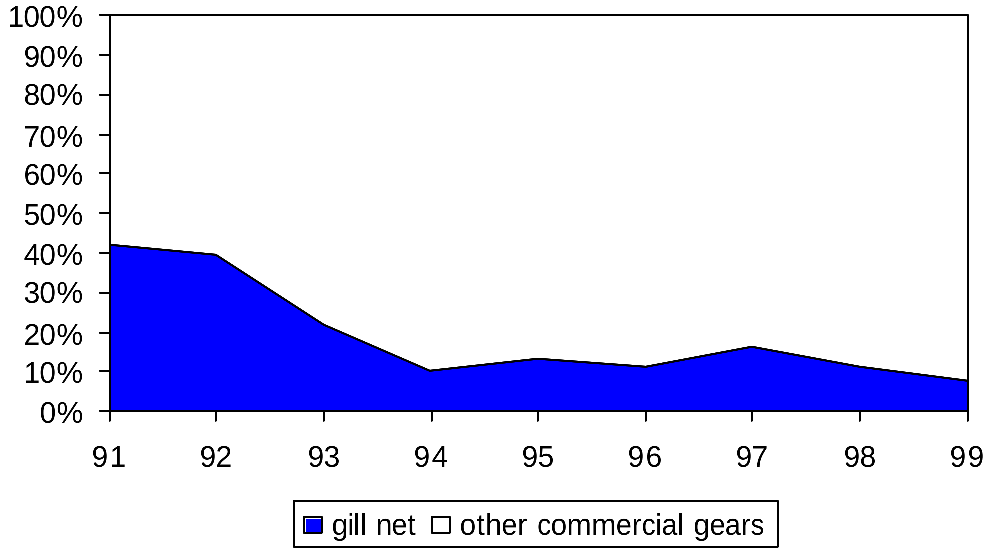


Figure 229e. Temporal distribution of gill net contribution to the commercial gear landings in the SSME-2 area, 1991-1999

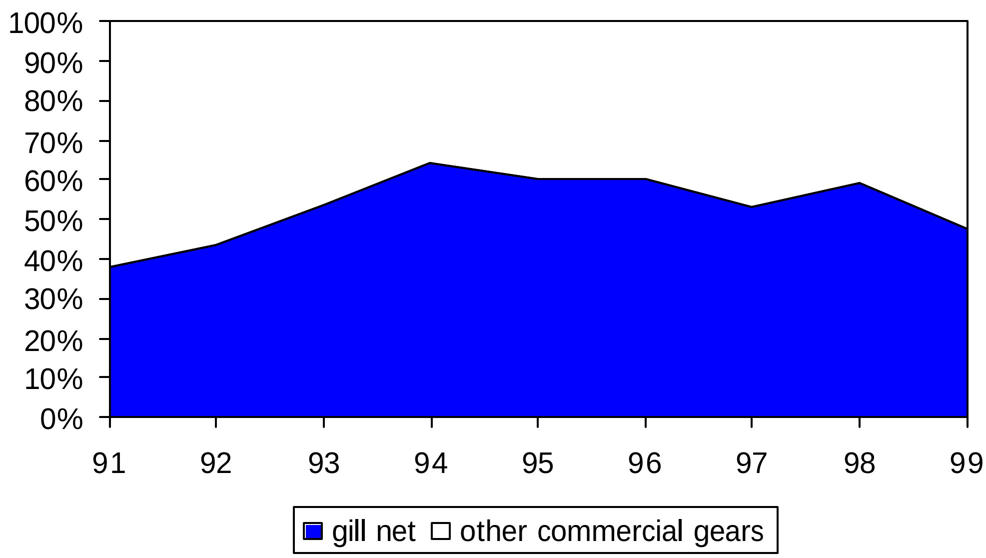


Figure 229f. Temporal distribution of gill net contribution to the commercial gear landings in the SSME-3 area, 1991-1999

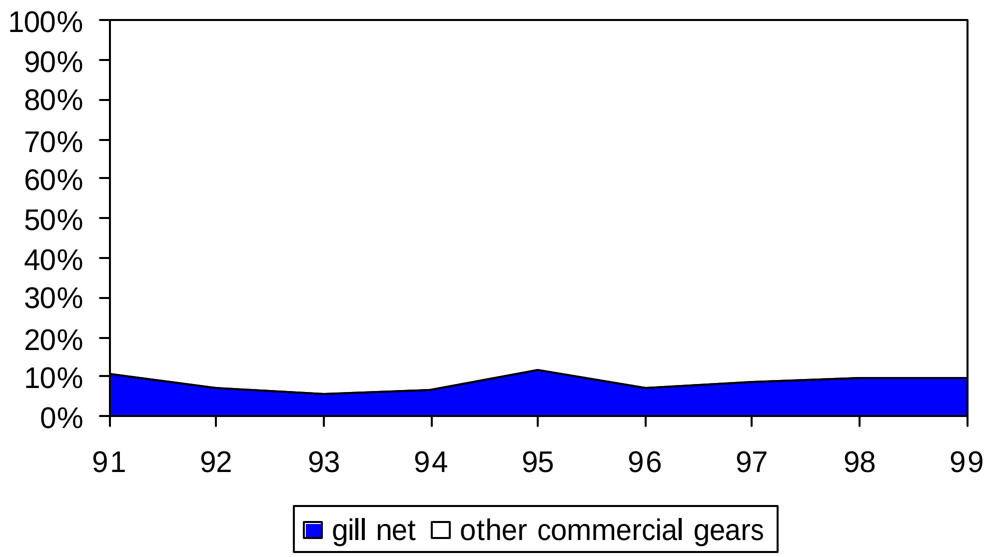


Figure 230. Temporal distribution of lift net landings in the SSME area, 1991-1999

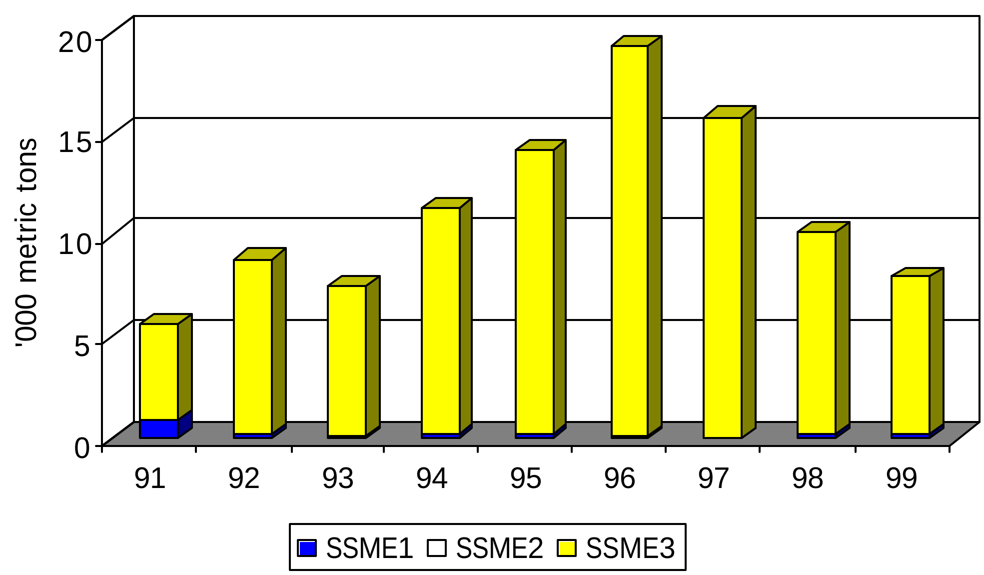


Figure 231. Temporal distribution of lift net landings in the SSME area, 1991-1999

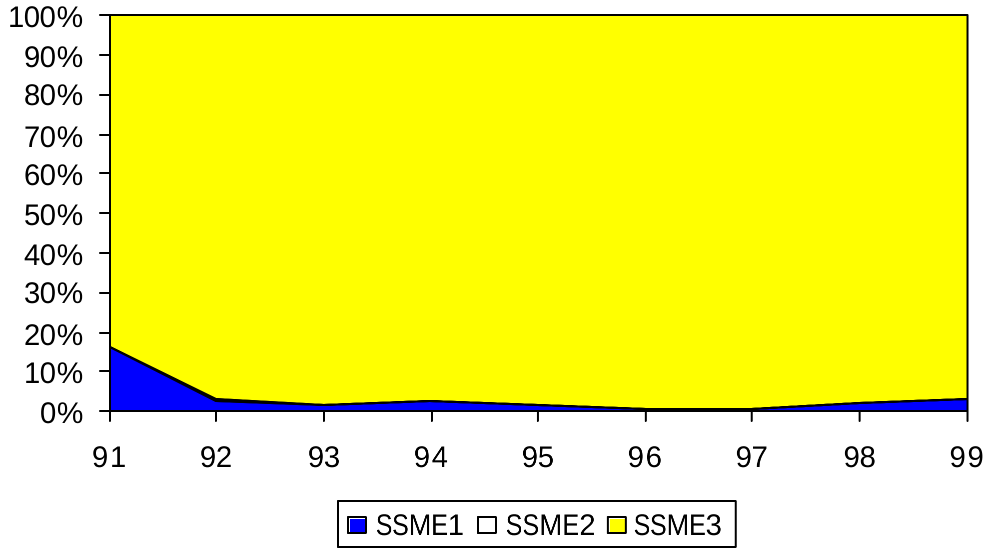


Figure 232. Temporal distribution of lift net landings in the SSME area, 1991-1999 (% annual)

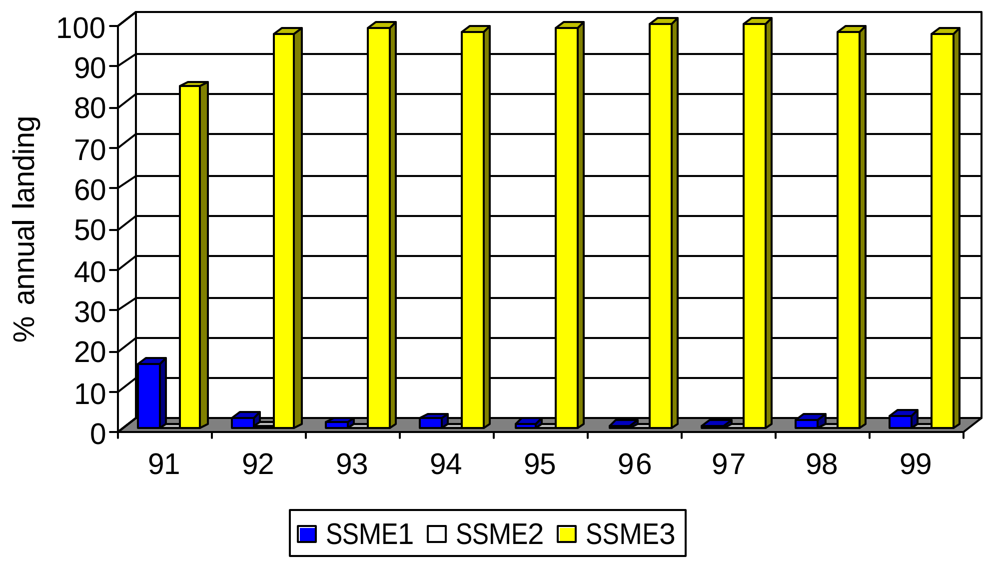


Figure 233a. Temporal distribution of lift net landings in Sabah, 1991-1999

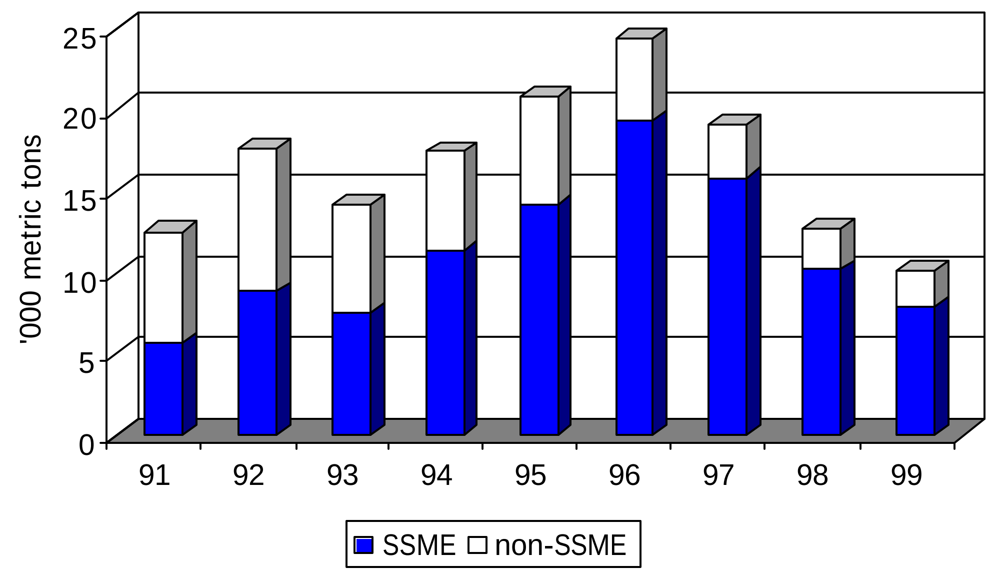


Figure 233b. Temporal distribution of lift net landings in Sabah, 1991-1999

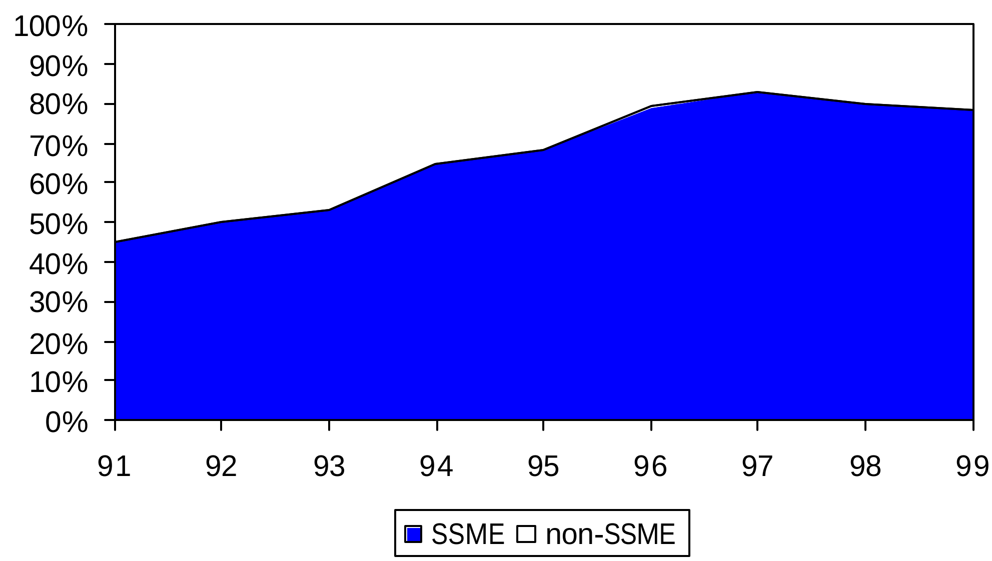


Figure 233c. Temporal distribution of lift net landings in Sabah, 1991-1999 (% annual)

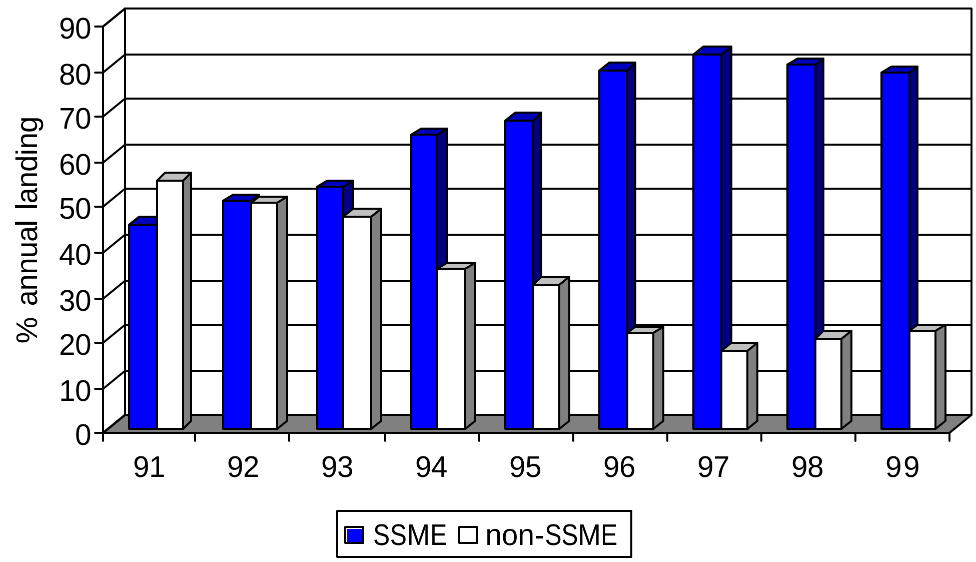


Figure 234a. Temporal distribution of lift net landings in Sabah, 1991-1999

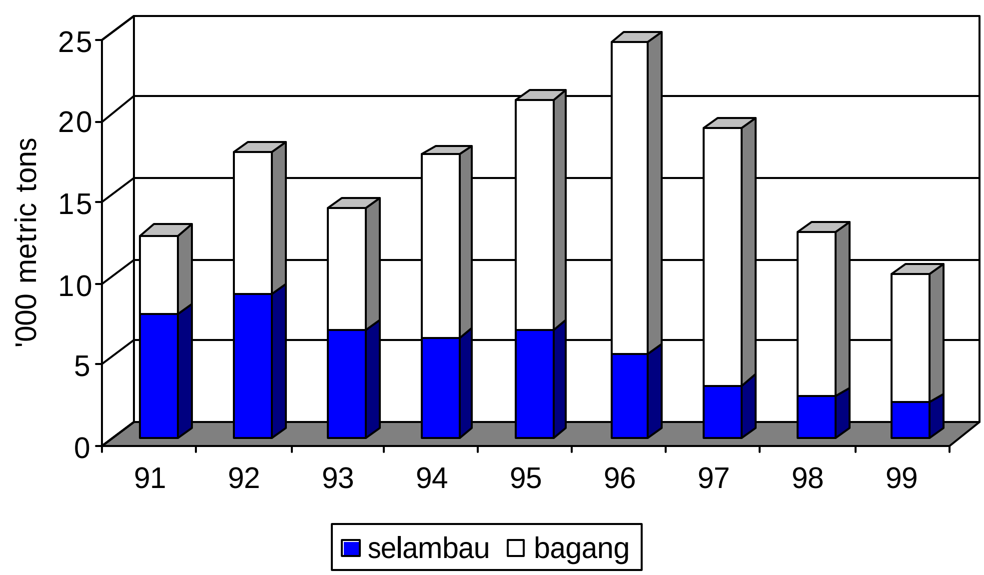


Figure 234b. Temporal distribution of lift net landings in Sabah, 1991-1999 (% annual)

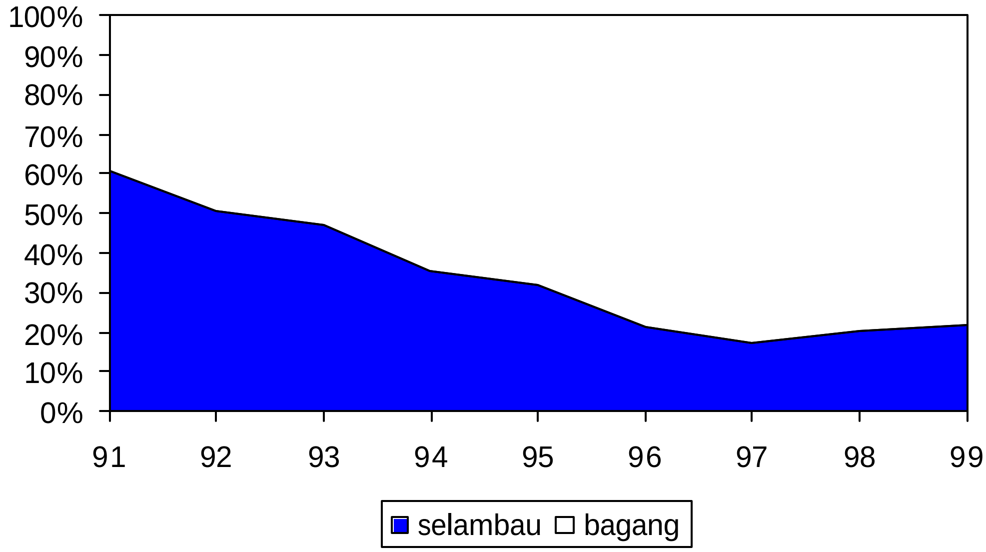


Figure 235a. Temporal distribution of lift net contribution to the traditional gear landings in Sabah, 1991-1999

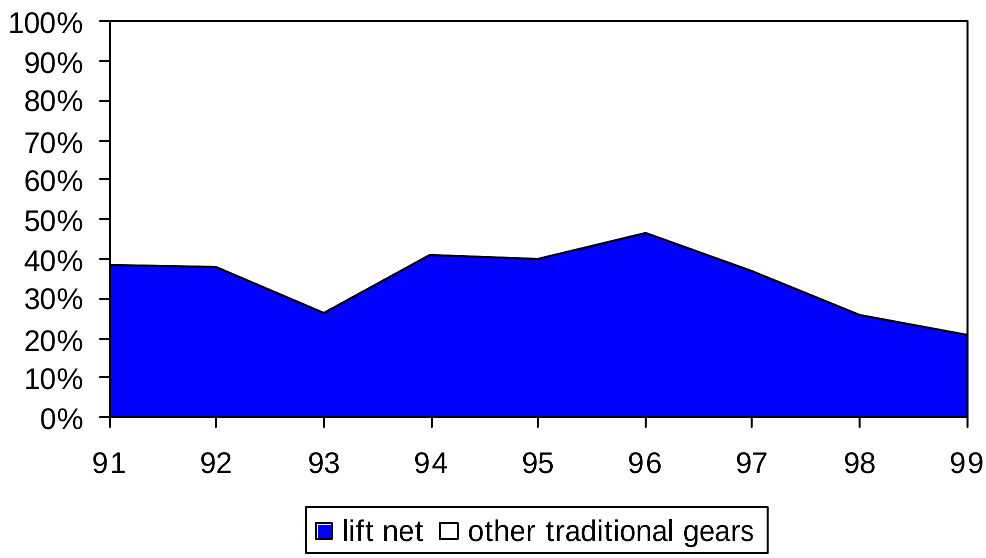


Figure 235b. Temporal distribution of lift net contribution to the traditional gear landings in the non-SSME area, 1991-1999

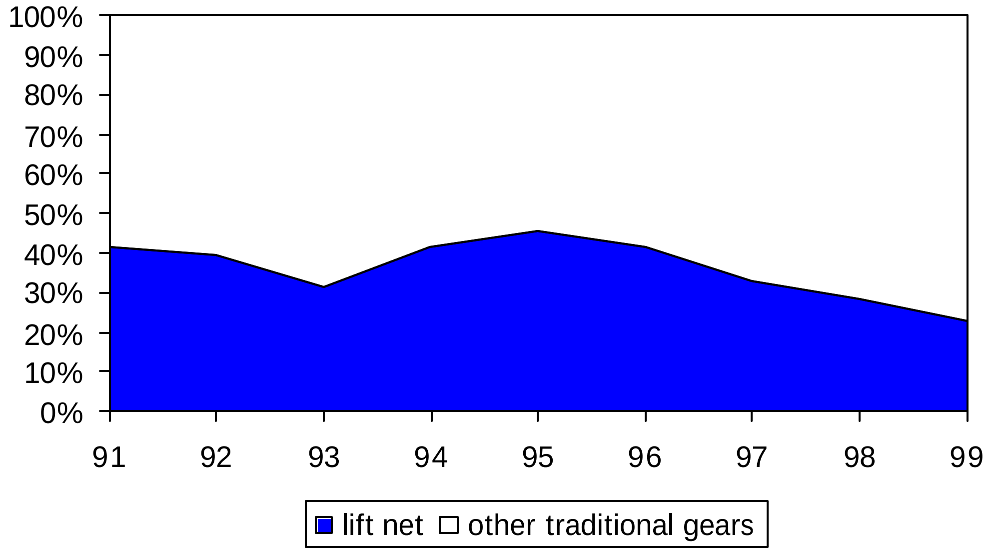


Figure 235c. Temporal distribution of lift net contribution to the traditional gear landings in the SSME area, 1991-1999

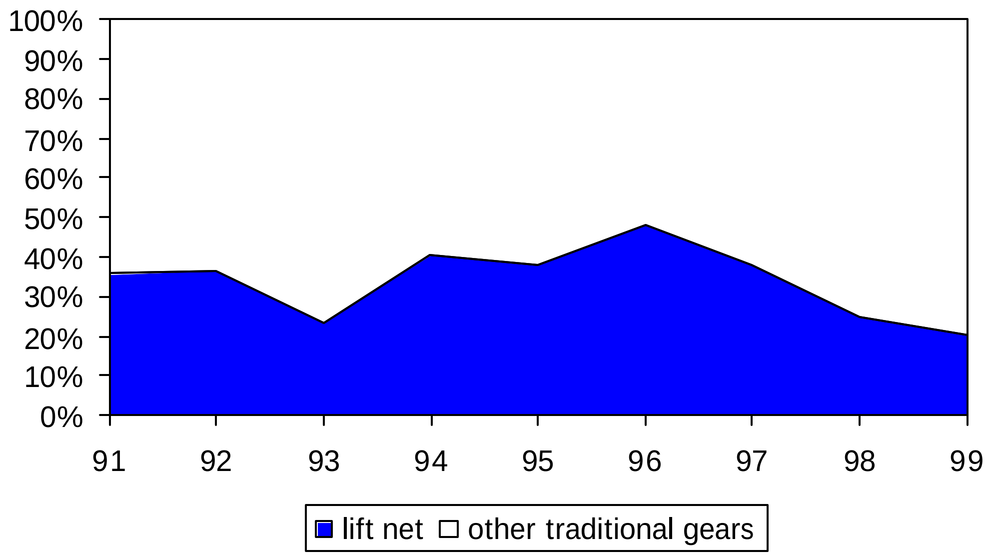


Figure 235d. Temporal distribution of lift net contribution to the traditional gear landings in the SSME-1 area, 1991-1999

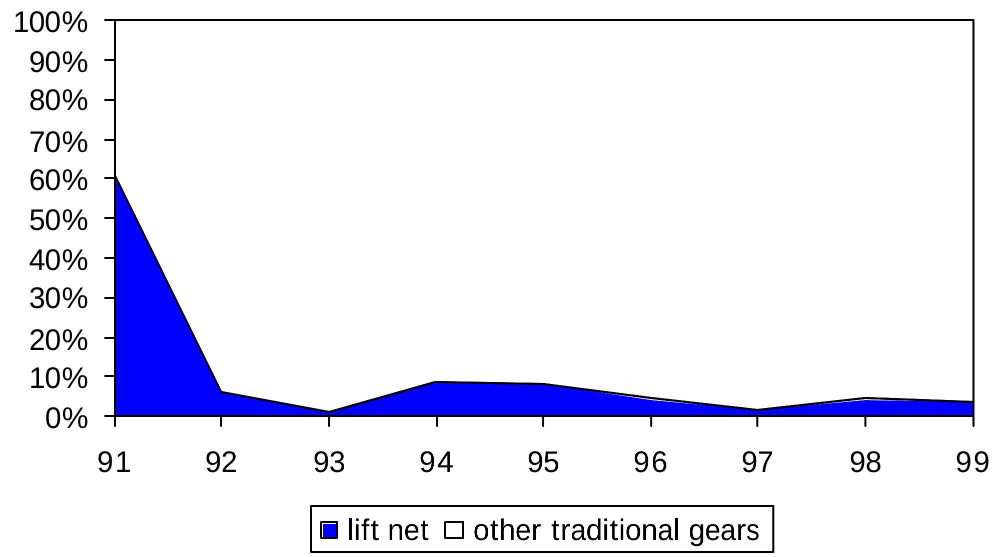


Figure 235e. Temporal distribution of lift net contribution to the traditional gear landings in the SSME-3 area, 1991-1999

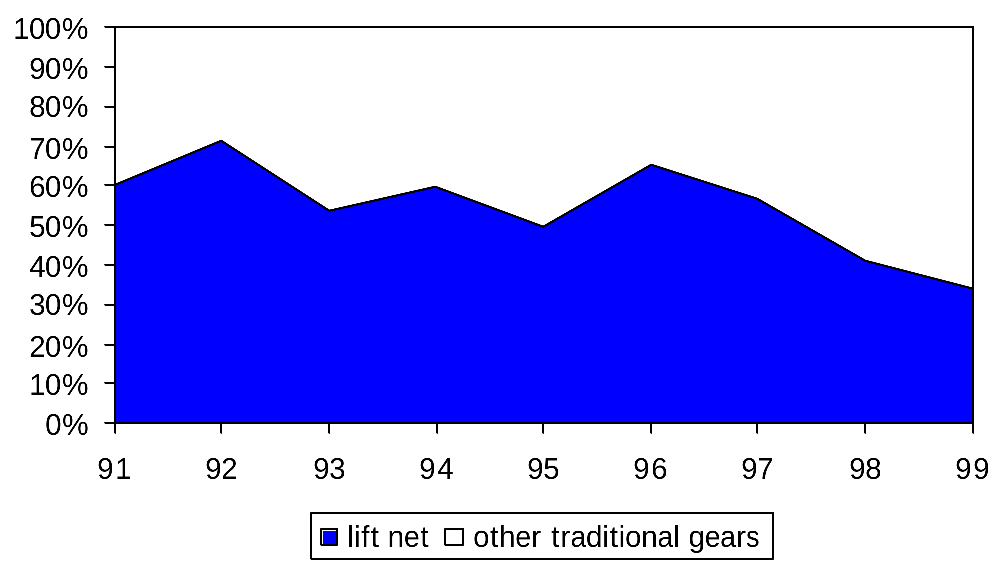


Figure 236. Temporal distribution of hook & line landings in the SSME area, 1991-1999

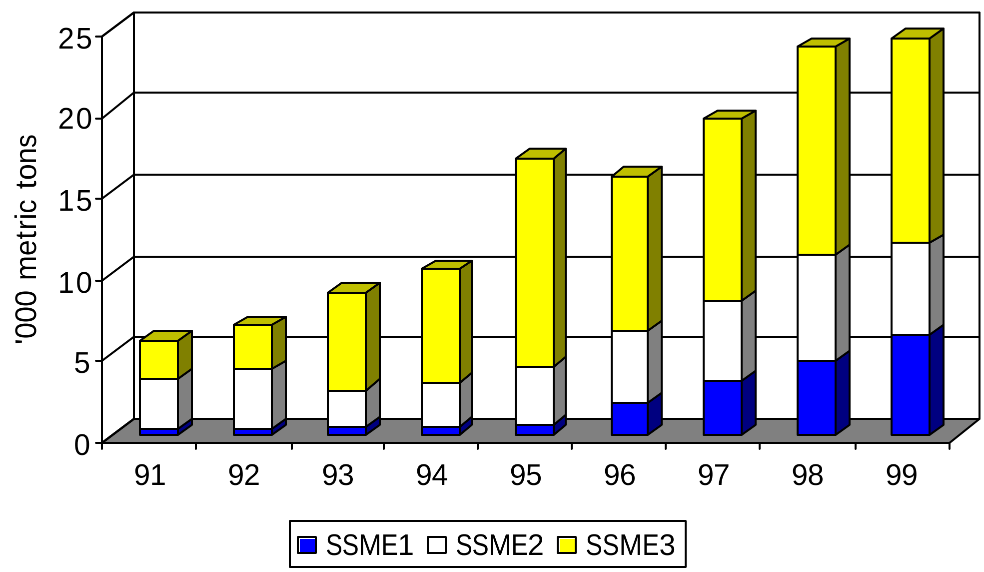


Figure 237. Temporal distribution of hook & line landings in the SSME area, 1991-1999

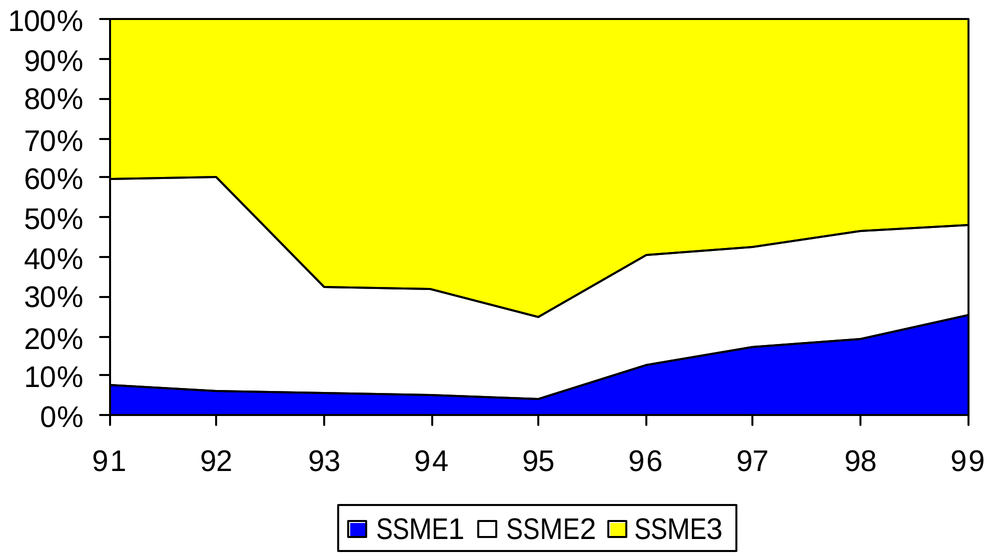


Figure 238. Temporal distribution of hook & line landings in the SSME area, 1991-1999 (% annual)

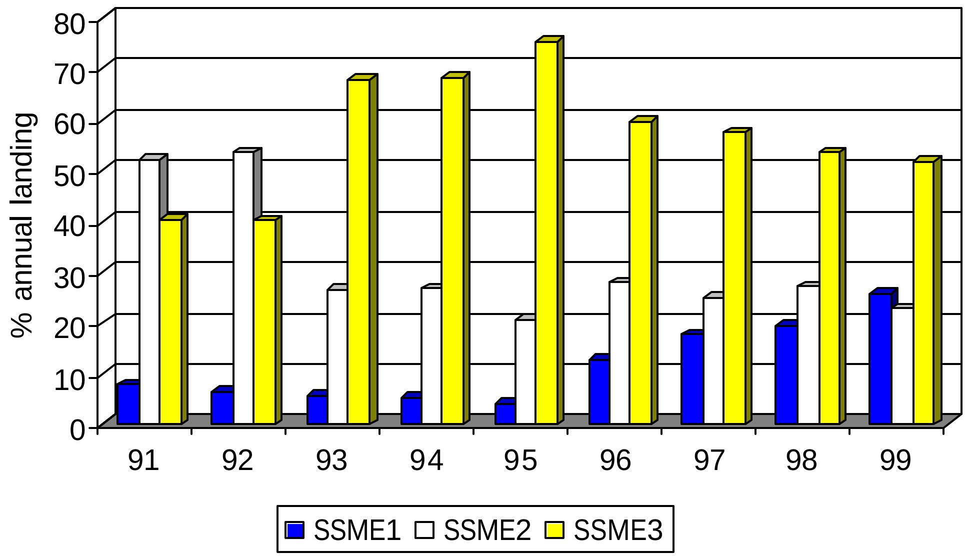


Figure 239. Temporal distribution of hook & line landings in Sabah, 1991-1999

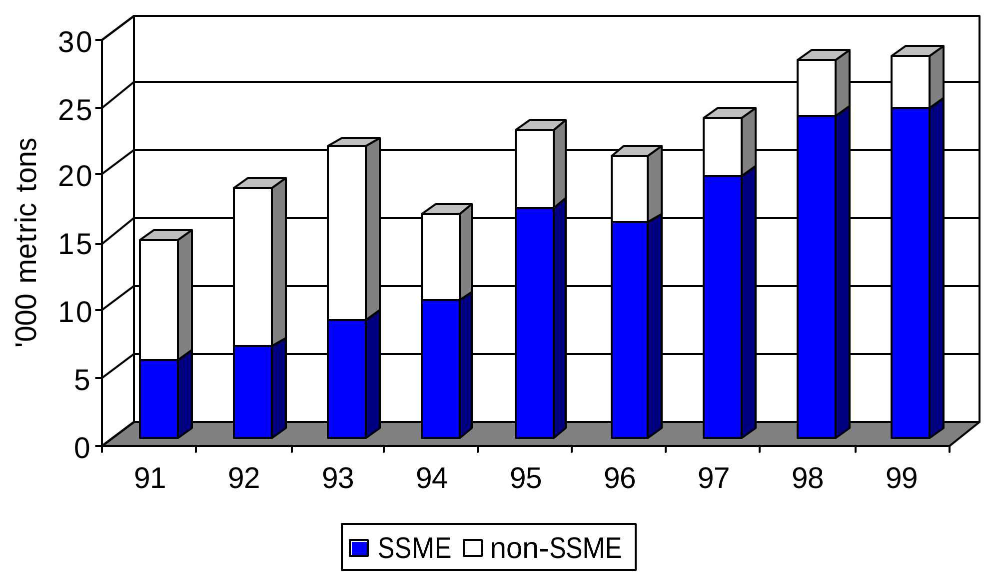


Figure 240a. Temporal distribution of hook & line landings in Sabah, 1991-1999

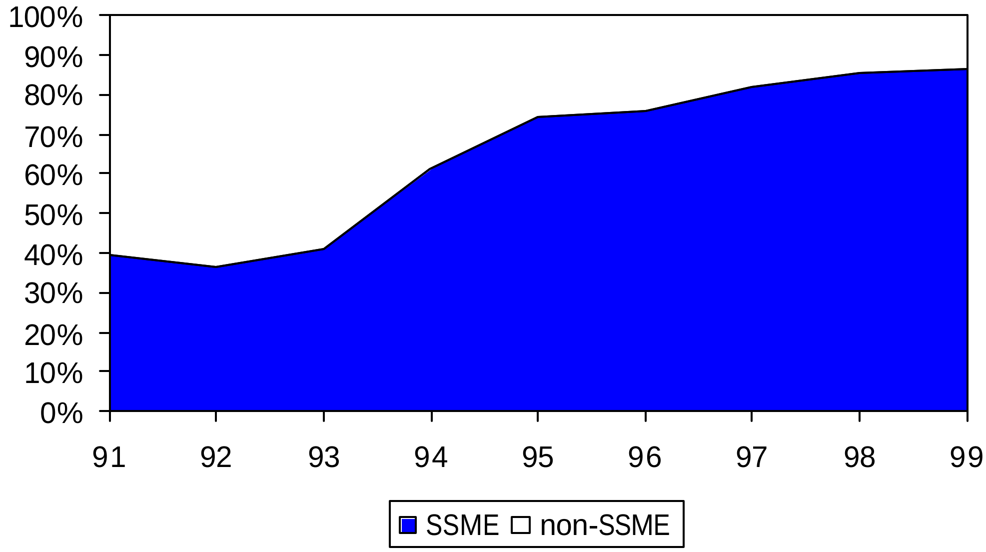


Figure 240b. Temporal distribution of hook & line landings in Sabah, 1991-1999 (% annual)

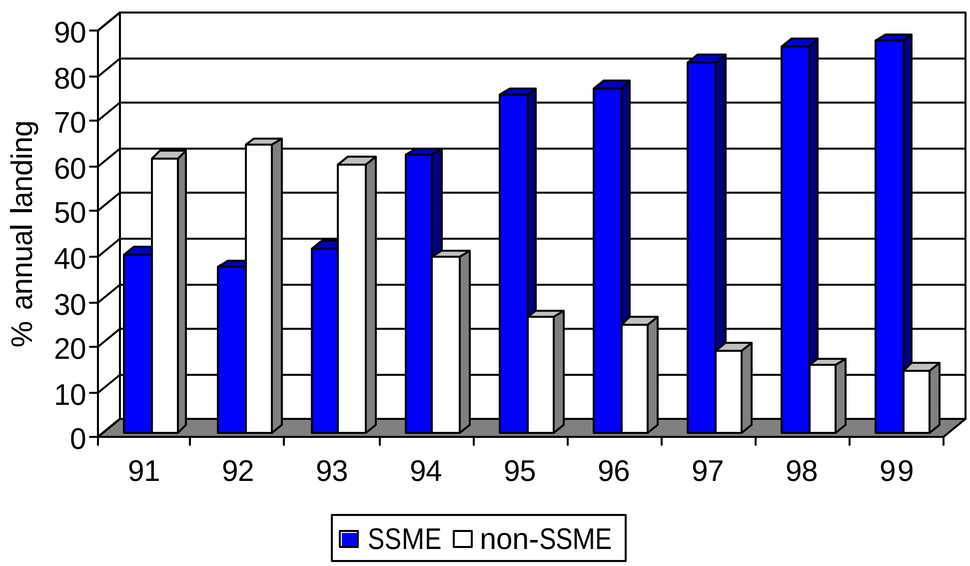


Figure 241a. Temporal distribution of hook & line contribution to the traditional gear landings in Sabah, 1991-1999

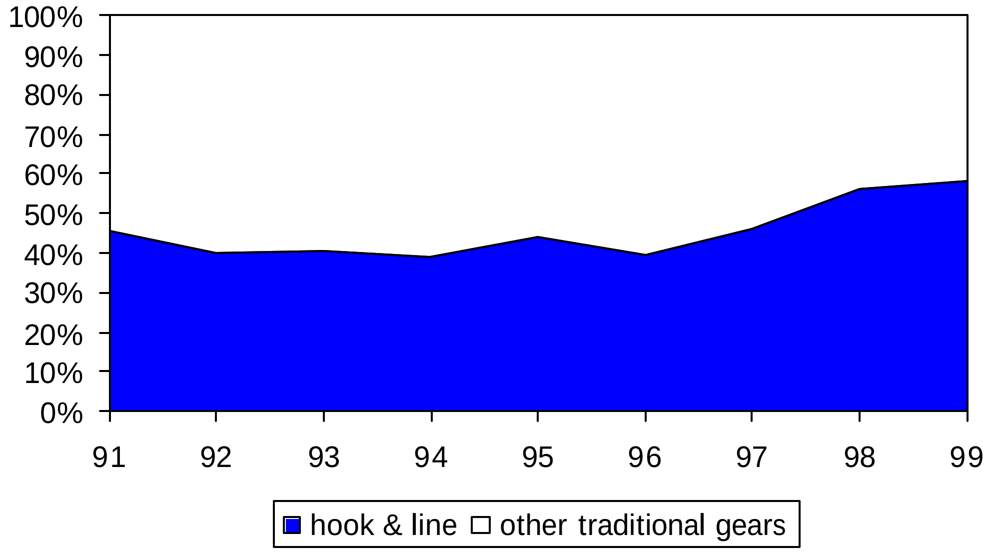


Figure 241b. Temporal distribution of hook & line contribution to the traditional gear landings in the non-SSME area, 1991-1999

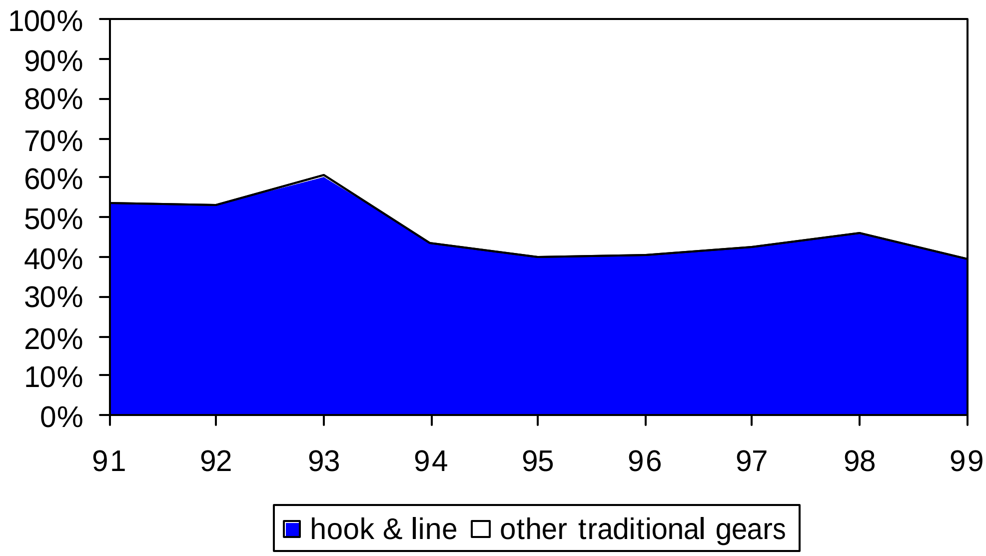


Figure 241c. Temporal distribution of hook & line contribution to the traditional gear landings in the SSME area, 1991-1999

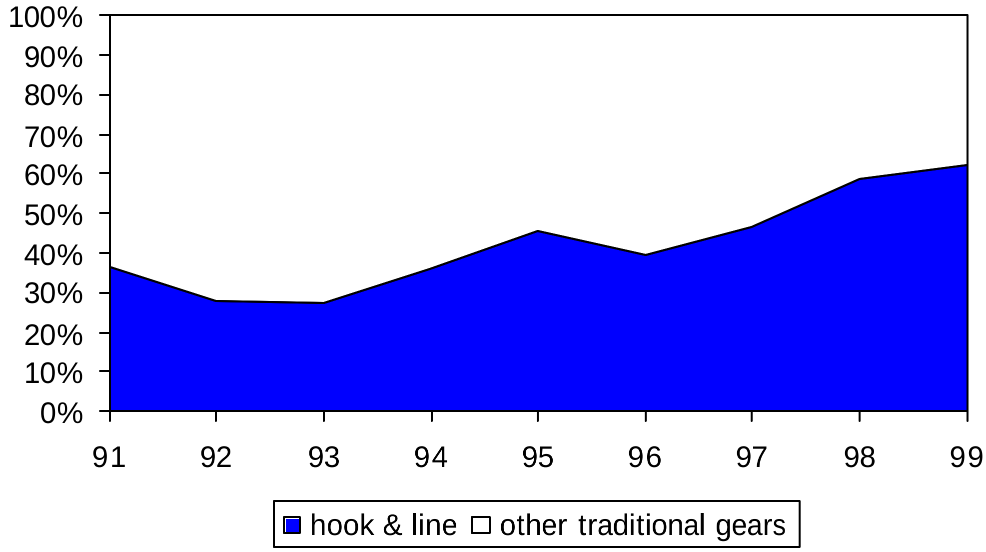


Figure 241d. Temporal distribution of hook & line contribution to the traditional gear landings in the SSME-1 area, 1991-1999

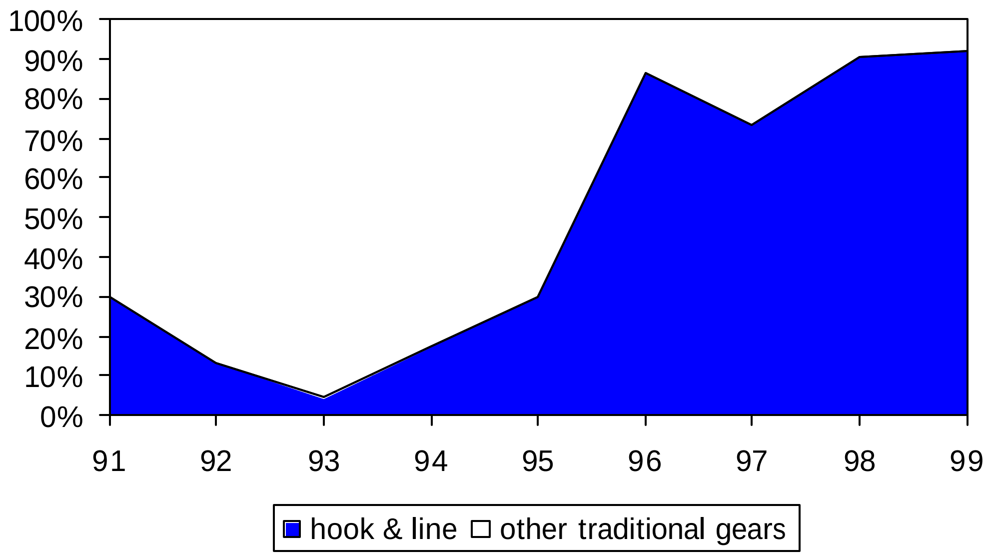


Figure 241e. Temporal distribution of hook & line contribution to the traditional gear landings in the SSME-2 area, 1991-1999

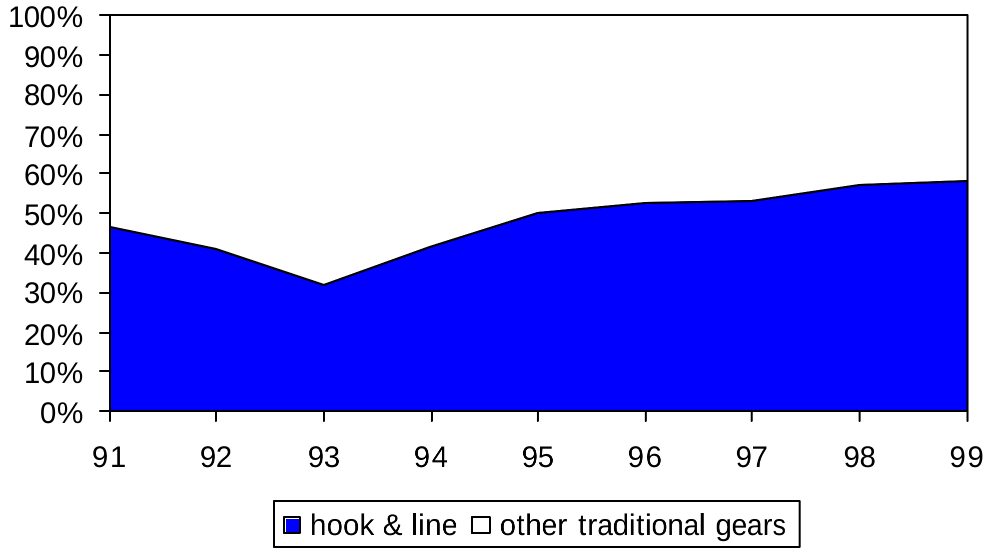


Figure 241f. Temporal distribution of hook & line contribution to the traditional gear landings in the SSME-3 area, 1991-1999

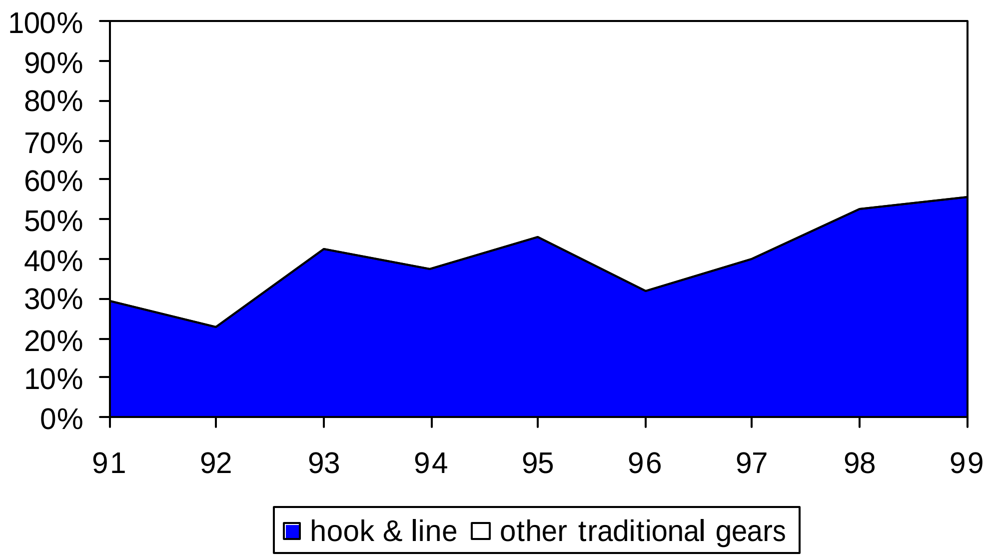


Figure 242. Temporal distribution of misc traditional gear landings in the SSME area, 1991-1999

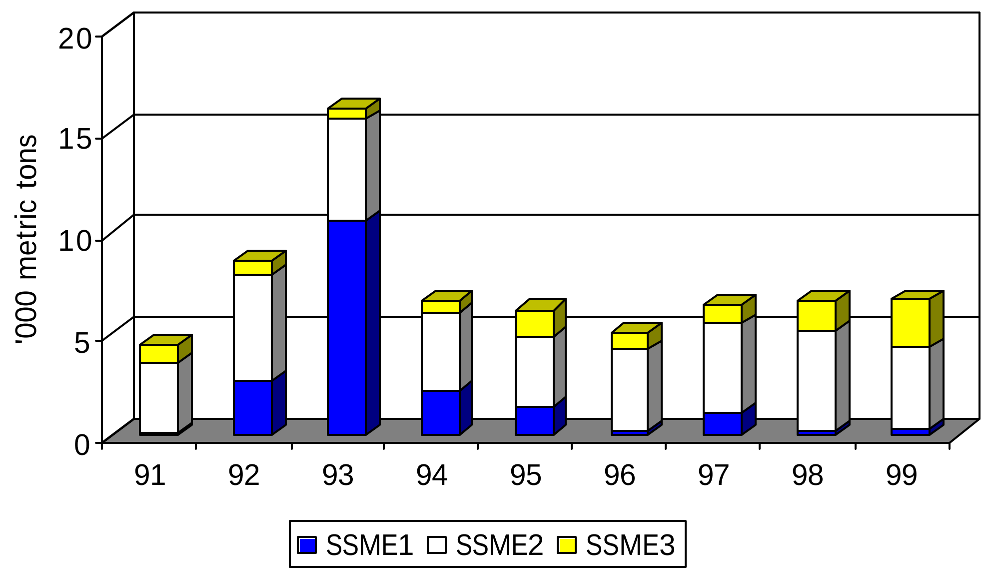


Figure 243. Temporal distribution of misc traditional gear landings in the SSME area, 1991-1999

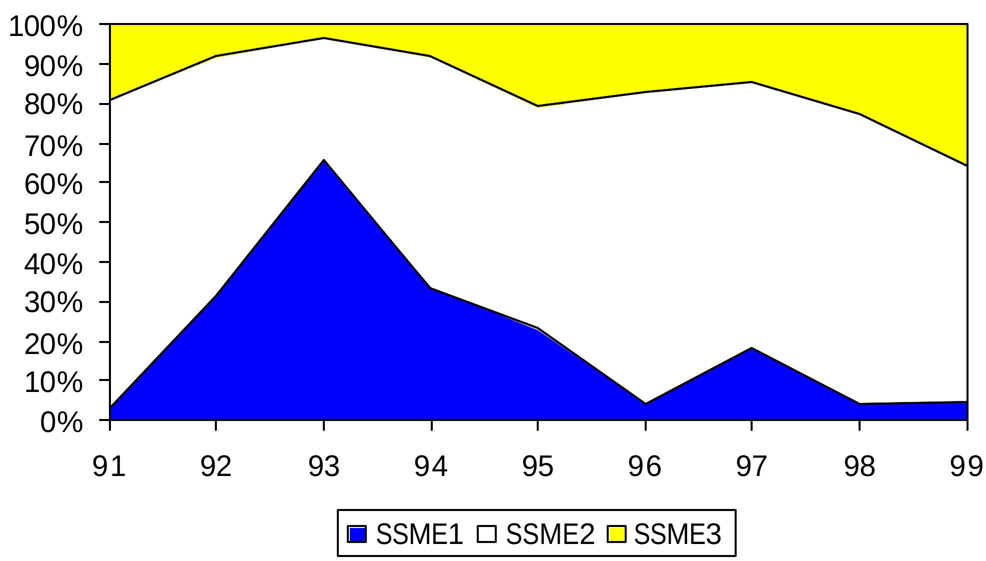


Figure 244. Temporal distribution of misc traditional gear landings in the SSME area, 1991-1999 (% annual)

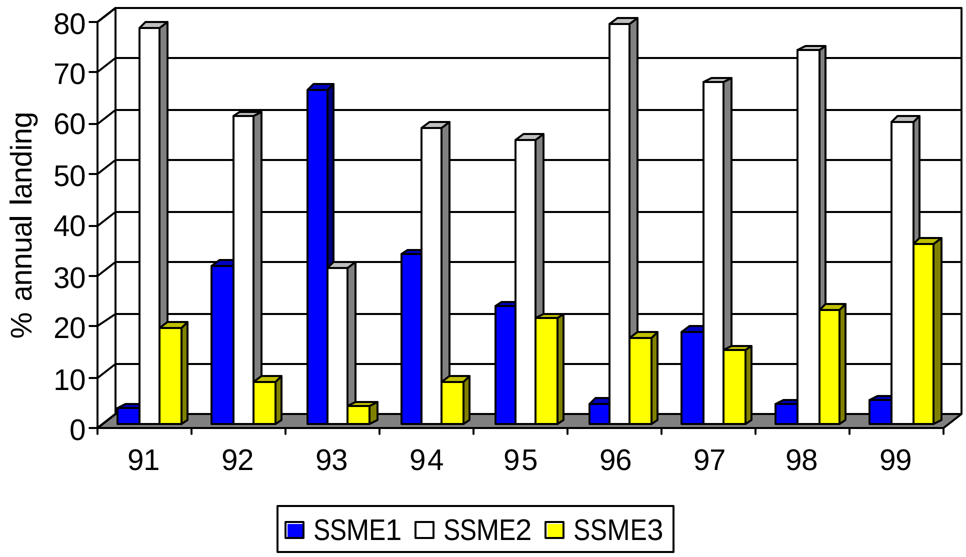


Figure 245. Temporal distribution of misc traditional gear landings in Sabah, 1991-1999

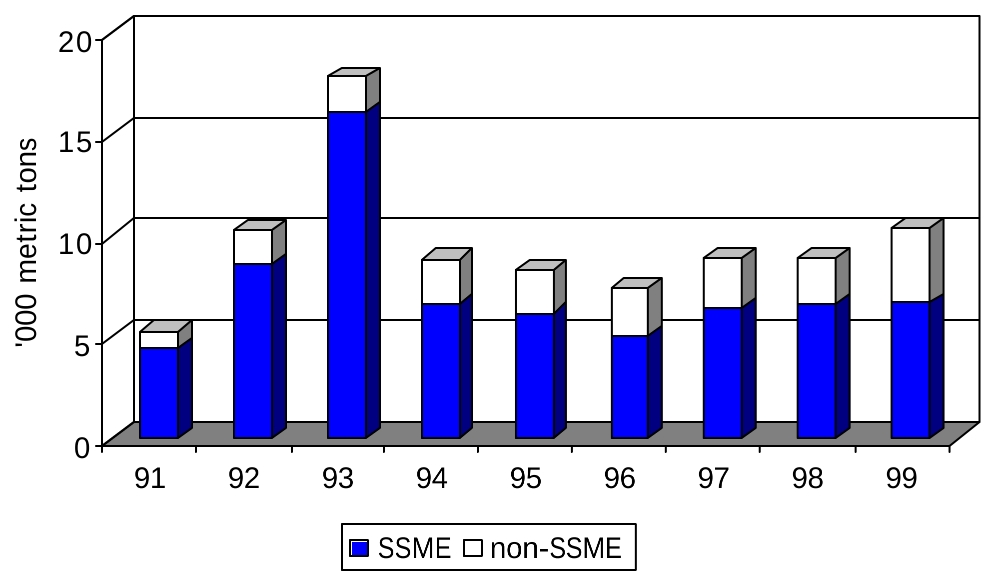


Figure 246a. Temporal distribution of misc traditional gear landings in Sabah, 1991-1999

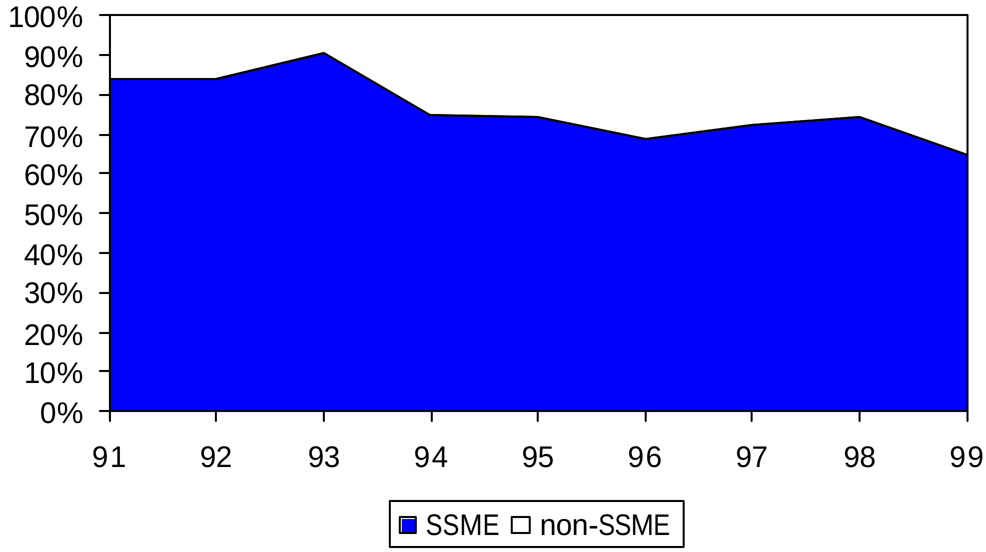


Figure 246b Temporal distribution of misc traditional gear landings in Sabah, 1991-1999 (% annual)

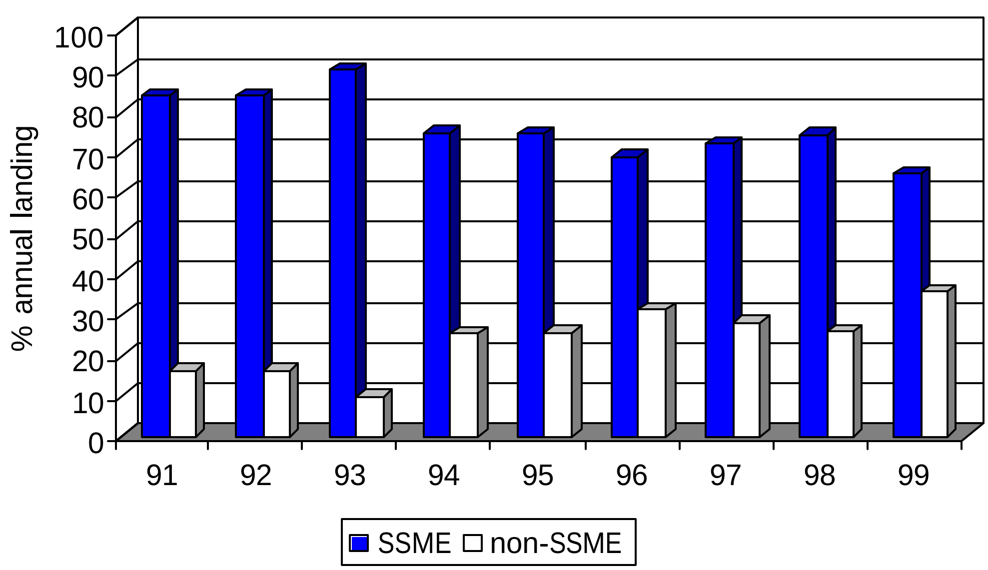


Figure 247a. Temporal distribution of misc. gear contribution to the traditional gear landings in Sabah, 1991-1999

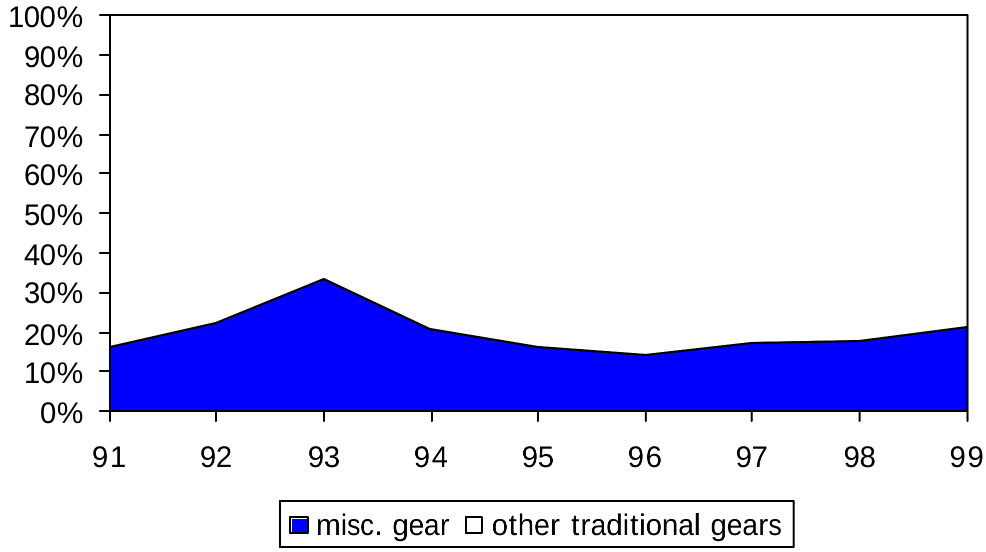


Figure 247b. Temporal distribution of misc. gear contribution to the traditional gear landings in the non-SSME area, 1991-1999

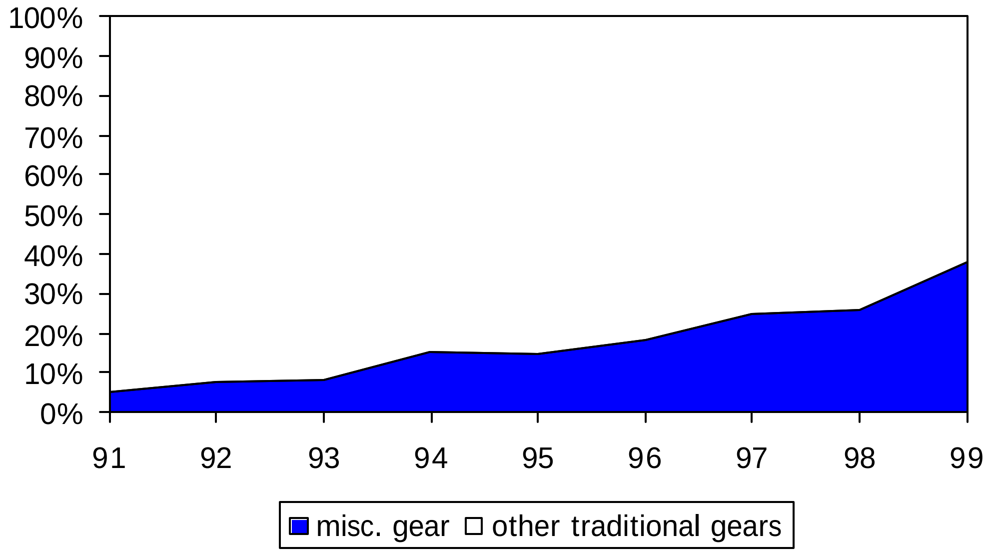


Figure 247c. Temporal distribution of misc. gear contribution to the traditional gear landings in the SSME area, 1991-1999

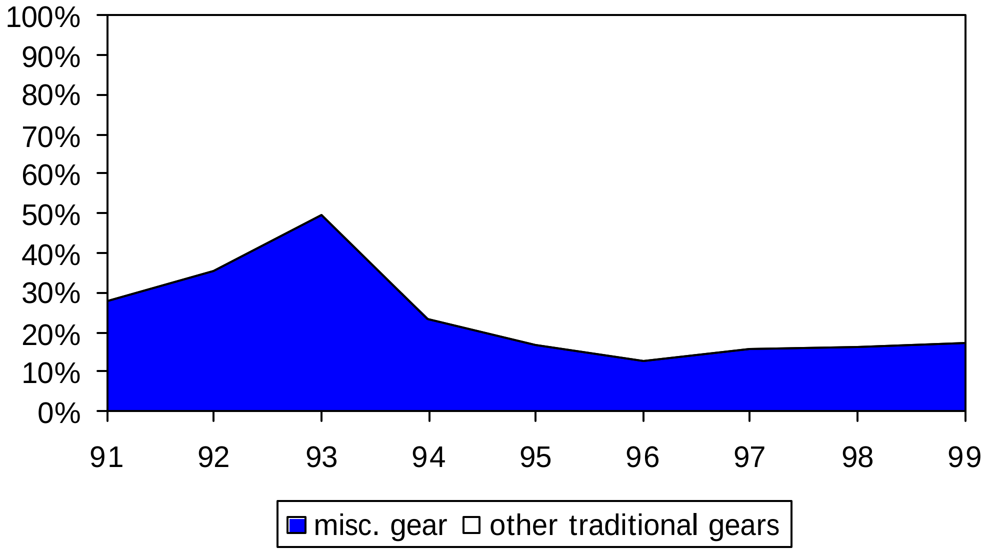


Figure 247d. Temporal distribution of misc. gear contribution to the traditional gear landings in the SSME-1 area, 1991-1999

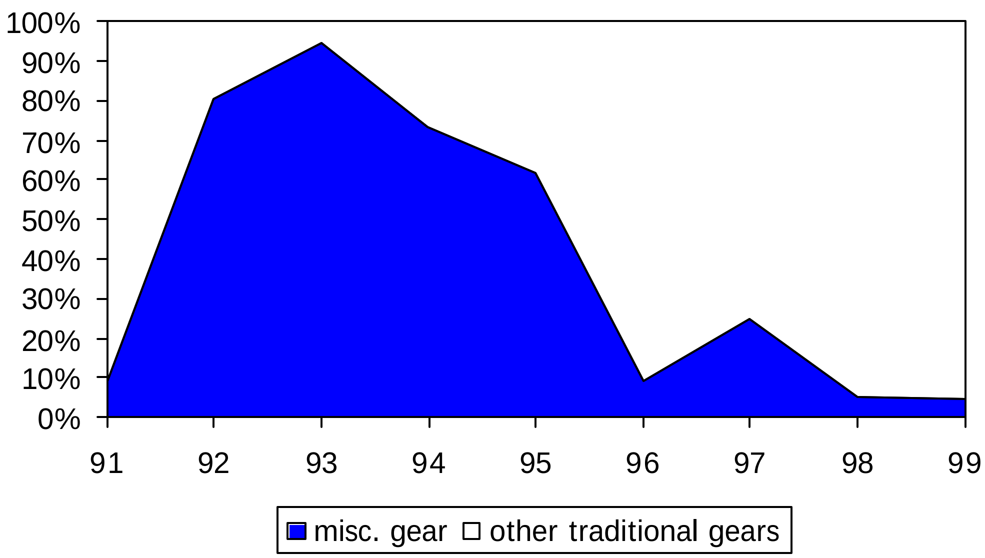


Figure 247e. Temporal distribution of misc. gear contribution to the traditional gear landings in the SSME-2 area, 1991-1999

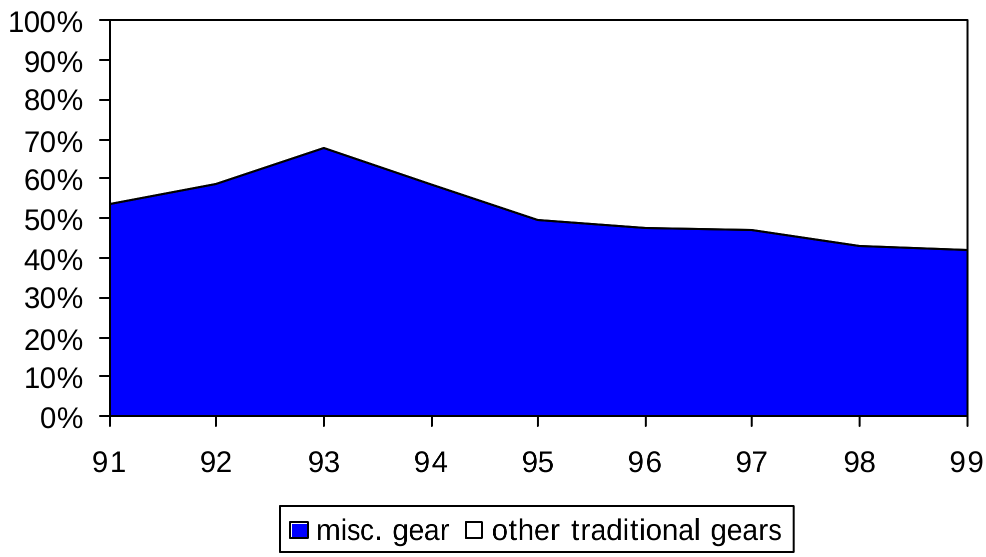


Figure 247f. Temporal distribution of misc. gear contribution to the traditional gear landings in the SSME-3 area, 1991-1999

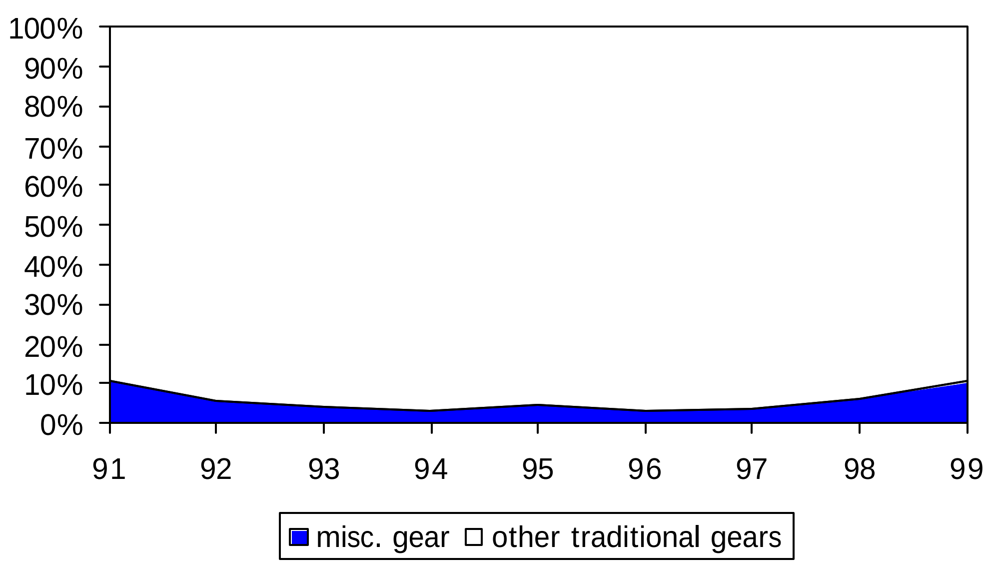


Figure 248. Breakdown marine fish landings by gear type in Sabah (average 1991-1999) (164,197 metric tons)

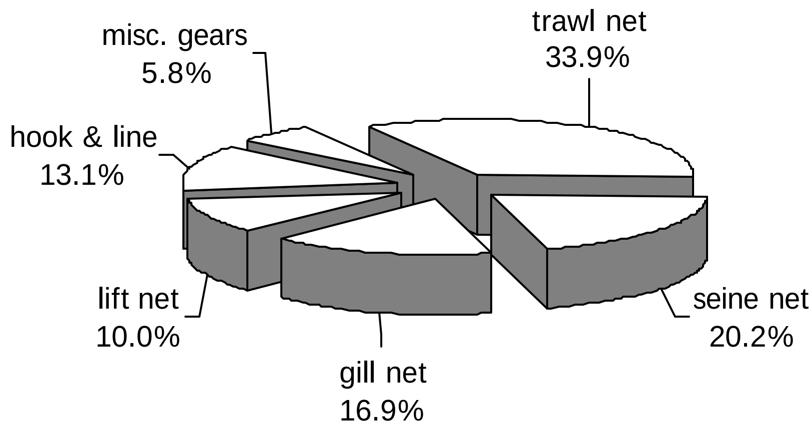


Figure 249. Breakdown marine fish landings by gear type in the non-SSME area (average 1991-1999) (53,805 metric tons)

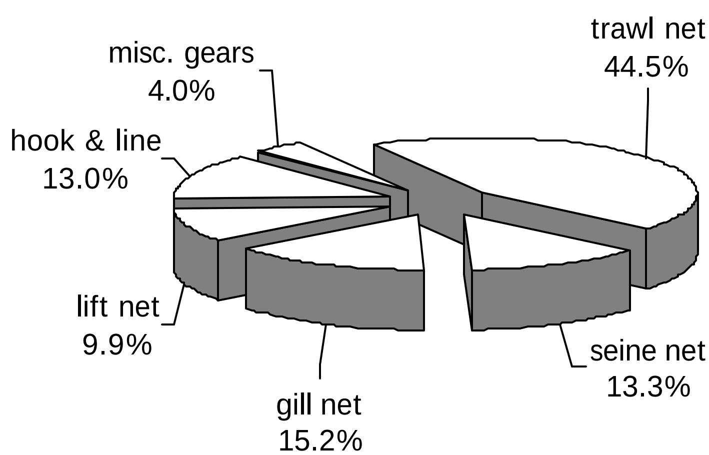


Figure 250. Breakdown marine fish landings by gear type in the SSME area (average 1991-1999) (111,143 metric tons)

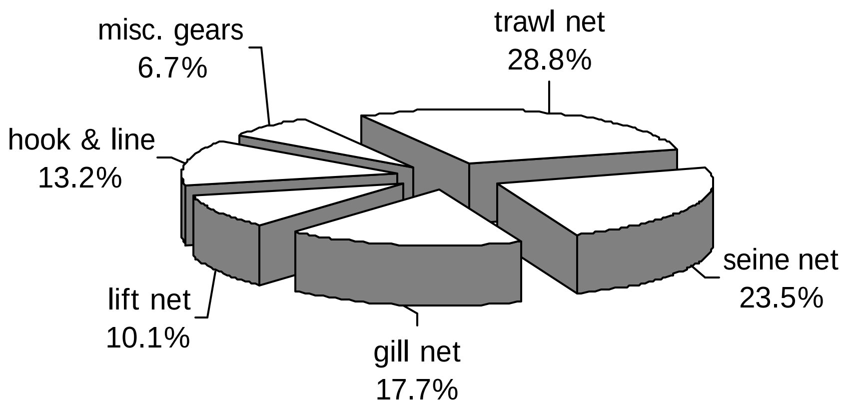


Figure 251. Breakdown marine fish landings by gear type in the SSME-1 area (average 1991-1999) (27,105 metric tons)

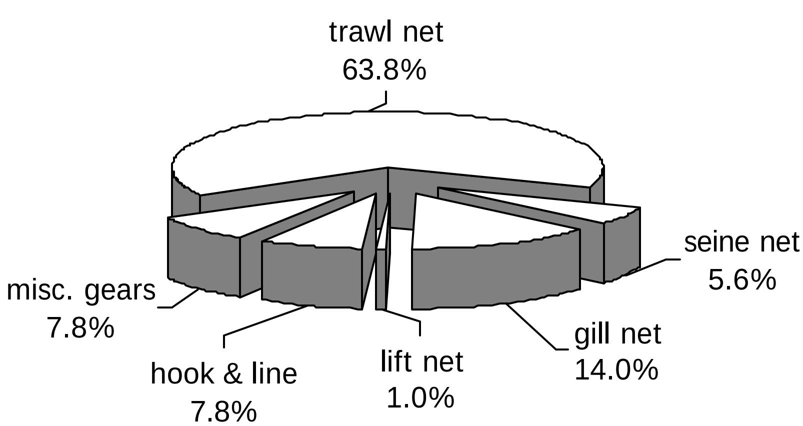


Figure 252. Breakdown marine fish landings by gear type in the SSME-2 area (average 1991-1999) (32,791 metric tons)

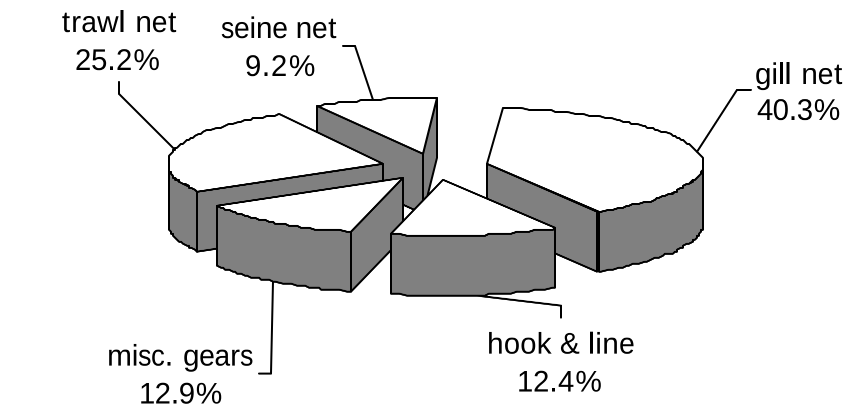
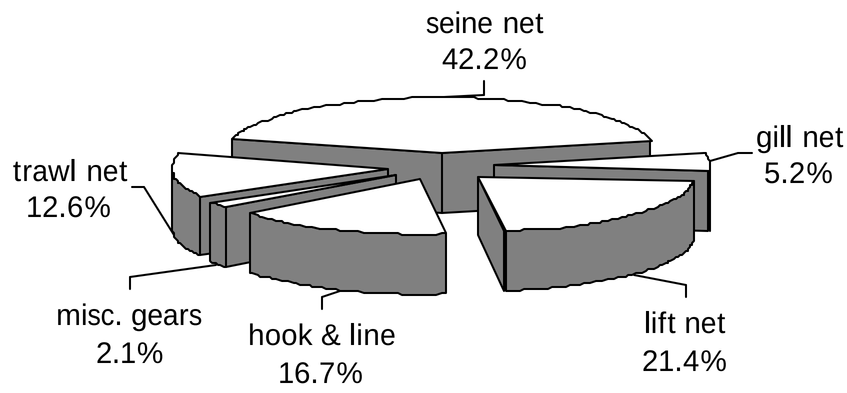


Figure 253. Breakdown marine fish landings by gear type in the SSME-3 area (average 1991-1999) (51,247 metric tons)



Resource Landings

The main components of the demersal landings in Sabah comprised of finfish, penaeid shrimps and invertebrates. Finfish comprised of 400-odd species of bottom fishes, reef resident species and elasmobranches. Trash fish is also an important component of the demersal finfish landings. Invertebrates comprised of shellfish, jellyfish, cephalopods, crustaceans, sea cucumbers and other types of invertebrates. The backbone of the pelagic landings in Sabah comprised of various coastal pelagic species dominated mainly by carangids, scombrids, clupeids, engraulids and other families. Among the common pelagic species making up the bulk of the pelagic in Sabah include coastal and oceanic tunas, sardine, round scad, mackerel and anchovy. Anchovy is mainly caught in the SSME-3 area, which formed the backbone of the SSME *bagang* fishery. During the 1991-1999 period, the above species contributed around 60-70% to the annual pelagic landings in Sabah. The annual pelagic landings comprised of 100-odd species distributed among 50 genera and 20 families. Some of these species are seasonal in nature and only appear in the landings during certain months of the year. The 1998-1999 regional landing breakdown by ISSCAAP[128] listing is summarized in **Table A48**. The quarterly and annual landing breakdown by fishing region, fishing gear and resource types are given in Tables A49-A69.

The annual demersal landing composition for the 1991-1999 period are shown respectively in **Figures 255c-255d** (non-SSME area) and **Figures 255e-255f** (SSME area). The annual demersal landing composition by fishing districts in the SSME area during the 1991-1999 period are shown respectively in **Figures 256a-256r** (SSME-1), **Figures 257a-255p** (SSME-2) and **Figures 258a-258t** (SSME-3). The average marine fish landing breakdown by gear type for the SSME and non-SSME areas are given respectively in **Figures 262a-262d** and **Figure 262e**. The overall marine fish breakdown by gear type in Sabah is summarized in **Figure 262f**. The regional annual demersal landing breakdown by gear type is summarized in **Figures 263a-263h** (combined demersal), **Figures 264a-264h** (finfish), **Figures 265a-265h** (shrimp) and **Figures 266a-266h** (invertebrates).

The temporal pelagic species landing breakdown distribution by fishing region is shown in **Figures 259a-259l**. The temporal distribution of individual pelagic fish landings is respectively shown for mackerels (**Figures 259m-259n**), round scads (**Figures 259o-259p**), sardines (**Figures 250q-250r**), anchovies (**Figures 259s-259t**), tunas (**Figures 259u-259v**) and other miscellaneous pelagic species (**Figures 259w-259x**). The temporal distribution of annual pelagic landing breakdown by fishing districts in the SSME area are shown in **Figures 260a-260f** (SSME-1 area), **Figures 260g-260j** (SSME-2 area) and **Figures 260k-260r** (SSME-3 area). The average annual pelagic landing breakdown summarized for the 1991-1999 period is shown in **Figures 261a-261b**. The average annual pelagic landing breakdown by gear type and fishing region for the 1997-1999 period is shown in **Figures 267a-267e**. The average annual pelagic landing breakdown by gear type and fishing districts in the SSME area is shown in **Figures 268a-268d**. The average annual pelagic species landing breakdown by gear type is given for mackerels (**Figures 260a-269h**), round scads (**Figures 270a-270h**), sardines (**Figures 271a-271h**), anchovies (**Figures 272a-272h**), tunas (**Figures 273a-273h**) and miscellaneous pelagic species (**Figures 274a-274h**).

The annual resource landings breakdown by fishing region and district for the 1991-1999 period is given in *Tables 151-169*. The summary of the annual fishing gear landings by resource type is given in respectively in *Tables 107b-107d* (non-SSME area), *Tables 112-115* (SSME area), *Tables 121-127* (SSME-1), *Tables 130-133* (SSME-2) and *Tables 136-145* (SSME-3).

[128] International Statistical Standard Classification of Aquatic Animals and Plants

The principal demersal gears are trawl net, hook & line and gill net. These gears contributed more than 80% to the annual demersal landings in 1997-1999 (*Table 183* & **Figures 263a-263h**). The contribution of these gears to the annual demersal finfish, shrimp and demersal invertebrate landings during the 1997-1999 period is shown respectively in **Figures 264a-264h** (finfish), **Figures 265a-265h** (shrimp) and **Figures 266a-266h** (invertebrates).

On the other hand, the principal pelagic gears are more diverse, where both commercial and traditional gears play equally important contribution to the annual landings. In general, seine net and trawl net are the principal gears contributing about 60% to the annual pelagic landings, with secondary gears comprising of gill net, lift net and hook & line contributing the remaining 40%.

Pelagic landings in 1999 amounted to 96,410 metric tons or 46.5% of the total fish landings. Round scad (*Decapterus* spp.) make up 16.1% of the pelagic landings, followed by sardine (*Sardinella* spp.) (14.9%), tuna (11.8%), Indian mackerel (*Rastrelliger* spp.) (9.0%), horse mackerel (*Carangoides* spp., *Alectis indica* & *Caranx sexfasciatus*) (5.8%), Japanese mackerel (*Scomber australasicus*) (5.7%), Spanish mackerel (*Scomberomorus* spp.) (5.5%), barracuda (*Sphyraena* spp.) (5.2%), selar scad (*Selar* spp.) (3.2%), anchovy (*Stolephorus* spp.) (2.8%), slender shad (*Illisha elongata*) (2.7%), queen fish (*Scomberiodes commersonianus*) (2.4%), threadfin (*Polynemus* spp.) (2.4%), hardtail scad (*Megalapsis cordyla*) (2.1%), mullet (*Valamugil* spp.) (1.9%), ribbon fish (*Trichiurus lepturus*) (1.9%), and other miscellananeous pelagic species (8.5%).

Other common miscellaneous pelagic species include amberjack (*Seriolina nigrafasciata*), black kingfin (*Rachycentron canadus*), black pomfret (*Formio niger*), white pomfret (*Pampus argenteus*), Chinese pomfret (*Pampus chinensis*), golden trevally (*Caranx speciosus*), ox-eyed scad (*Selar boops*), bigeye scad (*Selar crumenopthalmus*), rainbow runner (*Elagatis bipinnulatus*), wolf herring (*Chirocentrus dorad*), Indo Pacific tarpon (*Megalops cyprinoides*), sailfish (*Istiophorus* spp.) and marlin (*Makaira* spp.). *Rastrelliger kanagurta* and *R. brachysoma* are the common Indian mackerel species, with *R. faughni* being seasonal and repesent only a small portion of the landings. Round scad is represented by at least six species, with three common species making up most landings, including *D. macrosoma*, *D. maruadsi* and *D. russelli*. Common tuna species comprised mainly of neretic species including kawakawa (*Euthynnus affinis*), frigate tuna (*Auxis thazard*), longtail tuna (*Thunnus allalunga*) and oriental bonito (*Sarda orientalis*) that make up the bulk of the annual tuna landings. In SSME-3, the common oceanic tunas are yellowfin tuna with bigeye tuna being less dominant in Semporna and Sandakan waters. On the other hand, bigeye tuna is more dominant in the non-SSME area. Oceanic tunas are mainly caught using longlines. Diadromous species including shads are included as pelagic fishes. Among common shad species include Chacunda shad (*Anodontosoma chacunda*), ordinary shad (*Pellona* spp.), slender shad (*Hilsa elongata*) and longtail shad (*Hilsa macrura*).

Overall, carangids represented 33.1% of the pelagic landings in 1999, followed by scombrids (32.6%), clupeids (14.9%), mixed shads (3.4%), engraulids (2.8%) and other miscellaneous pelagic families (13.2%). Round scad represented 48.6% of the carangid landings, followed by horse mackerel (17.6%), selar scad (9.4%), queen fish (7.4%), hardtail scad (6.3%), yellow-stripped trevally (4.3%) and other miscellaneous species (6.5%). On the other hand, tuna represented 36.3% of the scombrid landings, followed by Indian mackerel (27.7%), Japanese mackerel (17.4%), Spanish mackerel (16.9%), marlin (1.0%) and sailfish (0.6%).

Demersal landings amounted to 110,801 metric tons in 1999, comprising of finfish (75.3%), invertebrates (14.7%) and shrimps (10.0%). Demersal species make up 53.3% of the total landings. Finfish landings amounted around 83,478 metric tons, comprising of commercial species (62.2%), sharks (3.5%), rays (3.4%) and trash fish including unsorted trawl by-catch

(30.8%). Threadfin bream - Nemipteridae make up 16.2% of the commercial fish landings, followed by snappers – Lutjanidae (15.8%), grouper – Serranidae (12.6%), catfish (9.3%), lizard fish – *Saurida* spp. (6.9%), jew fish – Scianidae (6.1%), humphead wrasse (3.3%), flat fish (3.3%), conger eel (2.6%), slipmouths – Leiognathidae (2.6%), barramundi – *Lates calcarifer* (2.2%) and various species of bottom & reef resident fishes (19.3%). Invertebrate landings amounted to 16,265 metric tons, comprising of cephalopods (55.4%), mangrove crabs (17.4%), pelagic crabs (17.1%), shellfish (6.4%), lobsters (2.6%), sea cucumbers (1.1%) and other crustaceans & invertebrates (0.1%). Other common miscellaneous demersal and reef resident fishes in the landings include goatfish (*Upeneus* spp.), spotted sicklefish (*Drepane punctata*), fulsier (*Caesio erythrogaster*), rabbit fish (*Siganus* spp.), grunter (*Pomadasys* spp.), trigger fish (*Abalistes stellaris*), silver biddy (*Gerres filamentosus*), spade fish (*Ephippus orbis*), Bombay duck (*Harpodon nehereus*), conger eel (*Muraenesox* spp.), whiting (*Silago* spp.), monocle beam (*Scolopsis* spp.), emperors (*Lethrinus* spp.), false trevally (*Lactarius lactarius*), and many other reef resident fishes not recorded in the SMPP landing records.

Shrimp landings amounted around 11,058 metric tons or 10% of the demersal landings in 1999. Banana shrimp (*Penaeus merguiensis*) make up the bulk (43.3%) of the shrimp landings in Sabah, followed by sand shrimp (*Metapeneopsis stridulans*, *M. barbeensis* & *Trachypenaeus fulvus*) (14.6%), yellow shrimp (*Metapenaeus brevicornis*) (11.3%), *Acetes* shrimp (9.5%), pink shrimp (*Metapenaeus affinis*, *M. ensis* & *M. intermedius*) (6.2%), sharp rostrum shrimp (*Parapenaeopsis hardwickii* & *P. coromandelica*) (5.9%), rainbow shrimp (*Parapenaeopsis sculptilis*) (4.3%), tiger shrimp (*Penaeus monodon*) (3.4%) and various other penaeid species (1.5%). Other penaeid shrimps landed by trawlers and other demersal gears in Sabah comprised of king shrimp (*P. indicus* & *P. latisulcatus*), green tiger shrimp (*P. semisulcatus*), red shrimp (*Solenocera subnuda*) and white shrimp (*Metapenaeus lysianassa*).

Demersal Fisheries

In 1999, demersal landings amounted to 110,801 metric tons, with an increase of 111.9% over the 1991 period (52,300 metric tons) (**Figure 254a**). During the 1991-1999 period, demersal landings represented 48-54% (mean 50.8%) of the annual landings (*Table 151*). The demersal portion of the annual landings had increased by 10.9%, from 48.2% in 1991 to 53.5% in 1999 (**Figure 254b**). During last few years, the demersal portion had increased by 10.3%, from 48.0% in 1996 to 53.5% in 1999. This increase was mainly attributed by substantial trawl net landings (**Figure 217a**), where trawl net landings had increased by 66.4%, from 54,842 metric tons in 1996 to 91,289 metric tons in 1999. Trawl net is the principal gear landing gear in the demersal fisheries in Sabah.

The demersal landings seems to have stagnated around the 80,000 metric ton level and might have already reached the lower limits of sustainable production since 1994-1996. The substantial increase in demersal landings for the 1997-1999 period are considered here as "*pseudo landings*", where a large portion of it comprised of trash fish from trawler landings. During the 1997-1999 period, trawl net contributed 58.5% to the annual demersal landings. Kudat, Kota Kinabalu and Sandakan contributed most of these trawl-based demersal landings, where a substantial portion of the landings comprised of trash fish[129]. In recent years, a large portion of the annual demersal landings comprised of trash fish from trawl net by-catches that had been previously discarded at sea because of marketing constraints.

[129] During the 1997-1999 period, annual trash fish landings including unsorted demersal catch fluctuated around 15,638-21,498 metric tons or 23-26% of the demersal landings.

In recent years, a large portion of the trawler by-catch[130] and other trash fish had been brought back to shore in increasing quantities to meet the demand from fish meal processing plants based in Kudat, Kota Kinabalu, Kuala Penyu, Sandakan, Tawau and Kunak[131]. Trawl net landings had also increased in Tawau during the 1996-1999 period (**Figure 258c**), where a substantial portion of the landings is used as raw materials for local fish meal plants or as supplies to commercial shrimp farms in the area. Tawau has the largest shrimp farm (924 ha) in the state, where trash fish is also being used as feed supplements in addition to formulated feed. Data on fish meal production and estimated raw materials used in 1992-1999 is given in Table A75 and **Figures 278a-278c**. During the 10-year period, it is estimated around 24-62% (mean 42%) of the annual landings in Sabah had been used as raw materials for fish meal production (**Figures 278b**). A large portion of these raw materials was sourced from the SSME area. In general, raw materials for fish meal production comprised mainly of low value demersal fishes sourced from trawl net landings except for SSME-3, where pelagic fishes are also being used. In SSME-3, there are two fish processing plants in Kunak which operated their own purse seiners for raw materials[132]. The high value fishes are exported in frozen forms to Peninsular Malaysia and other countries in the region including Hong Kong, China, Korea and Taiwan. Low value fishes including pelagic species (mainly sardine and round scad) and other utilized fish are used by these processing plants into fish meal products. Most of the fish meal was exported to Singapore and domestic markets in Peninsular Malaysia and Sarawak, and in recent years had found other new markets in the region including Indonesia[133] (**Figure 279** & **Table A83).** During the last 10 years, fish meal make up 22.6-43.7% (mean 31.5%) of the annual fisheries export volume. However, fish meal only make up 2.4-11.0% (mean 6.7%) of the annual fisheries export value.

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[130] In 1999, trash landings excluding unsorted catch amounted around 21,498 metric tons, with 62.4% landed in Kudat, Kota Kinabalu (33.2%), Tawau (4.2%) and other areas (4.4%). Overall, 66.7% of the trash landings came from the SSME area. SSME-1 and SSME-3 contributed respectively 93.5% and 6.5% to the SSME share of the trash landings. Trawl net and seine net respectively contributed 95.2% and 4.8% to the trash landings. Trash fish represents respectively 22.4% and 2.4% of the total trawl net and seine net landings. Other low value demersal finfish previously considered as trash fish include lizard fish, goat fish, juvenile threadfin bream, slipmouths and flat fish. These fishes are now classified in the SMPP landing records as commercial value fishes.

[131] In 1997-1999, there are eight fish meal plants operating in Sabah (6 plants in 1997), respectively in Kuala Penyu (1), Kota Kinabalu (1), Kudat (1), Sandakan (2), Tawau (1) and Kunak (2). The annual fish meal production from these plants during the 1997-1999 is estimated around 12,225-27,231 metric tons, where about 59,247-91,982 metric tons of trash fish were used as raw materials. In 1998, 27,231 metric tons of fish meal were produced from 91,982 metric tons of trash fish.

1998 fish meal production statistics:
<u>non-SSME area</u>: Kota Kinabalu: 10,301 metric tons (32,753 metric tons of trash fish) & Kuala Penyu: 7,584 metric tons (23,000 metric tons of trash fish)
<u>SSME area</u>: SSME-1: 2,518 metric tons (12,094 metric tons of trawh fish), SSME-2: 4,329 metric tons (15,927 metric tons of trash fish) & SSME-3: 2,498 metric tons (8,208 metric tons of trash fish).

[132] A total of 36,834 metric tons of mainly pelagic fishes landed by these purse seiners during the 1997-1999 period were used as raw materials to produce 7,376 metric tons of fish meal. The raw materials used represents around 69% of the annual fish landings in Kunak.

[133] In 1998, Sabah exported around 19,195 metric tons of fish meal with a total value of RM 31.35 million (ex-Kota Kinabalu). The 1998 export breakdown consists of: Indonesia (5,252 metric tons), Peninsular Malaysia (4,684 metric tons), Sarawak (3,709 metric tons), China (1,588 metroc tons), Sri Langka (1,100 metric tons), Thailand (590 metric tons), Brunei (259 metric tons), Singapore (200 metric tons), Hong Kong (158 metric tons), Taiwan (120 metric tons) and the Philippines (15 metric tons). During the same period, Sabah imported 383 metric tons of fish meal worth RM 0.61 million from Peninsular Malaysia (347 metric tons), Indonesia (24 metric tons) and New Zealand (12 metric tons).

In the non-SSME area, there are two development phases noted in the annual demersal landings respectively between the 1991-1996 and 1997-1999 periods. During the 1991-1996 period, the annual demersal landings fluctuated around 21,741-25,939 metric tons (mean 24,338 metric tons), which increased by 56.9% to 35,447-39,960 metric tons (mean 38,197 metric tons) during In the non-SSME area, demersal landings in 1999 amounted to 39,960 metric tons, an increase of 80.2% over the 1991 period (21,741 metric tons) (**Figure 254c**). The non-SSME landings in 1999 make up about 35.4% of the state total demersal landings. The demersal portion of the annual landings had also increased by 12.3%, from 51.3% in 1991-1996 to 57.6% in 1997-1999 (**Figure 254d**). As mentioned earlier, this increase was caused by trawl net by-catch landings. Trawl net landings contributed around 81% to the demersal landings in the non-SSME area. During the 1997-1999 period, Kota Kinabalu contributed around 85% to the non-SSME annual demersal landings.

In the WC-North region, the demersal fisheries at the district level have different characteristics (**Figure 263c**). Trawl net contributed 87% to the annual demersal landings in the WC-North. During the 1997-1999 period, WC-North contributed around 92% to the non-SSME annual demersal landings, with Kota Kinabalu contributing 93% to the WC-North annual share. Trawl net contributed 93% to the annual demersal landings in Kota Kinabalu, where traditional gears only make up 5% of the annual demersal landings (**Figure 263d**). Miscellaneous gears and hook & line are the principal landing gears in Kota Belud. These gears contributed around 85% to the demersal landings in Kota Belud. Overall, traditional gears contributed more than 90% to the annual demersal landings in Kota Belud. The principal landings gears in Tuaran are hook & line, gill net and miscellaneous gears, which contributed respectively 47%, 32% and 21% to the annual demersal landings. Overall, traditional gears contributed 68% to the annual demersal landings in Tuaran.

In the WC-South region, the principal landing gears are gill net and miscellaneous gears, which contributed 73% to the annual demersal landings during the 1997-1999 period (**Figure 263c**). Overall, commercial gears contributed 63% to the WC-South annual demersal landings. Gill net and hook & line are the principal landing gears in Papar, which contributed respectively 50% and 37% to the annual demersal landings. Overall, commercial gears contributed 50% to the annual demersal landings in Papar (**Figure 263e**). Gill net and miscellaneous gears are the principal landing gears in Beaufort, which contributed respectively 40% and 39% to the annual demersal landings during the 1997-1999 period. Overall, commercial gears contributed about 54% to the annual demersal landings in Beaufort. In Kuala Penyu, gill net is the main principal landing gear that contributed about 79% to the annual demersal landings. Overall, commercial gears had contributed around 86% to the annual demersal landings in Kuala Penyu during the 1997-1999 period. In Sipitang, trawl net, gill net and hook & line are the principal landing gears, which had contributed respectively 42%, 34% and 21% to the annual demersal landings during the 1997-1999 period. Commercial gears contributed 79% to the annual demersal landings in Sipitang.

In the SSME area, demersal landings in 1999 amounted to 71,618 metric tons, with an increase of 134.4% over the 1991 period (30,559 metric tons) (**Figure 254e**). The landings see to have leveled off around 55,000-62,000 metric tons during the 1993-1997 period, before increasing further to around 65,697-71,618 metric tons in 1998-1999. Landings had initially increased by 102.4% to 61,867 metric tons in 1996, declined by 8.3% to 56,743 metric tons in 1997, and increased by 26.2% to its present level in 1999. The demersal portion of the annual landings fluctuated around 46-52% (mean 49.8%) during the 9-year period, with slight increase by 3.3% from 50.1% in 1991 to 51.8% in 1999 (**Figure 254f**).

During the 9-year period, the non-SSME and SSME areas respectively contributed 34.5% (range: 28-42%) and 65.5% (range: 58-72%) to the annual demersal landings (**Figures 254g**-**254h**). SSME-2 contributed 40.7% (range: 32-61%) to the SSME annual demersal landings, followed by

SSME-1 (34.5%, range: 20-48%) and SSME-3 (24.8%, range: 14-34%) (**Figures 254i**). During the last few years, the non-SSME portion of the annual demersal had increased by 24.3%, from 28.4% in 1996 to 35.4% in 1999 because of increased contribution from trawl net landings. The non-SSME share of the annual trawl net landing had increased by 33.9%, from 37.3% in 1996 to 49.9% in 1999 (**Figures 215**-**216**). Most of the non-SSME contribution comes from landings in Kota Kinabalu. Likewise, SSME-1 share of the SSME annual demersal landings had also increased during the last few years because of trawl net landing contribution, consequently taking over SSME-2 position as the top demersal landing contributor in the SSME area. During the 1997-1999 period, SSME-1 contributed 34.2% (range: 31-37%) to the SSME annual demersal landings, followed by SSME-2 (33.9%, range: 32-36%) and SSME-3 (31.9%, range: 30-34%).

Principal demersal gears are trawl net, hook & line and miscellaneous gears (**Figures 262a**-**262f**). In SSME-2, demersal fishes make up more than 50% of the annual gill net landings (**Figure 262b**). Trawl net contributed about 60.2% to the demersal landings for the 1997-1999 period, followed by hook & line (16.7%), gill net (11.0%), miscellaneous gears (7.9%), seine net (2.7%) and lift net (1.6%) **(Figure 263a**). Commercial gears contributed 74% to the annual demersal landings in Sabah. Trawl net contribution is more significant in the non-SSME area compared to the SSME area where other gears also contribute a significant portion to the annual demersal landings.

During the 1997-1999 period, trawl net contributed 80.6% to the non-SSME annual demersal landings, followed by hook & line (6.7%), miscellaneous gears (5.9%), gill net (5.2%), seine net (1.2%) and *selambau* lift net (0.3%). Ttrawl net contributed 48.8% to the SSME annual demersal landings, followed by hook & line (22.2%), gill net (14.2%), miscellaneous gears (9.0%), seine net (3.5%) and *bagang* lift net (2.3%). Overall, commercial gears contributed respectively 87% and 67% to the non-SSME and SSME annual demersal landings in 1997-1999. In the SSME-1 area, commercial gears contributed around 80% to the annual demersal landings, with trawl net as the principal gear (72.4% share) and hook & line (17.5%) as secondary gear (**Figure 263b**). In the SSME-2 area, commercial gears contributed around 65% to the annual demersal landings, with trawl net (36%) and gill net (29%) as the main principal gears and hook & line as secondary gear (17%). Commercial gears only contributed 53% to the SSME-3 annual demersal landings, with principal gears comprising of trawl net (36.5%) and hook & line (32.7%). Gill net, seine net, miscellaneous gears and *bagang* lift net also play important roles as secondary gears in the SSME-3 demersal fisheries.

Trawl net formed the backbone (81% annual share) of the non-SSME demersal fisheries, with the remaining 19% shared by hook & line (35%), miscellaneous gears (31%), gill net (27%), seine net (6%) and lift net (2%) (**Figure 263a**). The non-SSME contribution to the demersal landings in Sabah during the 1991-1999 period is given respectively for total landings (**Figures 254g**-**254h**), finfish landings (**Figures 254k**-**254l**), invertebrate landings (**Figures 254o**-**254p**) and shrimp landings (**Figures 254s**-**254t**). The temporal demersal landing breakdown in the non-SSME area for the 1991-1999 period is shown in **Figures 255c**-**255d**. The average fishing gear contribution to the demersal landings in the non-SSME fishing districts for the 1997-1999 period is given respectively for total landings (**Figures 263c**-**263e**), finfish landings (**Figure 264a** & **Figures 264c**-**264e**), shrimp landings (**Figure 265a** & **Figures 265c**-**265e**) and invertebrate landings (**Figure 266a** & **Figures 266c**-**266e**). Overall, commercial gears contributed 87% to the annual demersal landings in the non-SSME area. In general, demersal fishes make up the bulk of the trawl net, hook & line and miscellaneous gear annual landings in the non-SSME area (**Figure 262e**).

Compared to the non-SSME area, the SSME demersal fishery is more diverse with traditional gears playing important roles in the annual landings (**Figures 263a**-**263b**). Traditional gears contributed 23% to the SSME annual demersal landings compared to only 13% contribution in the non-SSME area. During the 1997-1999 period, trawl net contributed 49% to the SSME annual demersal landings, followed by hook & line (22%), gill net (14%), miscellaneous gears (9%), seine net (4%) and lift net (2%) (**Figure 263a**). Trawl net is the main principal gear in SSME-1, compared to SSME-2 and SSME-3 where other gears play equally important roles in the annual landing contribution (**Figure 263b**).

The SSME contribution to the demersal landings in Sabah during the 1991-1999 period is given respectively for combined landings (**Figures 254g-254h**), finfish landings (**Figures 254k-254l**), invertebrate landings (**Figures 254o-254p**) and shrimp landings (**Figures 254s-254t**). The regional contribution to the SSME demersal landings during the 1991-1999 period is given respectively for combined landings (**Figure 254i**), finfish landings (**Figure 254m**), invertebrate landings (**Figures 254p-254q**) and shrimp landings (**Figures 254t-254u**). The temporal demersal landing breakdown by resource type and fishing districts in the SSME area is given respectively in **Figures 256a-256l** (SSME-1), **Figures 257a-257p** (SSME-2) and **Figures 258a-248j** (SSME-3). The average fishing gear contribution to the demersal landings in the SSME fishing districts for the 1997-1999 period is given respectively for total landings (**Figures 263b** & **Figures 263f-263h**), finfish landings (**Figure 264b** & **Figures 264f-264h**), shrimp landings (**Figure 265b** & **Figures 265f-265h**) and invertebrate landings (**Figure 266b** & **Figures 266f-266h**). Overall, commercial gears contributed 66% to the annual demersal landings in the SSME area. Demersal fishes make up the bulk of the trawl net, hook & line, miscellaneous gear and gill net annual landings in the SSME area (**Figures 262a-262d**).

In SSME-1, trawl net contributed 72% to the annual demersal landings during the 1997-1999 period, with the other 28% landed by hook & line (63%), gill net (16%), seine net (11%) and miscellaneous gears (9%) (**Figure 263b** & **Figure 263f**). Commercial gears contributed 80% to the demersal landings in SSME-1, where Kudat contributed around 92-98% to the SSME-1 demersal landings in 1997-1999 (**Figures 256c-256d**). Trawl net and hook & line contributed respectively 70% and 21% to the demersal landings in Kudat during the 1997-1999 period. Overall, commercial gears contributed about 78% to the demersal landings in Kudat, where trawl net contributed 90% to the commercial gear landing contribution, with the other 10% shared equally by gill net and seine net. Both Kota Marudu and Pitas only contributed 4% to the SSME-1 demersal landings, where the principal landing gears are miscellaneous traditional gears and gill net. In Kota Marudu, miscellaneous gears and gill net contributed respectively 48% and 47% to the demersal landings. Overall, commercial gears contributed 51% to the annual demersal landings in Kota Marudu, where gill net landings make up 93% of the commercial gear annual contribution. Miscellaneous gears and gill net contributed respectively 42% and 31% to the demersal landings in Pitas. Overall, traditional gears contributed 69% to the demersal landings in Pitas, where miscellaneous gears contributed 61% to the traditional gear landings, followed by hook & line (32%) and *bagang* lift net (7%). Demersal fishes make up the bulk of the trawl net, hook & line and miscellaneous gears annual landings in the SSME-1 area (**Figures 262a**).

In SSME-2, trawl net contributed 36% to the annual demersal landings during the 1997-1999 period, followed by gill net (29%), hook & line (18%) and miscellaneous gears (17%). Overall, commercial gears contributed 65% to the SSME-2 annual demersal landings during the 3-year period (**Figure 263b**). Demersal fishes make up the bulk of the trawl net, miscellaneous gears, hook & line and gill net annual landings in the SSME-2 area (**Figures 262b**). During the 1997-1999 period, Sandakan contributed 84-91% to the SSME-2 annual demersal landings (**Figures 257c-257d**). Both traditional and commercial gears play almost equally important roles in the demersal fisheries in Sandakan.

During the 1997-1999 period, gill net contributed 31% to the annual demersal landings in Sandakan, followed by trawl net (29%), hook & line (21%) and miscellaneous gears (19%) (**Figure 263g**). Traditional gears contributed around 40% to the annual demersal landings, where hook & line landings make up 52% of the annual traditional gear landings. Trawl net contributed 61% to the annual demersal landings in Beluran, followed by gill net (23%) and miscellaneous gears (11%). Compared to other districts in the SSME area with the exception of Tawau (2% contribution), hook & line only contributed 3% to the annual demersal landings in Beluran.

In SSME-3, trawl net contributed 37% to the SSME-3 annual demersal landings during the 1997-1999 period, followed by hook & line (33%), gill net (9%), seine net (8%), miscellaneous gears (7%) and lift net (7%) (**Figure 263b**). Demersal fishes make up the bulk of the trawl net, hook & line and miscellaneous gears annual landings in the SSME-3 area (**Figures 262c**). During the 1997-1999 period, commercial gears contributed about 53% to the SSME-3 annual demersal landings, with trawl net landings contributing 69% to the commercial gear share of the annual demersal landings, followed by gill net (17%) and seine net (14%). On the other hand, hook & line landings make up 69% of the annual traditional gear landings, followed by miscellaneous gears (16%) and *bagang* lift net (15%).

Demersal fishes make up the bulk of the trawl net, hook & line and miscellaneous gears annual landings in the SSME-3 area (**Figures 262c**). During the 1997-1999 period, Tawau contributed 53% to the SSME-3 annual demersal landings, followed by Lahad Datu (25%), Kunak (13%) and Semporna (8%) (**Figures 258c**-**258d**).

Commercial gears contributed 81% to the annual demersal landings in Tawau, where trawl net and gill net landings respectively make up 87% and 13% of the commercial gear share of the demersal landings. On the other hand, miscellaneous gear landings make up 45% of the annual traditional gear landing contribution, followed by *bagang* lift net (44%) and hook & line (2%) (**Figure 263h**). Hook & line is the principal landing gear in Lahad Datu, Kunak and Semporna during the 1997-1999 period. Hook & line contributed 78% to the annual demersal landings in Lahad Datu, followed by trawl net (11%), miscellaneous gears (5%), gill net (3%), *bagang* lift net (2%) and seine net (1%). Overall, traditional gears contributed 85% to the annual demersal landings in Lahad Datu. Hook & line contributed 68% to the annual demersal landings in Kunak, followed by *bagang* lift net (21%), gill net (10%) and miscellaneous gears (1%). Overall, traditional gears contributed about 90% to the annual demersal landings in Kunak. Traditional gears contributed 63% to the annual demersal landings in Semporna. Hook & line contributed 48% to the annual demersal landings in Semporna, followed by trawl net (21%), miscellaneous gears (15%), gill net (14%) and seine net (2%).

Finfish make up 68.3% of the annual demersal landings during the 1991-1999 period, followed by invertebrates (17.8%) and shrimp (13.9%) (**Figure 255b**). During the 9-year period, both finfish and invertebrate shares of the annual landings had respectively increased by 17.9% and 20.4%. The finfish share had increased from 63.9% in 1991 to 75.3% in 1999. The invertebrate share had increased from 12.2% in 1991 to 14.7% in 1999, with peak share around 21-29% in 1992-1993. The high invertebrate share of the 1992-1993 demersal landings was due to jellyfish landings in Kota Marudu (SSME-1). On the other hand, the shrimp share of the annual demersal landings had declined by 58.2%, from 23.9% in 1991 to 10.0% in 1999.

The SSME area contributed the bulk of these demersal groups during the 1991-1999 period. During the 9-year period, the non-SSME and SSME areas contributed respectively 26-49% (mean 35.0%) and 51-74% (mean 65.0%) to the annual finfish landings (**Figures 254k**). SSME-1 contributed 37.3% to the SSME annual finfish landings during the 1991-1999 period, followed by SSME-2 (36.9%) and SSME-3 (23.7%) (**Figures 254m**). During the 1997-1999 period, both non-SSME and SSME-1 finfish shares of the annual demersal landings had increased because of substantial contribution from trawl net landings. The non-SSME share had increased by 43.6%, from 25.8% in 1996 to 37.1% for the 1997-1999 period. On the other hand, SSME-1 share of the SSME annual finfish landings had increased by 11.7%, from 34.7% in 1991 to 38.8% in 1997-1999. SSME-2 share had declined by 12.0% from 34.9% in 1996 to 30.7% in 1997-1999. SSME-3 share had slightly increased by 0.4%, from 30.3% in 1991 to 30.5% in 1997-1999.

During the 1997-1999 period, the non-SSME and SSME areas contributed respectively 37.1% (range: 35-40%) and 62.9% (range: 60-65%) to the annual finfish landings (**Figure 254k**). The non-SSME share of the annual finfish landings had increased during that same period due to substantial trawl net landings. SSME-1 contributed 38.8% to the SSME share of the annual finfish landings, followed by SSME-2 (30.7%) and SSME-3 (30.5%) (**Figure 254m**). SSME-2 share had decreased gradually throughout the 1991-1999 period, from 51.6% in 1991 to only 28.3% in 1999. On the other hand, SSME-1 share had increased from only 26.0% in 1999 to 42.3% in 1999. While SSME-3 share had slightly increased from 22.4% in 1991 to 29.4% in 1999. The non-SSME and SSME areas contributed respectively 46.8% (range: 41-54%) and 53.2% (range: 46-59%) to the annual invertebrate landings during the 1997-1999 period (**Figure 254o**).

The non-SSME share of the annual invertebrate landings had increased from 27.7% in 1991 to 45.8% in 1999. SSME-2 contributed 49.7% to the SSME share of the annual invertebrate landings, followed by SSME-3 (29.9%) and SSME-1 (20.4%) (**Figure 254q**). Both SSME-2 and SSME-3 shares had increased during the 1991-1999 period. SSME-2 share had initially declined from 71.8% in 1991 to 27.1% in 1993, and throughout the last few years had increased up to 50-55% in 1998-1999. On the other hand, SSME-3 share had increased from only 2.9% in 1993 to 35.8% in 1999. SSME-1 share had declined from its peak of 70% in 1993 to only 14.5% in 1999.

The non-SSME and SSME areas contributed respectively 21.1% (range: 18-23%) and 78.9% (range: 77-82%) to the annual shrimp landings (**Figure 254s**). During the 1991-1999 period, the non-SSME share of the annual shrimp landings had declined from 37-42% (mean: 39.5%) between 1992-1995 to only 18-22% (mean: 20.0%) between 1997-1998, and had increased slightly to 23.2% in 1999. SSME-3 contributed 43.5% to the SSME share of the shrimp landings, followed by SSME-2 (35.8%) and SSME-1 (20.8%) (**Figure 254u**). During the 1991-1999 period, both SSME-1 and SSME-3 shares of the SSME annual shrimp landings had increased. SSME-1 share had increased from 11.8% in 1991 to 26.0% in 1999. On the other hand, SSME-3 share had increased significantly from only 13.1% in 1991 to 46.0% in 1997, before declining to 40.1% in 1999.

Finfish landings fluctuated around 33,430-83,478 metric tons (mean 58,358 metric tons) during the 9-year period, where landings had initially increased by 75.7%, from 33,430 metric tons in 1991 to about 56,951-60,665 metric tons (mean 58,738 metric tons) between 1994-1996, and then increased by 42.1% to 83,478 metric tons in 1999 (**Figure 254j**). Annual landings seems to have stabilized around 55,000-60,000 metric tons between 1994-1996, and the increase in landings in 1997-1999 might have been due to increase in trawl net by-catch contribution. Trawl net contributed 58.4% to the annual finfish landings during the 1997-1999 period, followed by hook & line (21.7%), gill net (11.4%), miscellaneous gears (4.5%), seine net (3.1%) and lift net (0.7%) (**Figure 264a**). The finfish share of the annual demersal landings had increased by 17.9%, from 63.9% in 1991 to 75.3% in 1999 (**Figure 255b**).

In the non-SSME area, substantial increases in demersal finfish landings were noted during the 1997-1999 period (**Figure 255c**). The annual landings during the 1991-1996 period fluctuated around 15,186-16,403 metric tons (mean 15,833 metric tons) compared to an average of 28,160 metric tons (range: 27,448-29,167 metric tons) during the 1997-1999 period. There was an increase of 78% in landings between these periods. About 90% of these demersal landings were landed in Kota Kinabalu. The demersal invertebrate landings also reached its peak of 10,6212 metric ton in 1998. As mentioned earlier, these *pseudo* increases was due to trawl net by-catch contribution. Trawl net contributed 84% to the invertebrate landings in 1998, where 87% of it was landed in Kota Kinabalu. It was also noted that there was substantial decline in the shrimp landings, where shrimp landings had dropped by 63.7%, from 4,058 metric tons to only 1,473 metric tons in 1998, and then increased to 2,570 metric tons in 1999.

In the non-SSME area, finfish[134] make up 68.2% of the annual demersal landings during the 1991-1999 period, followed by invertebrates[135] (18.4%) and shrimp[136] (13.4%) **(Figure 255d).** During the 9-year period, both finfish and shrimp shares of the annual landings had respectively declined by 1.3% and 60.1%. The finfish share had declined from 75.4% in 1991 to 74.4% in 1999. The shrimp share had declined from 16.4% in 1991 to only 6.6% in 1999. On the other hand, the invertebrate share had increased by 134.3%, from 8.1% in 1991 to 19.0% in 1999. During the 9-year period, the invertebrate share of the annual demersal landings had initially increased by 195.9% to 24.0% in 1995, declined by 31.6% to 16.4% in 1997, and then increased by 62.0% to its peak of 26.6% in 1998, and finally to its present level in 1999. During the 1997-1999 period, fishfish make up 73.9% of the annual demersal landings, followed by invertebrates (20.7%) and shrimps (5.5%).

During the 1997-1999 period, trawl net contributed 83.2% to the annual finfish landings, followed by hook & line (7.5%), miscellaneous gears (4.0%), gill net (3.8%) and seine net (1.4%) (**Figure 264a**). On the other hand, trawl net contributed 37.5% to the annual shrimp landings, followed by gill net (36.2%), miscellaneous gears (21.2%), lift net (5.0%) and seine net (0.1%) (**Figure 265a**). While trawl net contributed 85.2% to the annual invertebrate landings, followed by miscellaneous gears (8.0%), hook & line (6.0%) and seine net (0.9%) (**Figure 266a**).

During the 1997-1999 period, WC-North contributed 88.6% to the non-SSME annual demersal landings. About 95.8% of the non-SSME annual demersal finfish landings comes from the WC-North, where trawl net contributed 86.8% to the annual landings, followed by hook & line (6.5%), miscellaneous gears (4.2%), seine net (1.4%) and gill net (1.1%) (**Figure 264c**).

On the other hand, gill net contributed 49.2% to the WC-South annual demersal finfish landings, followed by miscellaneous gears (23.6%), trawl net (13.2%), hook & line (12.9%) and seine net (1.1%). WC-South contributed 62.0% to the non-SSME annual shrimp landings, where gill net contributed 46.8% to the annual shrimp landings, followed by miscellaneous gears (28.2%), trawl net (24.7%) and seine net (0.2%) (**Figure 265c**).

On the other hand, trawl net landed 58.4% of the WC-North annual shrimp landings, followed by gill net (18.8%), *selambau* lift net (13.2%) and miscellaneous gears (9.6%). About 95.2% of the

[134] In 1999, a total of 29,167 metric tons of demersal finfish was landed in the non-SSME area comprising of commercial fish (58.1%), sharks (4.2%), rays (4.0%) and trash fish & assorted by-catch (33.7%). Among the dominant species are threadfin bream (25.2% commercial demersal finfish), lizard fish (14.8%), snappers (6.0%), catfish (5.8%), groupers (5.0%), and various species of bottom & reef resident fishes (43.2%).

[135] In 1999, a total of 7,445 metric tons of invertebrate was landed in the non-SSME area, comprising of cephalopods (77.7%), shellfish (6.5%), pelagic crabs (5.3%), lobsters (4.8%), mangrove crabs (4.7%), sea cucumbers (0.8%) and misc. crustaceans (0.3%).

[136] In 1999, a total of 2,570 metric tons of shrimps was landed in the non-SSME area comprising of *Acetes* shrimp (29.1%), banana shrimp (45.8%), yellow shrimp (3.8%), tiger shrimp (2.8%) and other assorted penaeid shrimp species (18.5%).

non-SSME annual invertebrate landings comes from the WC-North, where trawl net landed about 89.3% of the annual invertebrate landings, followed by hook & line (5.9%), miscellaneous gears (4.0%) and seine net (0.8%) (**Figure 266c**). While miscellaneous gears contributed 87.0% to the WC-South annual invertebrate landings, followed by hook & line (7.5%), trawl net (2.8%), seine net (2.3%) and gill net (0.4%).

In the WC-North, finfish[137] make up 78.3% of the annual demersal landings during the 1997-1999 period, followed by invertebrates[138] (18.9%) and shrimps[139] (2.7%). On the other hand, shrimps[140] make up 50.3% of the annual demersal landings in the WC-South, followed by finfish[141] (38.9%) and invertebrates[142] (10.8%). WC-South only contributed 8.0% of the annual demersal landings. Most of the non-SSME commercial demersal fishing fleet operating in the WC-South area landed their catches in Kota Kinabalu. During the 1997-1999 period, Kota Kinabalu contributed respectively 89.9% and 86.8% of the annual finfish and invertebrates landings. On the other hand, only 27.7% of the non-SSME annual shrimp landings were landed in Kota Kinabalu, with 62.0% landed in WC-South, and 10.3% in Kota Belud and Tuaran. During the 1997-1999 period, trawl net contributed 92.5% to the annual demersal finfish landings in Kota Kinabalu, followed by hook & line (4.3%), seine net (1.5%), miscellaneous gears (1.1%) and gill net (0.6%) (**Figure 264d**). Trawl net contributed 97.9% to the annual demersal invertebrate landings in Kota Kinabalu (**Figure 266d**). On the other hand, trawl net contributed 80.0% to the annual shrimp landings in Kota Kinabalu, followed by miscellaneous gears (12.6%) and gill net (7.4%) (**Figure 265d**).

In the SSME-area, finfish[143] make up 67.9% of the annual demersal landings during the 1991-1999 period, followed by invertebrates[144] (17.6%) and shrimps[145] (14.6%) (**Figure 255e**).

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[137] In 1999, a total of 27,646 metric tons of demersal finfish was landed in the WC-North (non-SSME area) comprising of commercial fish (58.3%), sharks (3.3%), rays (3.4%) and trash fish & assorted by-catch (34.9%). Among the dominant species are threadfin bream (25.4% commercial demersal finfish), lizard fish (15.3%), snappers (5.5%), groupers (5.1%), catfish (5.0%), humphead wrasse (4.4%), coral fulsiers (4.2%), and various species of bottom & reef resident fishes (35.0%).

[138] In 1999, a total of 6,154 metric tons of invertebrates was landed in the WC-North (non-SSME area), comprising of cephalopods (84.8%), shellfish (7.4%), pelagic crabs (5.5%), mangrove crabs (1.3%) and sea cucumbers (0.8%).

[139] In 1999, a total of 1,111 metric tons of shrimps was landed in the WC-North (non-SSME area), comprising of *Acetes* shrimp (29.7%), sand shrimp (22.9%), yellow shrimp (11.2%), banana shrimp (10.6%), tiger shrimp (6.6%) and other assorted penaeid shrimp species (19.1%).

[140] In 1999, a total of 2,150 metric tons of shrimps was landed in the WC-South (non-SSME area), comprising of *Acetes* shrimp (28.8%), banana shrimp (64.0%), and other assorted penaeid shrimp species (7.2%).

[141] In 1999, a total of 1,192 metric tons of demersal finfish was landed in the WC-South (non-SSME area) comprising of commercial fish (52.9%), sharks (23.3%), rays (18.5%) and trash fish & assorted by-catch (5.3%). Among the dominant species are catfish (29.9% commercial demersal finfish), threadfin bream (20.4%), snappers (19.2%), whitings (4.5%), rabbit fish (3.6%), trigger fish (3.4%), flat fish (3.3%), and various species of bottom & reef resident fishes (18.6%).

[142] In 1999, a total of 278 metric tons of invertebrates was landed in the WC-South (non-SSME area), comprising of mangrove crabs (83.1%), cephalopods (10.3%) and pelagic crabs (6.6%).

[143] In 1999, a total of 54,311 metric tons of demersal finfish was landed in the SSME area comprising of commercial fish (64.4%), sharks (3.2%), rays (3.1%) and trash fish & assorted by-catch (29.3%). Among

During the 9-year period, the finfish portion of the demersal landings had increased by 36.1%, from 55.7% in 1991 to 75.8% in 1999. During the 1993-1999 period, finfish make up 72-76% (mean: 73.7%) of the demersal catch compared to only 56-57% (mean: 56.2%) during the 1991-1992 period (**Figures 255b**). Trawl net landings contributed to the increase in the demersal finfish portion in 1993-1999. The shrimp portion had decreased by 59.4% during the 9-year period, from 29.2% in 1991 to only 11.9% in 1999. On the other hand, the invertebrate portion seems to have stabilized around 10-14% of the annual demersal landings during the last few years, except in 1992-1993 because of high jellyfish landings in SSM-1 (Kota Marudu).

In SSME-1, finfish[146] make up 74.9% of the annual demersal landings during the 1991-1999 period, followed by invertebrates[147] (17.5%) and shrimps[148] (7.6%) (**Figure 256a**-**256b**). Most of the finfish catch comprised of trash fish contributed from trawl net landings. In recent years, trash fish make up more than 50% of the annual demersal finfish landings in the SSME-1 area. During the 1997-1999 period, trash & assorted by-catch landed by trawlers contributed 33.4-39.5% (mean: 37.4%) of the SSME-1 annual landings. Except for 1992-1993, where the finfish portion had dropped to 49-60% of the annual demersal landings, the finfish portion had increased to more than 80% of the annual demersal landings since 1996. Shrimp landings make up 17.1% of the demersal landings in 1991, and its portion dropped to 2.3-6.2% in 1992-1993 because of the increased in the invertebrate portion due to jellyfish landings, and during the 1995-1999 period fluctuated around 6.1-8.5% of the annual demersal landings. The significant decrease in the invertebrate portion of the annual demersal landings throughout the 1994-1999 period was due to declining jellyfish landings that had make up the bulk of the invertebrate portion in 1992-1993. During the 1997-1999 period, trawl net contributed 73.0% to the annual demersal finfish landings, followed by hook & line (20.5%), seine net (3.2%) and gill net (3.0%) (**Figure 264b**). Trawl net contributed 79.4% to the annual shrimp landings, followed by gill net (19.0%) and miscellaneous gears (1.6%) (**Figure 265b**). On the other hand, about 61.6% of the annual invertebrate landings came from trawl net contribution, followed by miscellaneous gears (25.1%), gill net (9.1%), seine net (3.1%), *bagang* lift net (0.6%) and hook & line (0.5%) (**Figure 266b**).

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the dominant species are snappers (21.1% commercial demersal finfish), groupers (16.2%), threadfin bream (11.9%), catfish (8.6%), and various species of bottom & reef resident fishes (42.2%).

[144] In 1999, a total of 8,819 metric tons of invertebrate was landed in the SSME area, comprising of cephalopods (39.5%), mangrove crabs (26.4%), pelagic crabs (25.5%), shellfish (6.1%), sea cucumbers (1.3%), lobsters (1.0%), and misc. crustaceans (0.1%).

[145] In 1999, a total of 6,488 metric tons of shrimps was landed in the SSME area comprising of *Acetes* shrimp (1.3%), banana shrimp (42.2%), yellow shrimp (14.4%), tiger shrimp (3.6%) and other assorted penaeid shrimp species (38.4%).

[146] In 1999, a total of 22,990 metric tons of demersal finfish was landed in the SSME-1 area comprising of commercial fish (38.6%), sharks (0.4%), rays (0.9%) and trash fish & assorted by-catch (60.1%). It is noted that SSME-1 finfish landings comprised substantially of trash fish. Among the dominant species are groupers (37.3% commercial demersal finfish), threadfin bream (19.8%), snappers (8.1%), humphead wrasse (7.3%), lizard fish (6.5%), and various species of bottom & reef resident fishes (20.9%).

[147] In 1999, a total of 1,282 metric tons of invertebrate was landed in the SSME-1 area, comprising of cephalopods (63.6%), pelagic crabs (18.9%), shellfish (13.0%), lobsters (1.6%), mangrove crabs (1.1%), sea cucumbers (1.1%), and assorted crustaceans & invertebrates (0.6%)

[148] In 1999, a total of 6,488 metric tons of shrimps was landed in the SSME-1 area comprising of sand shrimp (74.2%), banana shrimp (8.5%), *Acetes* shrimp (0.2%), tiger shrimp (1.1%) and other assorted penaeid shrimp species (13.9%).

In SSME-2, finfish[149] make up 61.7% of the annual demersal landings during the 1991-1999 period, followed by invertebrates[150] (19.5%) and shrimps[151] (18.7%) (**Figures 257a**-**257b**). During the 9-year period, both finfish and invertebrate portions of the annual demersal landings had increased respectively by 45.2% and 9.9%. The finfish portion had increased from 47-49% between 1991-1992 to 61% in 1993, and fluctuated between 65-69% during the 1994-1999 period. On the other hand, the invertebrate portion initially increased to 23-25% between 1992-1993, declined to 17-19% between 1994-1997, and increased to 19-22% between 1998-1999. Cockle landings attributed to these fluctuations, with landings peaking between 1991-1993 and decline of the cockle fishery in Beluran in 1994. Relatively high invertebrate share of the annual demersal landings in recent years was due to the increasing contribution from cephalopod and crab landings. During the 1997-1999 period, gill net contributed 41.3% to the SSME-2 annual demersal finfish landings, followed by hook & line (26.0%), trawl net (21.4%) and miscellaneous gears (11.3%) (**Figure 264b**). Trawl net contributed 87.8% to the annual shrimp landings, followed by gill net (8.7%) and miscellaneous gears (3.5%) (**Figure 265b**). On the other hand, about 53.4% of the annual invertebrate landings came from trawl net contribution, followed by miscellaneous gears (45.3%) and seine net (1.3%) (**Figure 266b**).

In SSME-3, finfish[152] make up 72.2% of the annual demersal landings during the 1991-1999 period, followed by shrimps[153] (16.4%) and invertebrates[154] (11.3%) (**Figures 258a**-**258b**). During the 9-year period, the finfish portion had slightly increased by 4.3%, from 68.0% in 1991 to 70.9% in 1999, peaking around 77-78% between 1993-1995 and stabilizing around 70-72% between 1996-1999. The invertebrate portion had increased by 24.5%, from 11.3% in 1991 to 14.0% in 1999, with minimum contribution of 7-10% between 1992-1994 and fluctuated around 12-16% in latter years. During the 1997-1999, hook & line contributed 46.4% to the annual demersal finfish landings, followed by trawl net (30.5%), seine net (9.6%), gill net (6.1%), miscellaneous gears (3.8%) and bagang lift net (3.6%) (**Figure 264b**). Trawl net contributed

[149] In 1999, a total of 22,601 metric tons of demersal finfish was landed in the SSME-2 area comprising of commercial fish (84.3%), sharks (7.1%), rays (4.2%) and trash fish & assorted by-catch (4.4%). It is noted that SSME-1 finfish landings comprised substantially of trash fish. Among the dominant species are snappers (31.2% commercial demersal finfish), catfish (18.4%), threadfin bream (10.8%), groupers (7.2%), barramundi (6.7%), and various species of bottom & reef resident fishes (25.7%).

[150] In 1999, a total of 4,376 metric tons of invertebrates was landed in the SSME-2 area, comprising of mangrove crabs (36.4%), cephalopods (32.2%), pelagic crabs (28.8%), shellfish (2.0%) and sea cucumbers (0.6%).

[151] In 1999, a total of 6,488 metric tons of shrimps was landed in the SSME-2 area comprising of banana shrimp (49.8%), yellow shrimp (28.6%), tiger shrimp (2.8%) and other assorted penaeid shrimp species (18.8%).

[152] In 1999, a total of 22,538 metric tons of demersal finfish was landed in the SSME-3 area comprising of commercial fish (82.5%), sharks (3.4%), rays (5.3%) and trash fish & assorted by-catch (8.8%). Among the dominant species are snappers (19.9% commercial demersal finfish), jew fish (11.3%), groupers (10.8%), catfish (9.1%), threadfin bream (7.5%), humphead wrasse (6.6%), and various species of bottom & reef resident fishes (34.7%).

[153] In 1999, a total of 2,880 metric tons of shrimps was landed in the SSME-3 area comprising of banana shrimp (50.0%), sharp rostrum shrimp (11.1%), tiger shrimp (5.4%), yellow shrimp (5.0%), *Acetes* shrimp (3.0%), and other assorted penaeid shrimp species (25.4%).

[154] In 1999, a total of 3,161 metric tons of invertebrates was landed in the SSME-3 area, comprising of cephalopods (35.3%), mangrove crabs (28.9%), pelagic crabs (25.6%), shellfish (7.7%) and sea cucumbers (2.6%).

73.0% to the annual shrimp landings, followed by gill net (19.7%), miscellaneous gears (5.7%) and seine net (1.8%) (**Figure 265b**). On the other hand, *bagang* lift net contributed 36.0% to the annual invertebrate landings, followed by miscellaneous gears (28.6%), trawl net (22.4%), gill net (8.4%), seine net (3.7%) and hook & line (1.0%) (**Figure 266b**).

Demersal invertebrate landings fluctuated around 6,375-19,809 metric tons (mean 14,989 metric tons) during the 9-year period (**Figure 254n**). Landings had initially increased by 258.5%, from 6,375 metric tons in 1991 to its peak of 22,853 metric tons in 1993, and then declined by 38.0% to 14,160 metric tons in 1997, increased by 39.9% to 19,809 metric tons in 1998, and declined by 17.9% to 16,625 metric tons in 1999. During the 1997-1999 period, trawl net contributed 63% to the annual invertebrate landings, followed by miscellaneous gears (24%), lift net (6%), hook & line (3%), gill net (3%) and seine net (2%) (**Figure 266a**). Most of the invertebrate landings in the non-SSME area come from trawl net landings. On the other hand, besides trawl net, other miscellaneous gears also play equally important roles in the invertebrate landings in the SSME area. These include the collection of shellfish, mangrove crab trapping, sea cucumber and jellyfish collection, lobster trapping, and various other traditional fishing activities carried out in estuarine, reef and mangrove areas.

During the 1991-1999 period, the non-SSME and SSME areas respectively contributed 20-54% (mean 36.4%) and 46-80% (mean 63.6%) to the annual invertebrate landings (**Figures 254n-254o**). SSME-2 contributed 47.7% (range: 27-72%) to the SSME annual invertebrate landings during the 9-year period, followed by SSME-1 (32.0%, range: 14-70%) and SSME-3 (20.3%, range: 3-36%) (**Figures 254p-254q**). The non-SSME share had increased by 30.3%, from 35.9% in 1996 to 46.8% in 1997-1999. Both SSME-2 and SSME-1 portion of the SSME share had decline during 1997-1999 period. SSME-2 contributed 49.6% to the SSME invertebrate landings in 1999, followed by SSME-3 (35.8%) and SSME-1 (14.5%). The high SSME-1 contribution between 1992-1995 (33-70% SSME share) was due to substantial jellyfish landings in Kota Marudu and Kudat.

Shrimp landings fluctuated around 8,128-12,495 metric tons (mean 10,978 metric tons) during the 1991-1999 period (**Figure 254r**). Shrimp landings had decreased by 11.5%, from 12,495 metric tons in 1991 to 11,058 metric tons in 1999. The fluctuation in the annual shrimp landings had to a certain extent indicate a gradual decline, where landings had declined to a low 8,128 metric tons in 1998 before increasing to its present levels in 1999. Landings during the last few years had been influenced by SSME-3 contribution, which contributed around 31-36% to the annual landings. SSME-3 contribution had increased by 71.5%, from 20.0% in 1996 to 34.4% during the 1997-1999 period. Shrimp landings in SSME-3 had increased by 35.4%, from 2,452 metric tons in 1996 to 2,958-3,607 metric tons (mean 3,322 metric tons) in 1997-1999. The principal gears of the shrimp fishery are trawl net, gill net and miscellaneous gears. Trawl net contributed 69% to the annual shrimp landings during the 1997-1999 period, followed by gill net (21%) and miscellaneous gears (8%). Other gears only contributed around 1% each to the annual shrimp landings. The reasons for the decline in shrimp landings in Sabah during the last few years might have been due to overfishing (**Figure 39**), decline in non-trawler fishing effort of the shrimp fishery and increasing contribution from demersal finfish landings in the annual trawl net landings. The shrimp share had decreased by 32.8%, from 14.2% share in 1996 to only 9.5% share during the 1997-1999 period.

The non-SSME and SSME areas contributed respectively 18-42% (mean 34.4%) and 58-82% (mean 68.6%) to the annual shrimp landings during the 1991-1999 period (**Figure 254r-254s**). The non-SSME share had declined by 18.8% during the 9-year period, from 28.6% in 1991 to 23.2% in 1999. Consequently, the SSME share had increased by 7.5%, from 71.4% in 1991 to 76.8% in 1999. During the 1991-1999 period, SSME-2 contributed 34-75% (mean 52.9%) to the SSME annual shrimp landings, followed by SSME-3 (mean: 29.8%, range 13-46%) and SSME-1 (mean: 17.3%, range 11-26%) (**Figures 254t-254u**). During the 1997-1999 period, SSME-3 contribution had increased by 53.4%, from 30.0% in 1996 to 46.0% in 1997, and declined to 40.0% in 1999. During the 1997-1999 period, SSME-3 contributed 40-46% (mean 43.5%) to the SSME annual shrimp landings, followed by SSME-2 (mean 35.8%, range 34-38%) and SSME-1 (mean 20.8%, range 16-26%).

In the SSME area, the demersal fisheries sector in SSME-3 is much influenced by traditional gear landings compared to the SSME-2 and SSME-1 areas. This trend is noted during the 1997-1999 period, where traditional gears contributed 47% to the annual demersal landings in the SSME-3 area, compared to 35% in SSME-2 and only 20% in SSME-1 (**Figure 263b**). About 54% of the SSME-3 annual demersal finfish landings had been contributed by traditional gears, with 37% in SSME-2 and only 21% in SSME-1 (**Figure 264b**). Likewise, traditional gears contributed 66% to the SSME-3 annual invertebrate landings, compared to 45% in SSME-2 and only 26% in SSME-1 (**Figure 265b**). On the other hand, commercial gears contributed more than 90% to the annual shrimp landings in the SSME area. Commercial gears contributed 98% to the annual shrimp landings in SSME-1, followed by 96% in SSME-2 and 94% in SSME-3 (**Figure 265b**). Compared to the non-SSME area, traditional gears play important roles in the SSME demersal fishery sector. Traditional gears contributed about 33.5% to the SSME annual demersal landings compared to only 12.9% in the non-SSME area (**Figure 263a**). This trend is noted in the 1997-1999 annual demersal finfish and invertebrate landings (**Figure 264a** & **Figure 266a**), where traditional gears contributed respectively between 33-36% and 12-14% to the annual landings of these demersal groups in the SSME and non-SSME areas. On the other hand, traditional gears play more important role in the non-SSME annual shrimp landings. Traditional gears contributed 26% to the non-SSME annual shrimp landings compared to only 4% in the SSME area (**Figure 265a**).

<u>Non SSME Area</u>

The non-SSME annual demersal landing breakdown is summarized in *Table 152*. The non-SSME share of the annual demersal landings during the 1991-1999 period is summarized in *Tables 157-160*. The spatial annual demersal landing landing breakdown by gear type and fishing districts in the non-SSME area are summarized in *Tables 172-181*.

During the 1991-1999 period, demersal landings in the non-SSME area increased by 80.2%, from 21,741 metric tons in 1991 to 39,183 metric tons in 1999. The significant increase in demersal landings was due to substantial contribution from trawl net landings, where around 81% of the annual demersal production had been landed by trawl net landings as well as other demersal gears (**Figure 263a**). Fishing gears with high demersal species in the annual landings include trawl net (68.4% annual gear landings), miscellaneous gears (75.3%) and hook & line (59.5%) (**Figure 262e**). In recent years, demersal landings had significantly increased by 55.4%, from 24,583 metric tons in 1996 to 38,197 metric tons in 1997-1999 (**Figure 254c**). During that period, trawl net landings and its portion of the annual landings had respectively increased by 107.8% and 140.9%. Trawl net landings had also increased from 20,439 metric tons in 1996 to 42,448 metric tons in 1997-1999. Likewise, the trawl net share of the annual landings had also increased from 45.3% in 1996 to 63.8% during that period (**Figure 140b**). Commercial gears contributed 87% to the non-SSME annual demersal landings. Trawl net landings make up 74.6% of the commercial gear landings during the 1997-1999 period, with an increase of 119.3% from 62.6% in 1996 (**Figure 217b**). Demersal species respectively make up 53.4% and 57.6% of the non-SSME annual landings during the 1991-1999 and 1997-1999 periods (*Table 152*). The demersal portion of the non-SSME annual landings had increased by 24.1%, from 45.8% in 1991 to 56.8% in 1999 (**Figure 254d**). The non-SSME area contributed 28.4-41.6% (mean 34.5%) to the annual demersal landings in Sabah during the 1991-1999 period. The non-SSME share of the demersal landings had declined by 31.6% during the 9-year period, from 41.6% in 1991 to 28.4% in 1996, and then further increased to 35.4-38.5% (mean 37.2%) during the 1997-1999 period (**Figure 254g**). As mentioned earlier, the non-SSME share had increased during the last 3 years due to increase in trawl net landings.

Kota Kinabalu contributed around 85% to non-SSME annual demersal landings in 1997-1999, with trawl net being the principal landing gear. Trawl net contributed about 81% to the annual demersal landings in the non-SSME area, with Kota Kinabalu contributing about 99% to the non-SSME annual trawl net landings during the 3-year period. Trawl net contributed 80.6% to the annual demersal landings in Kota Kinabalu during the 1997-1999 period, followed by hook & line (6.7%), miscellaneous gears (5.9%), gill net (5.2%), seine net (1.2%) and lift net (0.3%). Other districts in the west coast of Sabah contributed 15% to the non-SSME annual demersal landings, where gill net contributed 32.0% of the annual demersal landings, followed by miscellaneous gears (32.3%), hook & line (25.5%), lift net (2.2%) and seine net (0.6%). Most of the non-SSME annual demersal production had been landed in WC-North that include Kota Kinabalu. The characteristics of the demersal fisheries scenario in the non-SSME area including Kota Kinabalu for the 1997-1999 period are summarized in *Tables 168-171*. The bulk of the demersal landings in the non-SSME area had mainly been contributed by commercial gears (**Figures 123a**-**123f** & **Figures 131d**-**131f** & **Figures 140b**-**140d** & **Figures 217b** & **Figures 241b**).

During the 1997-1999 period, demersal species make up around 56.3% of the annual landings in the WC-North area. WC-North contributed around 92% to the non-SSME annual demersal landings during the 1997-1999 period. Kota Kinabalu contributed 92.8% to the WC-North annual landings, followed by Kota Belud (6.8%) and Tuaran (0.4%). In 1999, WC-North contributed 28,101 metric tons or 88.5% of the non-SSME demersal landings. Demersal species make up about 53.8% of the WC-North total landings. Demersal fishes make up 56.3% of the WC-North annual landings during the 1997-1999 period. In Kota Belud and Tuaran, demersal fishes respectively make up 43.6% and 10.6% of the annual landings. On the other hand, demersal fishes make up 58.7% of the annual landings in Kota Kinabalu. Trawl net is the principal landing gear in the WC-North, which contributed around 86% to the annual demersal landings (**Figure 263c**). Kota Kinabalu contributed almost 100% of the demersal fishes landed by trawl nets during the 1997-1999 period. Traditional gears, comprising of hook & line and miscellaneous gears formed the backbone of the demersal fisheries in the other districts (**Figure 263d**). These traditional gears contributed respectively around 85% and 68% to the annual landings in Kota Belud and Tuaran. Besides traditional gears, gill net also plays an important role in the demersal fisheries in Tuaran. Overall, commercial gears contributed 89% to the WC-North annual landings, with Kota Kinabalu contributing 99.1%, followed by Kota Belud (0.8%) and Tuaran (0.1%). Traditional gears only make up 10.9% of the WC-North annual demersal landings, with Kota Belud contributing 56.6%, followed by Kota Kinabalu (40.8%) and Tuaran (2.6%). Trawl net contributed 97.1% to the commercial gear annual demersal landings, followed by gill net (1.5%) and gill net (1.4%). On the other hand, hook & line contributed 56.9% to the traditional gear annual demersal landings, followed by miscellaneous gears (39.8%) and lift net (3.3%).

During the 1997-1999 period, demersal species make up around 43.6% of the annual landings in Kota Belud. Finfish make up 68.4% of the annual demersal landings, followed by invertebrates (21.4%) and shrimps (10.2%). In 1999, demersal landings in Kota Belud amounted to 2,300 metric tons. Demersal species make up 41.7% of the total fish landings in 1999. Finfish contributed 71.6% to the demersal landings, followed by shrimp (15.3%) and invertebrates (13.0%). Finfish landings amounted to 1,647 metric tons, comprising of 98.8% finfish, 0.5% sharks and 0.7% rays. Among the dominant species are coral fulsiers (34.2% commercial demersal finfish), threadfin bream (21.4%), snappers (18.8%), groupers (14.9%), and various species of bottom & reef resident fishes (10.7%). Invertebrate landings amounted to 300 metric ton, comprising of shellfish (37.3%), cephalopods (33.0%), mangrove crabs (15.3%) and pelagic crabs (14.3%). On the other hand, shrimp landings amounted to 353 metric tons, comprising of

Acetes shrimp (70.5%), banana shrimp (29.0%) and tiger shrimp (0.5%). Miscellaneous gears and hook & line are the principal demersal gears in Kota Belud. During the 1997-1999 period, both gears contributed respectively 44.3% and 40.5% to the annual demersal landings (**Figure 263d**), and respectively 53.8% and 38.8% to the annual finfish landings (**Figure 264d**). Hook & line and miscellaneous gears respectively contributed 65.5% and 34.5% to the annual invertebrate landings (**Figure 266d**). On the other hand, both *selambau* lift net and gill net respectively contributed 51.2% and 46.6% to the annual shrimp landings (**Figure 265d**).

During the 1997-1999 period, demersal species make up around 10.6% of the annual landings in Tuaran. Invertebrates make up 49.2% of the annual demersal landings, followed by finfish (41.5%) and shrimps (9.4%). In 1999, demersal landings in Tuaran amounted to 128 metric tons. Demersal species make up only 14.0% of the total fish landings in 1999. Invertebrates make up 48.4% of the demersal landings, followed by finfish (39.1%) and shrimp (12.5%). Invertebrate landings amounted around 62 metric tons, comprising of mangrove crabs (55.6%) and cephalopods (44.4%). Finfish landings amounted around 50 metric tons, comprising of groupers (67.39%), snappers (18.3%), slipmouths (14.4%) and rabbit fish (2.0%). On the other hand, shrimp landings amounted to 16 metric tons of shrimps, comprising of banana shrimp (94.2%) and tiger shrimp (5.8%). During the 1997-1999 period, hook & line contributed 46.9% to the annual demersal landings in Tuaran, followed by gill net (32.1%) and miscellaneous gears (21.0%) (**Figure 263d**). Both gill net and hook & line respectively contributed 54.9% and 45.1% to the annual finfish landings (**Figure 264d**). Hook & line and miscellaneous gears respectively contributed 57.3% and 42.7% to the annual invertebrate landings (**Figure 266d**). On the other hand, *selambau* lift net is the only shrimp landing gear in Tuaran (**Figure 265d**).

During the 1997-1999 period, demersal species make up 58.7% of the annual landings in Kota Kinabalu. Finfish make up 79.2% of the annual demersal landings, followed by invertebrates (18.6%) and shrimps (2.1%). In 1999, demersal landings in Kota Kinabalu amounted to 32,483 metric tons, comprising of finfish (79.9%), invertebrates (5,792 metric tons) and shrimps (742 metric tons). Demersal species make up 55.7% of the total fish landings in 1999. Finfish landings amounted to 25,949 metric tons, comprising of 55.7% commercial finfish, 3.5% sharks, 3.6% rays and 37.2% trash fish and assorted by-catch. Among the dominant commercial finfish are threadfin bream (26.0%), lizard fish (17.1%), catfish (5.5%), humphead wrasse (4.7%), snappers (3.9%), groupers (3.8%), jewfish (3.4%), slipmouths (2.7%), trigger fish (2.5%), goat fish (1.4%), bombay duck (1.0%), and various species of bottom & reef resident fishes (27.9%). Invertebrate landings amounted around 5,792 metric tons, comprising of cephalopods (88.0%), shellfish (5.9%), pelagic crab (5.2%), sea cucumbers (0.9%) and misc. crustaceans (0.1%). On the other hand, shrimp landings amounted around 742 metric tons, comprising of *Acetes* shrimp (10.9%), sand shrimp (34.3%), yellow shrimp (16.8%), tiger shrimp (9.5%) and other assorted penaeid shrimp species (28.5%). Trawl net is the principal demersal landing gear in Kota Kinabalu, contributing about 93.8% to the annual demersal landings during the 1997-1999 period (**Figure 263d**). Trawl net contributed respectively 92.6% and 97.9% to the finfish and invertebrate landings (**Figure 264d** & **Figure 266d**). On the other hand, trawl net contributed 79.9% to the annual shrimp landings, followed by miscellaneous gears (12.7%) and gill net (7.4%) (**Figure 265d**).

During the 1997-1999 period, demersal species make up around 38.6% of the annual landings in the WC-South area. WC-South contributed only 8.1% to the non-SSME annual demersal landings during the 1997-1999 period. Beaufort contributed 49.0% to the WC-South annual landings, followed by Kuala Penyu (20.3%), Papar (17.4%) and Sipitang (13.4%). In 1999, WC-South contributed 4,548 metric tons or 11.5% of the non-SSME demersal landings. Demersal species make up about 33.8% of the WC-South total landings. Demersal fishes only make up 38.6% of the WC-South annual landings during the 1997-1999 period, with Beaufort having annual fish landings dominated by demersal species (58.1%). Demersal fishes are less dominant in the annual landings in Kuala Penyu (21.7%), Sipitang (32.7%) and Papar (42.5%). Gill net is the principal gear in the WC-South, which contributed around 49% to the annual demersal landings (**Figure 263c**). Commercial gears contributed 63.5% to the WC-South annual demersal landings, with gill net making up 77.5% of the commercial gear share of the annual landings. Except for Sipitang, gill net is the principal landing gear in the WC-South (**Figure 263e**). Beaufort contributed 40.2% to the gill net share of the annual demersal landings, followed by Kuala Penyu (32.7%), Papar (17.8%) and Sipitang (9.3%). Miscellaneous gears and hook & line respectively contributed 64.6% and 35.4% to the traditional gear share of the annual demersal landings (**Figure 263e**). Beaufort contributed 82.0% to the miscellaneous gear share of the annual demersal landings, followed by Papar (9.4%), Kuala Penyu (8.3%) and Sipitang (0.2%). On the other hand, Papar contributed 49.4% to the hook & line share of the annual demersal landings, followed by Beaufort (22.8%), Sipitang (21.7%), and Kuala Penyu (6.2%). In Papar, the principal demersal gears are gill net and hook & line, which contributed 87% to the annual demersal landings. In Beaufort, the principal gears are gill net and miscellaneous gears, which contributed 80% to the annual demersal landings. Gill net is the principal gear in Kuala Penyu, which contributed 79% to the annual demersal landings. Trawl net and gill net are the principal gears in Sipitang, which contributed 76% to the annual demersal landings.

During the 1997-1999 period, demersal species make up around 58.1% of the annual landings in Beaufort. Shrimps make up 78.4% of the annual demersal landings in Beaufort during the 1997-1999 period, followed by invertebrates (11.9%) and finfish (9.8%). In 1999, demersal landings in Beaufort amounted to 6,130 metric tons, comprising of shrimps (94.5%), invertebrates (2.5%) and finfish (3.0%). Demersal species make up 67.8% of the total fish landings in 1999. Shrimp landings amounted around 1,757 metric tons, comprising of *Acetes* shrimp (32.2%), banana shrimp (60.1%), sand shrimp (34.3%), yellow shrimp (16.8%) and other assorted penaeid shrimp species (7.8%). Beaufort is the major contributor of *Acetes* shrimp landings in Sabah[155]. This species is used for making fermented shrimp paste or *belacan*. On the other hand, mangrove crabs make up 100% of the invertebrate landings amounting around 157 metric tons. Finfish landing amounted to 181 metric tons, comprising of snappers – *Lutjanus* spp. (52.6%) and threadfin bream (47.4%). During the 1997-1999 period, gill net contributed 40.3% to the annual demersal landings, followed by miscellaneous gears (39.5%), trawl net (14.2%) and hook & line (6%) (**Figure 263e**). Hook & line and gill net contributed respectively 61.5% and 38.5% to the annual finfish landings (**Figure 264e**). Gill net contributed 46.7% to the annual shrimp landings, followed by miscellaneous gears (35.2%) and trawl net (18.1%) (**Figure 265e**). On the other hand, miscellaneous gears contributed 100% to the annual invertebrate landings (**Figure 266e**). Mangrove crab (*Scylla serrata*) is the main component of the miscellaneous gear fishery in Beaufort, where mangrove crab trapping is carried out in mangrove and estuarine areas off Beaufort and Weston (Brunei Bay). Beaufort is the major source of mangrove crab landings in the non-SSME area. In 1999, Beaufort contributed respectively 68% and 50% to the total mangrove crab landings in WC-South and non-SSME area.

During the 1997-1999 period, demersal species make up around 21.7% of the annual landings in Kuala Penyu. Finfish make up 87.4% of the annual demersal landings, followed by invertebrates (11.7%) and shrimps (0.9%). In 1999, demersal landings in Kuala Penyu amounted to 724 metric tons, comprising of finfish (88.7%), invertebrates (10.2%) and shrimp (1.1%). Demersal species make up 24.4% of the total fish landings in 1999. Finfish landings amounted to 642 metric tons, comprising of commercial fish (29.0%), shark (39.4%), rays (27.4%) and trash fish (4.2%). Catfish make up 70.5% of the commercial species, followed by threadfin bream (6.9%),

[155] In 1999, *Acetes* shrimp landings in Sabah amounted to 1,053 metric tons or 9.5% of the total shrimp landings. The non-SSME area contributed around 90% to the total landings. Beaufort contributed 53.6% to the total landings, followed by Kota Belud (23.6%), Tawau (9.6%), Kota Kinabalu (7.7%), Papar (4.1%), Sipitang (1.0%) and Kudat (0.3%).

rabbit fish (6.0%), flatfish (5.4%), humphead wrasse (3.9%), groupers (2.4%) and various species of bottom & reef resident fishes (4.9%). Invertebrate landings amounted around 74 metric tons, comprising of mangrove crabs (75.7%), cephalopods (22.9%) and pelagic crabs (1.4%). On the other hand, shrimp landings only amounted around 8 metric tons, comprising of banana shrimp (86.9%) and tiger shrimp (13.1%). During the 1997-1999 period, gill net contributed 79.3% to the annual demersal landings, followed by miscellaneous gears (9.7%), hook & line (3.9%), seine net (3.9%) and trawl net (3.2%) (**Figure 263e**). Gill net contributed 89.6% to the finfish landings, followed by hook & line (4.5%), seine net (3.1%) and trawl net (2.8%) (**Figure 264e**). Gill net and trawl net respectively contributed 97.7% and 2.3% to the shrimp landings (**Figure 265e**). Miscellaneous gears contributed 83.3% to the invertebrate landings, followed by seine net (10.4%), trawl net (5.7%) and gill net (0.6%) (**Figure 266e**).

During the 1997-1999 period, demersal species make up 42.5% of the annual landings in Papar. Finfish make up 74.4% of the annual demersal landings, followed by invertebrates (13.3%) and shrimps (12.3%). In 1999, demersal landings in Papar amounted to 411 metric tons, comprising of finfish (70.1%), shrimp (19.0%) and invertebrates (10.9%). Demersal species make up 50.9% of the total fish landings in 1999. Finfish landings amounted aroundo 288 metric tons, comprising of commercial fish (81.5%), elasmobranches (6.6%) and trash fish (11.9%). Threadfin bream make up 12.9% of the commercial fish landing, followed by catfish (10.4%), trigger fish (9.1%), snappers (8.9%), silver biddies (8.6%), whitings (8.1%), coral fulsiers (5.6%), rabbit fish (4.9%), barramundi (4.9%) and various other species of bottom & reef resident fishes (26.4%). Invertebrate landings amounted around 45 metric tons, comprising of pelagic crabs (38.7%), mangrove crabs (35.1%) and cephalopods (26.2%). Shrimp landings amounted to 78 metric tons, comprising of *Acetes* shrimp (55.8%), banana shrimp (21.7%) and tiger shrimp (22.5%). During the 1997-1999 period, gill net contributed 50.4% to the annual demersal landings, followed by hook & line (36.7%) and miscellaneous gears (12.8%) (**Figure 263e**). Gill net and hook & line respectively contributed 56.4% and 43.6% to the finfish landings (**Figure 264e**). Gill net and miscellaneous gears respectively contributed 68.9% and 31.1% to the shrimp landings (**Figure 265e**). On the other hand, hook & line and miscellaneous gears respectively contributed 32.4% and 67.6% to the invertebrate landings (**Figure 266e**).

During the 1997-1999 period, demersal species make up around 32.7% of the annual landings in Sipitang. Shrimp make up 71.4% of the annual demersal landings, followed by finfish (26.2%) and invertebrates (2.4%). In 1999, demersal landings in Sipitang amounted to 391 metric tons or 30% of the total fish landings. Shrimps make up 78.5% of the demersal landings, followed by finfish (20.7%) and invertebrates (0.8%). Shrimp landings amounted around 307 metric tons, comprising of *Acetes* shrimp (3.4%) and banana shrimp (96.6%). Finfish landings amounted to 81 metric tons, comprising of rays (54.7%), commercial fishes (35.8%), sharks (7.0%) and trash fish (2.5%). Catfish make up 43.3% of the commercial fish landings, followed by whitings (19.3%), groupers (17.5%), snappers (9.2%) and various other species of bottom & reef resident fishes (10.7%). On the other hand, mangrove and pelagic crabs respectively make up 98.5% and 1.5% of the invertebrate landings amounting around 3 metric tons. During the 1997-1999 period, trawl net contributed 42.1% to the annual demersal landings, followed by gill net (36.7%), hook & line (21.0%), seine net (2.3%) and miscellaneous gears (0.4%) (**Figure 263e**). Hook & line contributed 78.4% to the finfish landings, followed by gill net (16.3%) and seine net (5.3%) (**Figure 264e**). Trawl net contributed 57.2% to the shrimp landings, followed by gill net (41.6%) and seine net (1.2%) (**Figure 265e**). Trawl net contributed 51.6% to the invertebrate landing, followed by hook & line (19.4%), miscellaneous gears (17.9%) and gill net (11.0%) (**Figure 266e**).

SSME Area

The SSME annual demersal landing breakdown by fishing regions is summarized in *Tables 153-156*. The SSME and SSME regional share of the annual demersal landings during the 1991-1999 period is summarized in *Tables 157-160*. The spatial characteristics of the demersal landing breakdown by gear type in the SSME area during the 1997-1999 period are summarized respectively in *Tables 182-185* & Figures (SSME-1), *Tables 186-188* (SSME-2) and *Tables 189-193* (SSME-3).

In the SSME area, demersal landings had increased by 134.4%, from 30,559 metric tons in 1991 to 71,618 metric tons in 1999 (**Figure 254e**). During the 9-year period, demersal species make up 49.8% of the SSME annual landings (*Table 153*). The demersal portion of the SSME annual landings had fluctuated between 45.8-52.0% during the 9-year period, and in recent years had increased to 49.7-52.0% (**Figure 254f**). During the 1997-1999 period, demersal species make up around 49.7-52.0% of the annual landings. Compared to the non-SSME area, the annual gear landing contribution in the SSME area is more evenly distributed throughout the 9-year period (**Figure 140e**). Trawl net contributed 48.3% to the SSME annual demersal landings, followed by hook & line (22.2%), gill net (14.2%), miscellaneous gears (9.0%), seine net (3.5%) and lift net (2.3%). The principal demersal landing gears in the SSME area are trawl net (demersal species make up 86.5% of annual gear landings), followed by miscellaneous gears (87.9%) and hook & line (63.2%).

During the 1991-1999 period, SSME contributed around 58-72% (mean 65.5%) to the annual demersal landings. SSME share of the demersal landings had increased by 10.6% during the 9-year period, from 58.4% in 1991 to 64.6% in 1999 (**Figures 254g**-**254h**). SSME share had initially increased by 22.5%, to 71.6% in 1996, and declined down to 62-63% in 1997-1999. The SSME area contributed 65.0% (range: 51-74%) to the annual finfish landings during the 9-year period, where its share of the annual landings had increased by 27.7%, from 50.9% in 1991 to 65.1% in 1999 (**Figures 254j**-**254k**). SSME share of the finfish landings had initially increased by 45.7% to 74.2% in 1996, and declined down to 60-65% in 1997-1999. On the other hand, SSME contributed 63.6% to the annual invertebrate landings, and its landing share had declined by 25.1%, from 72.4% in 1991 to 54.2% in 1999 (**Figures 254n**-**254o**). The SSME share of the invertebrate landings had increased by 10.4% to 79.9% in 1993, and since then had declined steadily to its present level in 1999. SSME contributed 68.6% to the shrimp landings during the 9-year period, and its share had increased slightly by 7.5%, from 71.4% in 1991 to 76.8% in 1999 (**Figures 254r**-**254s**). Its share of the annual shrimp landings had increased initially by 14.7% to 81.9% in 1998, and had declined by 6.3% to its present level in 1999.

In the SSME area, SSME-2 contributed 32-62% (mean: 40.7%) to the SSME annual demersal landings during the 1991-1999 period, followed by SSME-1 (34.5%, range: 20-48%) and SSME-3 (24.8%, range: 14-34%) (**Figure 254i**). During the 9-year period, SSME-1 share of the SSME annual demersal landings had significantly increased by 83.4%, from 20.1% in 1991 to 37.0% in 1999. Trawl net contributed to the SSME-1 significant increase of the SSME annual demersal landings (**Figure 217d**). During that period, SSME-1 share of the SSME annual trawl net landings had increased by 48.7%, from 33.8% in 1991 to 50.3% in 1999 **(Figures 212-214**). SSME-3 share had also increased by 71.4%, from 18.3% in 1991 to 31.5% in 1999. On the other hand, SSME-2 share of the SSME annual demersal landings had declined by 48.7%, from 61.6% in 1991 to only 31.6% in 1999. In 1999, SSME-1 had taken over SSME-2 as the principal demersal landing contributor in the SSME area. During the 1997-1999 period, the SSME-1 area contributed 34.2% (range: 31-37%) to the SSME annual demersal landings, followed by SSME-2 (33.9%, range: 32-36%) and SSME-3 (31.9%, range: 30-34%).

SSME-1 demersal landings had increased by 330.9% during the 9-year period, from 6,146 metric tons in 1991 to 26,480 metric tons in 1999 (**Figures 256a**-**256b**). Demersal species make up 70.2% of the SSME-1 annual landings during the 1991-1999 period (*Table 154*). Substantial trawl net contribution attributed to the dominant presence of demersal species in the SSME-1 annual landings (**Figures 167-168**). During the 1997-1999 period, trawl net contributed 72.4% to the SSME-1 annual demersal landings, followed by hook & line (17.5%), gill net (4.5%), seine net (3.0%), miscellaneous gears (2.6%) and lift net (0.05%) (**Figure 263b**). The principal gears in the SSME-1 demersal fisheries are trawl net (demersal species make up 84% of annual gear landings), hook & line (82%) and miscellaneous gears (99%) (**Figure 262a**). During the 9-year period, the demersal portion of the SSME-1 annual landings had increased by 44.7%, from 52.3% in 1991 to 75.6% in 1999 (**Figure 173**). SSME-1 share of the SSME annual demersal landings increased by 136.5%, from a low 20.1% in 1991 to its peak of 47.6% in 1993, declined by 36.3% to 30.3% in 1996, and then increased by 22.0% to 37.0% in 1999 (**Figure 172**).

The characteristics of the demersal fisheries scenario in the SSME-1 area are given in *Tables 172-175* and **Figures 156-173** & **Figures 256a**-**256r**. Kudat contributed the bulk of the SSME-1 annual demersal landings. During the 1991-1999 period, Kudat contributed 86.4% to the SSME-1 annual demersal landings, followed by Kota Marudu (10.9%) and Pitas (2.7%). During the 9-year period, Kudat share of the annual demersal landings had increased because of declining landings in Kota Marudu **(Figures 256c-256d**). Kudat contributed 95.5% to the SSME-1 annual demersal landings during the 1997-1999 period, followed by Kota Marudu (2.4%) and Pitas (2.1%) (**Figures 256e**-**256f**). Trawl net is the principal landing gear in the SSME-1 area (**Figure 263b**). Trawl net and hook & line contributed respectively 70% and 21% to the annual demersal landings in Kudat (**Figure 263f**). On the other hand, gill net and miscellaneous gears respectively contributed 48% and 47% to the demersal landings in Kota Marudu. Traditional gears contributed 64% to the annual demersal landings in Pitas. Miscellaneous gears contributed 42.1% to the annual demersal landings in Pitas, followed by gill net (31.3%) and hook & line (22.0%). SSME-1 share of the SSME annual demersal landings during the 1991-1999 period is shown in **Figure 172**.

SSME-1 contributed respectively 37.3%, 17.3% and 32.0% to the demersal finfish, shrimp and invertebrate annual landings in the SSME area in 1991-1999 (**Figures 255g-255i**). During the 1991-1999 period, finfish make up 74.9% of the SSME-1 annual demersal landings, followed by invertebrates (17.5%) and shrimps (7.6%) (**Figure 255j**).

During the 9-year period, SSME-1 contribution to the SSME annual demersal finfish landings had increased by 62.9%, from 26.0% in 1991 to 42.3% in 1999 (**Figure 255g**). During the 1997-1999 period, SSME-1 share fluctuated around 35-42% (mean: 38.8%), replacing SSME-2 as the principal contributor in the SSME area. Kudat contributed 98.7% to the SSME-1 annual demersal finfish landings during the 1991-1999 period, followed by Kota Marudu (0.8%) and Pitas (0.5%) (**Figures 256e**-**256f**). The principal landing gears for demersal finfish in the SSME-1 are trawl net (73.0% share) and hook & line (20.5%) (**Figure 264b**). During the 1997-1999 period, both gears respectively contributed 68.2% and 24.5% to the annual landings in Kudat (**Figure 264f**). In Kota Marudu, gill net and hook & line contributed respectively 80.9% and 11.8% to the annual landings. Hook & line and gill net contributed respectively 62.5% and 37.5% to the annual demersal finfish landings in Pitas.

SSME-1 share of the SSME annual invertebrate landings fluctuated around 15-70% during the 9-year period, and during the 1997-1999 period had declined to 15-28% (mean 20.4%) (**Figure 255i**). SSME-1 has the smallest share to the annual invertebrate landings in the SSME area, after SSME-3 (29.9%) and SSME-2 (49.7%). Kudat contributed 79.5% to the SSME-1 annual invertebrate landings, followed by Kota Marudu (14.4%) and Pitas (6.1%) (**Figures 256g**-**256h**). Trawl net is the principal invertebrate gear in the SSME-1, with miscellaneous gears as secondary landing gears (**Figure 266b**). In Kudat, trawl net contributed more than 70% to the annual invertebrate landings (**Figure 266f**). Miscellaneous gears contributed respectively 98% and 83% to the annual invertebrate landings in Kota Marudu and Pitas.

SSME-1 share of the SSME annual shrimp landings had increased by 120.3%, from 11.8% in 1991 to 26.0% in 1999 (**Figure 255j**). During the 1997-1999 period, SSME-1 share fluctuated around 16-24% (mean 20.8%). SSME-1 has the smallest share of the SSME annual shrimp landings during the 1997-1999 period, after SSME-2 (35.7%) and SSME-3 (43.5%). Kudat contributed 79.5% to the SSME-1 annual shrimp landings during the 1997-1999 period, followed by Kota Marudu (16.7%) and Pitas (3.8%) (**Figures 256i-256j**). Trawl net is the principal shrimp landing gear in SSME-1, with gill net as secondary gears (**Figure 265b**). Trawl net contributed more than 98% to the annual shrimp landings in Kudat during the 1997-1999 period (**Figure 265f**). On the other hand, gill net is the principal landing gear in Kota Marudu, which had contributed more than 90% to the annual shrimp landings. In Pitas, gill net and miscellaneous gears contributed respectively 73% and 27% to the annual shrimp landings.

During the 1997-1999 period, demersal species make up 72.0% of the annual landings in Kudat (**Figures 256m-256n**). Finfish make up 85.9% of the annual demersal landings, followed by invertebrates (8.1%) and shrimps (6.0%). In 1999, demersal landings in Kudat amounted to 26,034 metric tons or 76.1% of the total landings. Finfish make up 87.7% of the demersal landings, followed by invertebrates (7.5%) and shrimps (4.8%). Finfish landings amounted to 22,843 metric tons, comprising of commercial fishes (38.2%), rays (0.9%), sharks (0.4%) and trash fish & unsorted by-catch (60.5%). Groupers make up 37.8% of the commercial fish landings, followed by threadfin bream (20.0%), lizard fish (6.6%), snapper (5.6%) coral parrot fish - *Callyodon* spp. (4.2%), jew fish (4.0%), silver biddies (4.0%), humphead wrasse (3.2%) and various other species of bottom & reef resident fishes (14.8%). Invertebrate landings amounted to 1,941 metric tons, comprising of cephalopods (64.3%), pelagic crab (18.8%), shellfish (6.4%), abalone (6.2%), lobsters (1.6%), sea cucumbers (1.1%), mangrove crab (0.9%) and other miscellaneous invertebrates (0.6%). Shrimp landings amounted to 1,250 metric tons, comprising of sand shrimp (90.1%), pink shrimp (5.4%), *Acetes* shrimp (0.2%) and other penaeid species (4.3%). During the 1997-1999 period, trawl net contributed 70.5% to the annual demersal landings, followed by hook & line (21.1%), gill net (3.7%), seine net (3.7%) and miscellaneous gears (1.1%) (**Figure 263f**). Trawl net contributed 68.2% to the finfish landings, followed by hook & line (24.5%), seine net (3.9%), gill net (3.1%) and miscellaneous gears (0.3%) (**Figure 264f**). Trawl net contributed 98.8% to the shrimp landings, followed by gill net (1.0%) and miscellaneous gears (0.2%) (**Figure 265f**). Trawl net contributed 72.9% to the invertebrate landing, followed by gill net (11.7%), miscellaneous gears (10.4%), seine net (4.2%) and hook & line (0.8%) (**Figure 266f**).

Demersal species make up 85.7% of the annual landings in Kota Marudu during the 1997-1999 period (**Figures 256o-256p**). Invertebrates make up 48.2% of the annual demersal landings, followed by shrimps (41.6%) and finfish (10.2%). In 1999, demersal landings in Kota Marudu amounted to 273 metric tons or 76.9% of the total landings. Shrimps make up 77.9% of the demersal landings, followed by invertebrates (14.9%) and finfish (14.9%). Shrimp landings amounted to 213 metric tons, comprising of banana shrimp (67.0%), yellow shrimp (30.5%) and other penaeid species (2.5%). Invertebrate landings amounted to about 20 metric tons, comprising of shellfish (57.0%), mangrove crabs (23.6%) and pelagic crab (19.4%). Finfish landings amounted to only 41 metric tons, comprising of commercial fishes (97.0%) and trash fish & unsorted by-catch (3.0%). Snappers make up 28.4% of the commercial fish landings, followed by silver biddies (17.1%), whitings (14.1%), barramundi (11.0%), grunts (10.1%), catfish (10.0%), sickle fish (6.2%), grouper (1.5%) and conger eel (1.5%). During the 1997-1999 period, miscellaneous gears contributed 48.2% to the annual demersal landings, followed by gill net (47.2%), trawl net (3.4%) and hook & line (1.2%) (**Figure 263f**). Gill net contributed

80.9% to the finfish landings, followed by hook & line (11.8%), trawl net (7.2%) and miscellaneous gears (0.2%) (**Figure 264f**). Gill net contributed 92.3% to the shrimp landings, followed by trawl net (5.4%) and miscellaneous gears (2.3%) (**Figure 265f**). Miscellaneous gears contributed 98.1% to the invertebrate landing, followed by gill net (1.1%) and trawl net (0.8%) (**Figure 266f**).

During the 1997-1999 period, demersal species make up 45.8% of the annual landings in Pitas (**Figures 256q**-**256r**). Invertebrates make up 44.1% of the annual demersal landings, followed by finfish (35.2%) and shrimps (20.8%). In 1999, demersal landings in Pitas amounted to 135 metric tons or 28.8% of the total landings. Finfish make up 52.0% of the demersal landings, followed by shrimp (39.0%) and invertebrates (9.0%). Finfish landings amounted to 70 metric tons, comprising of 92.7% commercial fishes, rays (6.2%) and sharks (1.1%). Grunts make up 26.0% of the commercial fish landings, followed by snappers (25.5%), threadfin breams (18.0%), cat fish (12.5%), groupers (9.9%), cat fish (8.0%), barramundi (6.9%), jew fish (0.6%) and sickle fish (0.6%). Shrimp landings amounted to 53 metric tons, comprising of yellow shrimp (64.2%), rainbow shrimp (20.6%), tiger shrimp (11.0%) and other penaeid species (4.2%). Invertebrate landings amounted to 12 metric tons, comprising of cephalopods (65.4%) and pelagic crabs (34.6%). During the 1997-1999 period, miscellaneous gears contributed 42.1% to the annual demersal landings, followed by gill net (31.3%), hook & line (22.0%) and *bagang* lift net (4.6%) (**Figure 263f**). Hook & line and gill net respectively contributed 62.5% and 37.5% to the finfish landings (**Figure 264f**). Gill net and miscellaneous gears respectively contributed 72.8% and 27.2% to the shrimp landings (**Figure 265f**). Miscellaneous gears contributed 82.8% to the invertebrate landing, followed by *bagang* lift net (10.4%) and gill net (6.9%) (**Figure 266f**).

SSME-2 demersal landings had increased slightly by 20.2%, from 18,804 metric tons in 1991 to 22,601 metric tons in 1999 (**Figure 257m**). Demersal species make up 65.8% of the SSME-2 annual landings during the 1991-1999 period (*Table 155* & **Figure 257n**). The high portion of demersal species in the annual landings was attributed by the combined contribution of principal fishing gears in the SSME-2 demersal fisheries (**Figures 186-187**). Trawl net contributed 36.0% to the SSME-2 annual demersal landings, followed by gill net (29.0%), hook & line (17.6%), miscellaneous gears (17.1%) and seine net (0.3%) (**Figure 263b**). The principal gears in the SSME-2 demersal fisheries are trawl net (demersal species make 92% of annual gear landings), hook & line (68%), gill net (52%) and miscellaneous gears (85%) (**Figure 262b**). The demersal portion of the SSME-2 annual landings had decreased by 5.3%, from 70.8% in 1991 to 67.0% in 1999 (**Figure 192**). SSME-2 share of the SSME annual landings had declined significantly from 61.3% in 1991 to only 31.6% in 1999 (**Figure 191**). In 1999, SSME-2 position as the SSME principal contributor had been taken over by SSME-1 (**Figure 254i**).

The characteristics of the demersal fisheries scenario in the SSME-2 area are given in *Tables 176-178* and **Figures 174-192** & **Figures 257a**-**257p**. Sandakan contributed 80% to the SSME-2 annual demersal landings during the 1991-1999 period (**Figures 254m-254n**). During the last few years, Sandakan share of the annual demersal landings had increased because of declining landings in Beluran (**Figures 257c**-**257d**). During the 1997-1999 period, Sandakan contributed 87% to the SSME-2 annual demersal landings. Gill net contributed 31.4% to the Sandakan annual demersal landings, followed by trawl net (28.7%), hook & line (20.9%) and miscellaneous gears (19.0%) (**Figures 263g**). Overall, commercial gears contributed 60.1% to the annual demersal landings in Sandakan. On the other hand, trawl net contributed 61.1% to the annual demersal landings in Beluran, followed by gill net (22.9%), miscellaneous gears (10.9%), hook & line (3.1%) and seine net (2.0%). Overall, commercial gears contributed 86.0% to the annual demersal landings in Beluran.

Sandakan contributed 85.0% to the SSME-2 annual demersal landings during the 1997-1999 period. Gill net and trawl net are the principal demersal landing gears in Sandakan. During the 1997-1999 period, these gears contributed 60% to the annual demersal landings in Sandakan (**Figure 263g**). Traditional gears also play an important role in the demersal fisheries, where hook & line and miscellaneous gears landings respectively making up 52.4% and 47.6% of the traditional gear contribution to the annual demersal landings in Sandakan. Commercial gears contributed 86% to the annual demersal landings in Beluran. During the 1997-1999 period, trawl net and gill net contributed respectively 61.1% and 22.9% to the annual demersal landings in Beluran. On the other hand, traditional gears only contributed 14% to the annual demersal landings, with hook & line and miscellaneous gears landings respectively making up 52.4% and 47.6% of the traditional gear contribution to the annual demersal landings in Beluran.

SSME-2 contributed respectively 36.9%, 52.9% and 47.7% to the SSME demersal finfish, shrimp and invertebrate annual landings in 1991-1999 (**Figures 254l-254m**, **Figures 254p-254q** & **Figures 254t-254u**). During the 1991-1999 period, finfish make up 61.7% of the SSME-2 demersal landings, followed by invertebrates (19.5%) and shrimps (18.7%) (**Figure 257a-257b**). During the 9-year period, SSME-2 share of the SSME demersal finfish landings had declined by 45.3%, from 51.6% in 1991 to 28.2% in 1999 (**Figures 254l-254m**). During the 1997-1999 period, SSME-2 share fluctuated around 28-32% (mean: 30.7%), making it the second main contributor in the SSME area after SSME-1. During the 1991-1999 period, Sandakan and Beluran respectively contributed 92.8% and 7.2% to the SSME-2 demersal finfish landings (**Figures 257c-257d**). Gill net is the principal landing gear in the SSME-2, with hook & line and trawl net as secondary gears (**Figure 264g**). Both gill net and hook & line respectively contributed 43% and 28% to the annual demersal finfish landings in Sandakan (**Figure 264g**). In Beluran, gill net and trawl net contributed respectively 46% and 39% to the annual landings.

SSME-2 share of the SSME annual invertebrate landings fluctuated around 27.1-71.8% during the 9-year period, and during the last 3-years seems to have declined to 45-50% (mean 49.7%) (**Figures254p-254q**). SSME-2 contributed the largest portion of the SSME annual invertebrate landings. Sandakan and Beluran contributed respectively 81% and 19% to the SSME-2 annual invertebrate landings (**Figures 257g-257h**). The principal invertebrate landing gears in the SSME-2 area are trawl net and miscellaneous gears (**Figure 266b**). Both gears respectively contributed 51.6% and 48.4% to the annual invertebrate landings in Sandakan (**Figure 266g**). On the other hand, trawl net and miscellaneous gears contributed respectively 54% and 38% to the annual invertebrate landings in Beluran.

SSME-2 share of the SSME annual shrimp landings had declined by 54.8%, from 75.1% in 1991 to 33.9% in 1999 (**Figures254t-254u**). During the 1997-1999 period, SSME-2 share fluctuated around 34-39% (mean 35.7%). SSME-2 position as the principal shrimp contributor in the SSME area had been taken over by SSME-3 (43.5%) during the last few years. During the 1997-1999 period, Sandakan and Beluran respectively contributed 52.9% and 47.1% to the SSME-2 annual shrimp landings (**Figures 257i-257j**). Trawl net is the principal shrimp landing gear in SSME-2 (**Figure 265b**). Trawl net contributed respectively 93% and 82% to the annual shrimp landings in Sandakan and Beluran during the 1997-1999 period (**Figure 265g**).

During the 1997-1999 period, demersal species make up 65.0% of the annual landings in Sandakan (**Figures 257m-257n**). Finfish make up 73.4% of the annual demersal landings, followed by invertebrates (18.2%) and shrimps (8.4%). In 1999, demersal landings in Sandakan amounted to 19,351 metric tons or 65.8% of the total landings. Finfish make up 71.2% of the demersal landings, followed by invertebrates (18.9%) and shrimps (9.9%). Finfish landings amounted to 13,779 metric tons, comprising of commercial fishes (82.6%), rays (4.6%), sharks (7.9%) and trash fish & unsorted by-catch (4.9%). Snappers make up 34.8% of the commercial fish landings, followed by threadfin breams (11.7%), catfishes (15.6%), groupers (8.1%), barramundi (6.9%), conger eel (6.8%), jew fish (3.8%), flatfish (2.7%) and other species of bottom & reef resident fishes (9.0%). Invertebrate landings amounted to 3,664 metric tons, comprising of mangrove crabs (36.3%), pelagic crabs (31.6%), cephalopods (30.6%), shellfish (0.8%) and sea cucumbers (0.7%). Shrimp landings amounted to 1,907 metric tons, comprising of banana shrimp (55.1%), yellow shrimp (26.8%), pink shrimp (13.9%) and tiger shrimp (4.2%). During the 1997-1999 period, gill net contributed 31.4% to the annual demersal landings, followed by trawl net (28.7%), hook & line (20.9%) and miscellaneous gears (19.0%) (**Figure 263g**). Gill net contributed 42.8% to the finfish landings, followed by hook & line (28.5%), trawl net (16.4%) and miscellaneous gears (12.4%) (**Figure 264g**). Trawl net and miscellaneous gears respectively contributed 93.5% and 6.5% to the shrimp landings (**Figure 265g**). Trawl net and miscellaneous gears respectively contributed 48.4% and 51.6% to the invertebrate landing (**Figure 266g**).

During the 1997-1999 period, demersal species make up 68.4% of the annual landings in Beluran (**Figures 257o-257p**). Shrimp make up 42.5% of the annual demersal landings, followed by finfish (33.4%) and invertebrates (24.1%). In 1999, demersal landings in Beluran amounted to 3,044 metric tons or 70.9% of the total landings. Finfish make up 44.7% of the demersal landings, followed by shrimps (32.0%) and invertebrates (23.3%). Finfish landings amounted to 1,359 metric tons, comprising of commercial fishes (98.6%), rays (1.2%) and trash fish (0.2%). Catfish make up 44.6% of the commercial fish landings, followed by jew fish (26.5%), snapper (17.0%), barramundi (6.0%), threadfin bream (5.0%), slipmouths (0.6%), grouper (0.2%) and flat fish (0.2%). Shrimp landings amounted to 973 metric tons, comprising of banana shrimp (39.4%), yellow shrimp (32.2%) and sharp rostrum shrimp (28.4%). Invertebrate landings amounted to 712 metric tons, comprising of cephalopods (40.6%), mangrove crabs (37.1%), pelagic crabs (14.5%) and shellfish (7.8%). During the 1997-1999 period, trawl net contributed 61.1% to the annual demersal landings, followed by gill net (22.9%), miscellaneous gears (10.9%), hook & line (3.1%) and seine net (2.0%) (**Figure 263g**). Gill net contributed 46.0% to the finfish landings, followed by trawl net (39.2%), hook & line (9.3%), miscellaneous gears (4.8%) and seine net (0.7%) (**Figure 264g**). Trawl net and gill net respectively contributed 82.3% and 17.7% to the shrimp landings (**Figure 265g**). Trawl net contributed 54.0% to the invertebrate landings, followed by miscellaneous gears (36.5%) and seine net (7.5%) (**Figure 266g**).

SSME-3 demersal landings had increased by 301.8%, from 5,609 metric tons in 1991 to 22,538 metric tons in 1999 (**Figure 258a**). Demersal species make up only 26.8% of the SSME-3 annual landings (*Table 156* & **Figure 211**). The low portion of demersal species in the SSME-3 annual landings was attributed by substantial landings from pelagic gears (**Figure 205**), purse seines in particular that contributed 33-53% to the annual landings (**Figure 206**). During the 1997-1999 period, trawl net contributed 36.5% to the annual demersal landings, followed by hook & line (32.7%), gill net (8.7%), seine net (7.5%), miscellaneous gears (7.4%) and lift net (7.3%) (**Figure 263b**). The principal demersal gears in the SSME-3 demersal fisheries are trawl net (demersal species make up 85.9% of the annual gear landings, hook & line (53.5%) and miscellaneous gears (91.3%) (**Figure 262c**). The demersal portion of the SSME-3 annual landings had increased by 30.9%, from 24.8% in 1991 to 32.4% in 1999 (**Figure 211**). SSME-3 share of the SSME annual demersal landings had increased by 87.2% from 18.4% in 1991 to 34.4% in 1997, and then declined by 8,4% to 31.5% in 1999 (**Figure 210**).

During the 1991-1999 period, Tawau contributed 48.1% to the SSME-3 annual demersal landings, followed by Lahad Datu (19.9%), Kunak (18.2%) and Semporna (13.9%) (**Figures 258c-258d**). In recent years, Tawau share of the SSME-3 annual demersal landings had substantially increased due to increase in trawl net landings. During the 1997-1999 period, Tawau contributed 53.0% to the SSME-3 annual demersal landings, followed by Lahad Datu (25.2%), Kunak (13.4%) and Semporna (8.4%). Hook & line is the principal demersal landing gear in Lahad Datu, Kunak and Semporna (**Figure 263h**). On the other hand, trawl net is the principal landing gear in Tawau. During the 1997-1999 period, trawl net contributed 71.1% to the annual demersal landings in Tawau, followed by gill net (10.3%), miscellaneous gears (8.3%), lift net (8.1%) and hook & line (2.2%). Overall, commercial gears contributed 81.4% to the annual demersal landings in Tawau. Hook & line contributed 77.6% to the annual demersal landings in Lahad Datu, followed by trawl net (11.1%), miscellaneous gears (5.3%), gill net (2.8%), lift net (2.2%) and seine net (0.9%). Overall, traditional gears contributed 85.1% to the annual demersal landings in Lahad Datu. Hook & line contributed 47.6% to the annual demersal landings in Kunak, followed by lift net (21.0%), gill net (10.4%) and miscellaneous gears (1.1%). Overall, traditional gears contributed 89.6% to the annual demersal landings in Kunak. Hook & line contributed 47.6% to the annual demersal landings in Semporna, followed by trawl net (20.9%), miscellaneous gears (15.1%), gill net (14.3%) and seine net (2.1%).

SSME-3 contributed respectively 25.8%, 29.8% and 20.3% to the demersal finfish, shrimp and invertebrate annual landings in the SSME area during the 1991-1999 period (**Figures 254l-254m**, **Figures 254p-254q** & **Figures 254t-254u**). During the 1991-1999 period, finfish make up 72.2% of the SSME-3 annual demersal landings, followed by shrimps (16.5%) and invertebrates (11.3%) (**Figures 258a-258b**). During the 9-year period, SSME-3 share of the SSME demersal finfish annual landings had increased by 31.4%, from 22.4% in 1991 to 29.4% in 1999 (**Figure 254l-254m**). During the 1997-1999 period, SSME-3 share of the demersal finfish landings fluctuated around 28-34% (mean: 30.5%), making it the smallest contributor in the SSME area. During the 1997-1999 period, Tawau contributed 47.8% to the SSME-3 annual demersal finfish landings, followed by Lahad Datu (32.8%), Kunak (12.2%) and Semporna (7.1%) (**Figures 258e-258f**). Hook & line and trawl net are the principal finfish landing gears in the SSME-3 (**Figure 264b**). Trawl net is the principal landing gear in Tawau (**Figure 264h**). On the other hand, hook & line is the principal demersal finfish landing gear in Semporna, Kunak and Lahad Datu.

SSME-3 share of the SSME annual invertebrate landings fluctuated around 3-36% during the 1991-1999 period, and in recent years had increased steadily to 27-36% (mean 29.9%) in 1997-1999 (**Figures 254t-254u**). SSME-3 is the second main contributor to the annual invertebrate landings in the SSME area after SSME-2. During the 1997-1999 period, Tawau contributed 53.5% to the SSME-3 annual demersal finfish landings, followed by Semporna (18.1%), Kunak (16.0%) and Lahad Datu (12.4%) (**Figures 258g-258h**). Lift net, miscellaneous gears and trawl nets are the principal invertebrate landing gears in the SSME-3 (**Figure 266b**). These gears contributed 33.3% each to the annual invertebrate landings in Tawau (**Figure 266h**). On the other hand, gill net and miscellaneous gears are the principal gears in Semporna. Lift net is the sole landing gear for invertebrate in Kunak. Trawl net and miscellaneous gears contributed 41% each to the annual invertebrate landings in Lahad Datu.

SSME-3 share of the SSME annual shrimp landings had increased by 206.8%, from 13.1% in 1991 to 40.1% in 1999 (**Figures 254p-254q**). During the 1997-1999 period, SSME-3 share fluctuated around 40-46% (mean 43.5%). SSME-3 had replaced SSME-2 as the top shrimp contributor in the SSME area since 1997. During the 1997-1999 period, Tawau contributed 84.9% to the SSME-3 annual shrimp landings, followed by Lahad Datu (8.3%) and Semporna (6.8%) (**Figures 258i-258j**). No shrimps landings were recorded for Kunak. It is generally believed that a significant portion of the shrimp landings in Tawau was sourced from nearby Indonesian waters. The shrimp fishing ground in Tawau is limited in area, and according to previous studies carried out by some workers (Simpson and Chin, 1978 & Biusing, 1985), the annual MSY of trawler-shrimp resources in Tawau was estimated to be around 600-800 metric tons based on catch and effort data for 1967-1985. According to available landing statistics for 1991-1999, the annual shrimp landings in the SSME-3 had significantly increased from less than 2,000 before 1995 to 3,000 metric tons during the 1997-1999 period, with high jump in annual landings observed for Tawau, Lahad Datu and Semporna. Trawl net and gill net are the principal shrimp landing gears in the SSME-3 area (**Figure 265b**). Trawl net and gill net contributed respectively 71.1% and 22.5% to the annual shrimp landings in Tawau during the 1997-1999 period (**Figure 265h**). Trawl net contributed respectively 93% and 86% to the annual shrimp landings in Semporna and Lahad Datu.

During the 1997-1999 period, demersal species make up 63.1% of the annual landings in Tawau (**Figures 258m-258n**). Finfish make up 61.3% of the annual demersal landings, followed by shrimps (25.8%) and invertebrates (12.9%). In 1999, demersal landings in Tawau amounted to 11,862 metric tons or 60.9% of the total landings. Finfish make up 61.8% of the demersal landings, followed by shrimps (23.2%) and invertebrates (15.0%). Finfish landings amounted to 7,327 metric tons, comprising of commercial fishes (73.9%), rays (6.0%), sharks (3.0%) and trash fish & unsorted by-catch (17.1%). Jew fishes 15.4% of the commercial fish landings, followed by threadfin breams (11.5%), conger eel (10.0%), catfishes (9.8%), snappers (9.3%), slip mouths (8.0%), lizard fishes (6.5%), groupers (6.1%), goat fishes (3.7%) and other bottom species (19.6%). Shrimp landings amounted to 2,752 metric tons, comprising of banana shrimp (53.0%), rainbow shrimp (13.4%), sharp rostrum shrimp (11.6%), sand shrimp (8.4%), yellow shrimp (4.1%), tiger shrimp (3.7%), *Acetes* shrimp (3.7%) and other penaeid species (2.1%). Invertebrate landings amounted to 1,784 metric tons, comprising of mangrove crabs (47.7%), cephalopods (36.6%), pelagic crabs (11.6%), shellfish (3.0%) and lobsters (1.2%). During the 1997-1999 period, trawl net contributed 71.1% to the annual demersal landings, followed by gill net (10.3%), miscellaneous gears (8.3%), *bagang* lift net (8.1%) and hook & line (2.2%) (**Figure 263h**). Trawl net contributed 79.1% to the finfish landings, followed by gill net (7.3%), *bagang* lift net (6.3%), miscellaneous gears (3.9%) and hook & line (3.5%) (**Figure 264h**). Trawl net contributed 71.2% to the shrimp landings, followed by gill net (22.5%) and miscellaneous gears (6.3%) (**Figure 265h**). Miscellaneous gears contributed 33.7% to the invertebrate landing, followed by trawl net (33.3%) and *bagang* lift net (33.0%) (**Figure 266h**).

Demersal species make up 44.3% of the annual landings in Lahad Datu during the 1997-1999 period (**Figures 258q-258r**). Finfish make up 88.4% of the annual demersal landings, followed by invertebrates (6.3%) and shrimps (5.3%). In 1999, the demersal landings in Lahad Datu amounted to 6,433 metric tons or 43.3% of the total landings. Finfish make up 85.8% of the demersal landings, followed by invertebrates (7.7%) and shrimps (6.5%). Finfish landings amounted to 5,520 metric tons, comprising of commercial fishes (95.9%), rays (1.9%), sharks (1.0%) and trash fish & unsorted by-catch (1.2%). Snappers make up 38.0% of the commercial fish landings, followed by grouper (13.8%), humphead wrasse (13.4%), catfish (12.7%), jewfish (12.4%), barramundi (1.9%), threadfin bream (1.6%), trigger fish (1.4%) and various other species of bottom & reef resident fishes (4.8%). Invertebrate landings amounted to 498 metric tons, comprising of shellfish (36.1%), cephalopods (32.7%), pelagic crab (16.3%), mangrove crab (7.7%) and lobsters (7.3%). Shrimp landings amounted to 415 metric tons, comprising of banana shrimp (53.8%), tiger shrimp (18.0%), sharp rostrum shrimp (14.4%) and yellow shrimp (13.7%). During the 1997-1999 period, hook & line 77.6% to the annual demersal landings, followed by trawl net (11.1%), miscellaneous gears (5.4%), gill net (2.8%), *bagang* lift net (2.2%) and seine net (0.9%) (**Figure 263h**). Hook & line contributed 87.7% to the finfish landings, followed by trawl net (4.5%), gill net (3.1%), miscellaneous gears (3.0%), *bagang* lift net (1.2%) and seine net (0.5%) (**Figure 264h**). Trawl net contributed 86.3% to the shrimp landings, followed by seine net (9.4%), miscellaneous gears (2.7%) and gill net (1.7%) (**Figure 265h**). Trawl net contributed 40.9% to the invertebrate landings, followed by miscellaneous gears (40.7%) and *bagang* lift net (18.4%) (**Figure 266h**).

During the 1997-1999 period, demersal species make up only 10.3% of the annual landings in Kunak (**Figures 258s-258t**). Finfish and invertebrates respectively make up 80.3% and 19.7% of the annual demersal landings. In 1999, demersal landings in Kunak amounted to 1,311 metric tons or 5.7% of the total landings. Finfish and invertebrates respectively make up 85.3% and 14.7% of the demersal landings. Finfish landings amounted to 1,118 metric tons, comprising of commercial fishes (60.2%), sharks (19.9%) and rays (19.9%). Snappers make up 45.6% of the commercial fish landings, followed by coral fulsiers (12.7%), slipmouths (12.6%), groupers (10.9%), barramundi (10.8%), rabbit fishes (5.5%) and various species of bottom & reef resident fishes (1.9%). Invertebrate landings amounted to 193 metric tons comprising of cephalopods. During the 1997-1999 period, hook & line 67.5% to the annual demersal landings in Kunak, followed by *bagang* lift net (21.0%), gill (10.4%) and miscellaneous gears (1.1%) (**Figure 263h**). Hook & line contributed 87.7% to the finfish landings, followed by trawl net (4.5%), gill net (3.1%), miscellaneous gears (3.0%), *bagang* lift net (1.2%) and seine net (0.5%) (**Figure 264h**). Trawl net contributed 86.3% to the shrimp landings, followed by seine net (9.4%), miscellaneous gears (2.7%) and gill net (1.7%) (**Figure 265h**). Trawl net contributed 40.9% to the invertebrate landings, followed by miscellaneous gears (40.7%) and *bagang* lift net (18.4%) (**Figure 266h**).

Demersal species make up only 13.0% of the annual landings in Semporna during the 1997-1999 period (**Figures 258o-258p**). Finfish make up 58.8% of the annual demersal landings, followed by invertebrates (28.0%) and shrimps (13.3%). In 1999, demersal landings in Semporna amounted to 2,278 metric tons or 19.0% of the total landings. Finfish make up 59.6% of the demersal landings, followed by invertebrates (30.1%) and shrimps (10.3%). Finfish landings amounted to 1,358 metric tons, comprising of commercial fishes (84.1%), rays (5.5%), sharks (3.5%) and trash fish & unsorted by-catch (6.9%). Snappers make up 35.7% of the commercial fish landings, followed by groupers (25.9%), threadfin breams (24.1%), rabbit fishes (7.6%), humphead wrasse (4.0%) and various species of bottom & reef resident fishes (2.7%). Shrimp landings amounted to 234 metric tons, comprising of pink shrimp (88.6%), banana shrimp (8.1%) and tiger shrimp (3.3%). On the other hand, invertebrate landings amounted to 686 metric tons, comprising of pelagic crab (73.4%), cephalopods (12.1%), sea cucumbers (11.6%), lobsters (1.6%), abalone (0.8%) and mangrove crabs (0.5%). During the 1997-1999 period, hook & line 47.6% to the annual demersal landings in Semporna, followed by trawl net (20.9%), miscellaneous gears (15.1%), gill net (14.3%), and seine net (2.1%) (**Figure 263h**). Hook & line contributed 78.5% to the annual finfish landings, followed by miscellaneous gears (10.7%), trawl net (8.4%), seine net (1.3%) and gill net (1.0%) (**Figure 264h**). Trawl net contributed 92.6% to the shrimp landings, followed by gill net (6.2%) and miscellaneous gears (1.2%) (**Figure 265h**). Gill net contributed 46.2% to the invertebrate landings, followed by miscellaneous gears (30.7%), trawl net (13.2%), hook & line (5.3%) and seine net (4.7%) (**Figure 266h**).

Pelagic Fisheries

Pelagic landings in Sabah had increased by 71.7% during the 9-year period, from 56,137 metric tons in 1991 to 96,410 metric tons in 1999 (**Figure 254a**). Pelagic fishes make up around 46-53% (mean 49.2%) of the annual landings. During the 1991-1999 period, the pelagic portion had declined by 10.1% from 51.8% in 1991 down to 46.5% in 1999 (**Figure 254b**). The annual pelagic landings in the non-SSME and SSME areas are shown respectively in **Figures 254c-254d** and **Figures 254e-254f**. The non-SSME and SSME annual pelagic landing contribution during the 9-year period is shown in **Figures 254v-254y**. The characteristics of the pelagic fisheries at the regional and district levels are shown respectively for SSME-1 (**Figures 256k-256r**), SSME-2 (**Figures 257k-257p**) and SSME-3 (**Figures 258k-258t**).

Fishing gears with dominant pelagic fishes in the annual pelagic landings are seine net, lift net and gill net (**Figure 262f**). Seine net is the principal pelagic gear, which contributed 40.9% to the annual pelagic landings during the 1997-1999 period (**Figure 267a**). Besides seine net, other important contributing gears are trawl net (19.8% annual contribution), gill net (13.5%), *selambau* and *bagang* lift nets (13.4%), hook & line (10.8%) and miscellaneous gears (1.6%). Overall, commercial gears contributed 74.2% to the annual pelagic landings during the 1997-1999 period, with seine net contributing 55.1% to the commercial gear share of the annual pelagic landings, followed by trawl net (26.7%) and gill net (18.2%). Lift net is the principal traditional pelagic gear in Sabah. During the 1997-1999 period, lift net contributed 52.0% to the traditional gear share of the annual pelagic landings, followed by hook & line (41.7%) and miscellaneous gears (6.3%). During the 1991-1999 period, *selambau* and *bagang* contributed respectively 17-61% (mean: 34.1%) and 39-83% (mean: 65.9%) to the annual lift net landings (**Table A51** & **Figures 234a-234b**). The non SSME-based *selambau* share of the annual lift net landings had declined by 63.9% during the 9-year period, from 61% in 1991 to only 22% in 1999. On the other hand, the SSME-based *bagang* share of the annual lift net landings had increased by 100.1%, from 39% in 1991 to 78% in 1999.

During the 1991-1999 period, SSME-3 contributed 30-59% (mean: 44.8%) to the annual pelagic landings in Sabah, followed by non-SSME (31.5%, range: 22-46%), SSME-2 (14.1%, range: 12-17%) and SSME-1 (9.5%, range: 7-13%) **(Figure 254v-254w**). During the 9-year period, the SSME area contributed 54-78% (mean: 68.5%) to the annual pelagic landings in Sabah. SSME-3 contributed 54-75% (mean: 68.6%) to the SSME share of the annual pelagic landings, followed by SSME-2 (20.9%, range: 15-26%) and SSME-1 (14.2%, range: 9-22%) (**Figures 278-280**). The SSME share of the annual pelagic landings had increased by 27.6% during the 9-year period, from 54.2% in 1991 to 69.1% in 1999. The SSME share had initially increased by 44.2% to 78.1% in 1996, which then declined by 12.3% to around 62-65% (mean: 62.8%) in 1997-1999. Consequently, the non-SSME share had declined by 32.6%, from 45.8% in 1991 to 30.9% in 1999. The non-SSME share had initially declined by 52.2% to 21.9% in 1996, which then increased by 69.8% to 35-38% (mean: 37.2%) in 1997-1999.

Non-SSME Area

Pelagic landings in the non-SSME area fluctuated between 20,534 and 29,988 metric tons during the 1991-1999 period. Pelagic landings had initially increased by 5.7% from 25,737 metric tons in 1991 to 27,195 metric tons in 1992, declined by 24.5% to 20,534 metric tons in 1996 before increasing by 45.1% to 29,973-29,988 metric tons in 1998-99 (**Figure 254c**). Pelagic species make up 46.6% of the non-SSME annual landings during the 1991-1999 period (*Table 152*). The pelagic portion of the non-SSME annual landings had declined by 20.3%, from 54.2% in 1991 to 43.2% in 1999 (**Figure 254d**). During the 1997-1999 period, pelagic species make up 42.4% of the non-SSME annual landings. As mentioned earlier, the sharp decline in the pelagic portion of the annual landings was due to significant increase in trawl net landing contribution that comprised mainly of demersal fishes (**Figures 140b** & **262e**).

Trawl net and seine net are the principal pelagic landing gears in the non-SSME area. During the 1997-1999 period, these gears contributed respectively 44.3% and 29.8% to the non-SSME annual pelagic landings (**Figure 267a**). Besides these gears, other important contributing gears are gill net (9.8% annual contribution), *selambau* lift net (8.4%), hook & line (5.4%) and miscellaneous gears (2.3%). Overall, commercial gears contributed 83.9% to the non-SSME annual pelagic landings during the 1997-1999 period. Trawl net contributed 52.8% to the commercial gear share of the non-SSME annual pelagic landings, followed by seine net (33.5%) and gill net (11.7%). On the other hand, *selambau* lift net contributed 52.0% to the traditional gear share of the annual pelagic landings, followed by hook & line (33.7%) and miscellaneous gears (14.3%). Fishing gears with dominant pelagic fishes in the non-SSME annual pelagic landings are seine net, *selambau* lift net and gill net (**Figure 262e**). Kota Kinabalu contributed 71.3% to the non-SSME annual pelagic landings during the 1997-1999 period, where trawl net and seine net are the principal landing gears (**Figure 267d**). Other districts in the non-SSME area contributed 28.7% to the non-SSME annual pelagic landings, where the principle commercial and traditional landing gears are seine net and gill net (60% contribution) and selambau lift net and hook & line (33% contribution) (**Figures 267d**-**267e**).

The WC-North contributed 84.6% to the non-SSME annual pelagic landings during the 1997-1999 period. Trawl net and seine net contributed respectively 52.3% and 25.1% to the annual pelagic landings (**Figure 267c**). Overall, commercial gears contributed 83.9% to the annual pelagic landings. Trawl net contributed 62.3% to the commercial gear share of the annual pelagic landings, followed by seine net (29.9%) and gill net (7.7%). On the other hand, *selambau* lift net contributed 54.0% to the traditional gear share of the annual pelagic landings, followed by hook & line (29.2%) and miscellaneous gears (16.8%). During the 1997-1999 period, Kota Kinabalu contributed 84.2% to the WC-North annual pelagic landings, followed by Kota Belud (11.3%) and Tuaran (4.4%). Pelagic landings in the WC-North amounted to 28,101 metric tons in 1999 or 86% of the non-SSME pelagic landings. Round scad represented 18.0% of the annual landing, followed by Indian mackerel (12.0%), tuna (11.5%), Japanese mackerel (10.8%), slender shad (9.0%), horse mackerel (8.6%), barracuda (8.3%), yellow-stripped trevally (5.3%), Spanish mackerel (5.1%), ribbon fish (4.4%), sardine (2.1%), hardtail scad (1.7%) and other miscellaneous pelagic species (3.3%). Overall, scombrids represented 39.9% of the WC-North pelagic landings in 1999, followed by carangids (35.3%), miscellaneous shads (9.0%), and other pelagic families (15.8%). Indian mackerels are mainly landed by trawl net and seine net (**Figure 269c**). Trawl net, seine net and *selambau* lift net are the principal landing gears for round scads (**Figure 270c**). Sardines are mainly landed by seine net and *selambau* lift net (**Figure 271c**). Miscellaneous gears and *selambau* lift net are the principal anchovy landing gears (**Figure 272c**). Seine net and gill net are the principal tuna landing gears (**Figure 273c**). Trawl landed the bulk of the miscellaneous pelagic landings (**Figure 274c**).

Pelagic landings in the non-SSME area amounted to 29,973 metric tons in 1999. Round scad represented 16.7% of the 1999 pelagic landing, followed by tuna (12.2%), Indian mackerel (11.6%), Japanese mackerel (10.3%), queen fish (8.4%), slender shad (7.7%), barracuda (7.4%), Spanish mackerel (5.7%), sardine (4.9%), yellow striped trevally (4.9%) and other miscellaneous pelagic species (10.1%). Overall, scombrids represented 40.9% of the non-SSME pelagic landings in 1999, followed by carangids (33.8%), misc. shads (7.7%), clupeids (4.9%), and other families (12.7%).

In Kota Kinabalu, pelagic species make up 41.3% of the annual landings during the 1997-1999 period. Trawl net and seine net contributed respectively 62.1% and 29.6% to the annual pelagic landings in Kota Kinabalu (**Figure 267d**). Overall, commercial gears contributed 93.4% to the annual pelagic landings. Trawl net contributed 66.5% to the commercial gear share of the pelagic landings, followed by seine net (31.7%) and gill net (1.8%). Traditional gears only contributed 6.6% to the annual pelagic landings. *Selambau* lift net contributed 75.8% to the traditional gear share of the pelagic landings, followed by hook & line (18.2%) and miscellaneous gears (6.0%). Pelagic landings in Kota Kinabalu amounted to 24,089 metric tons in 1999. Round scad represented 18.2% of the pelagic landing, followed by Indian mackerel (13.7%), Japanese mackerel (12.6%), longtail shad (10.5%), barracuda (9.5%), tuna (9.0%), horse mackerel (7.0%), ribbon fish (5.1%), selar scad (4.5%), Spanish mackerel (2.5%), sardine (2.4%), and other miscellaneous pelagic species (5.1%). Overall, scombrids represented 38.3% of the Kota Kinabalu pelagic landings in 1999, followed by carangids (35.6%), shads (10.5%), clupeids (2.4%) and other miscellaneous pelagic families (13.2%).

In Kota Belud, pelagic species make up 56.4% of the annual landings during the 1997-1999 period. Gill net and hook & line contributed respectively 41.3% and 27.5% to the annual pelagic landings in Kota Belud (**Figure 267d**). Overall, traditional gears contributed 57.3% to the annual pelagic landings. Hook & line contributed 48.0% to the traditional gear share of the annual pelagic landings, followed by miscellaneous gears (37.2%) and *selambau* lift net (14.8%).

On the other hand, gill net and seine net contributed respectively 96.7% and 3.3% to the commercial gear share of the annual pelagic landings. Pelagic landings in Kota Belud amounted to 3,224 metric tons in 1999. Tuna represented 28.4% of the pelagic landing, followed by Spanish mackerel (24.4%), horse mackerel (21.7%), round scad (8.3%), selar (7.7%), hardtail scad (2.4%), Indian mackerel (1.9%), barracuda (1.3%), mullet (1.0%) and other miscellaneous pelagic species (2.9%). Overall, scombrids represented about 55.6% of the Kota Belud pelagic landings in 1999, followed by carangids (40.9%), engraulids (0.5%), clupeids (0.3%) and other miscellaneous pelagic families (2.7%).

In Tuaran, pelagic species make up 89.4% of the annual landings during the 1997-1999 period. Lift net is the principal pelagic gear in Tuaran, contributing almost 80% to the annual pelagic landings. Overall, traditional gears contributed 92.5% to the annual pelagic landings, where *selambau* lift net and hook & line contributed respectively 85% and 15% to the traditional gear share of the pelagic landings. Gill net is the only commercial gear used in the pelagic fisheries in Tuaran, contributing only 7.5% to the annual pelagic landings. Pelagic landings in Tuaran amounted 788 metric tons in 1999. Round scad represented 50.3% of the pelagic landing, followed by selar (20.9%), tuna (20.5%), Spanish mackerel (3.9%), horse mackerel (3.1%) and rainbow runner (1.3%). Overall, carangids and scombrids respectively represented 75.6% and 24.4% of the Tuaran pelagic landing in 1999.

Round scad represented 21.6% of the WC-North annual pelagic landings during the 1997-1999 period, followed by Indian mackerel (13.6%), tuna (13.4%), sardine (3.1%), anchovy (0.1%) and miscellaneous pelagic species (48.2%).

Kota Kinabalu contributed 83.7% to the WC-North annual round scad landings during the 1997-1999 period, followed by Tuaran (12.2%) and Kota Belud (4.1%). *Selambau* lift net is the round scad principal landing gear in Kota Belud and Tuaran (**Figure 270d**). On the other hand, trawl net and seine net are the round scad principal landing gear in Kota Kinabalu.

During the 1997-1999 period, Kota Kinabalu contributed 98.1% to the WC-North annual Indian mackerel landings, followed by Kota Belud (1.3%) and Tuaran (0.6%). Miscellaneous gears contributed around 90% Indian makerel annual landings (**Figure 269d**). Gill net is the principal landing gear in Tuaran, with *selambau* lift net playing the role as secondary landing gear. Trawl net is the principal landing gear in Kota Kinabalu, with seine net as the secondary landing gear.

Kota Kinabalu contributed 70.4% to the WC-North annual tuna landings during the 1997-1999 period, followed by Kota Belud (25.9%) and Tuaran (3.7%). In Kota Belud, gill net and hook & line are respectively the principal and secondary tuna landing gears (**Figure 273d**). On the other hand, hook & line and gill net are respectively the principal and secondary landing gears in Tuaran. Kota Kinabalu contributed the bulk of the WC-North annual tuna landing, where seine net is the principal landing gear.

During the 1997-1999 period, Kota Kinabalu contributed 95.5% to the WC-North annual sardine landings during the 1997-1999 period, followed by Tuaran (3.0%) and Kota Belud (1.5%). *Selambau* lift net is the principal sardine landing gear in Kota Belud and Tuaran (**Figure 271d**). On the other hand, seine net is the principal sardine landing gear in Kota Kinabalu. Overall, seine net is the principal sardine landing gear in the WC-North area, with *selambau* lift net playing the role as the secondary landing gear (**Figure 271c**).

Anchovy is only landed in Kota Belud during the 1997-1999 period, with miscellaneous gears contributing the bulk of the annual landings (**Figure 272d**). No anchovy landings were recorded in Tuaran and Kota Kinabalu. Overall, miscellaneous gear and *selambau* lift net are respectively the principal and secondary anchovy landing gears in the WC-North area (**Figure 272c**).

During the 1997-1999 period, Kota Kinabalu contributed 83.9% to the WC-North annual misc. pelagic landings, followed by Kota Belud (13.8%) and Tuaran (2.4%). In Kota Belud, the miscellaneous annual pelagic portion is landed by hook & line, miscellaneous gears and gill net (**Figure 274d**). On the other hand, *selambau* lift net is the principal landing gear, with gill net and miscellaneous gears playing their roles as secondary contributors. Trawl net is the principal landing gear in Kota Kinabalu. Overall, trawl net is the principal landing gear in the WC-North area, with other gears contributing less than 5% each to the annual miscellaneous pelagic fish landings (**Figure 274c**).

The WC-South contributed 15.4% to the non-SSME annual pelagic landings during the 1997-1999 period. Kuala Penyu contributed 45.8% to the pelagic landings, followed by Beaufort (22.2%), Sipitang (17.2%) and Papar (14.8%). Seine net and gill net contributed respectively 55.5% and 28.3% to the annual pelagic landings (**Figure 267c**). Overall, commercial gears contributed 83.8% to the annual pelagic landings. Seine net and gill net contributed respectively 66.2% and 33.8% the commercial gear share of the annual pelagic landings. On the other hand, hook & line and *selambau* lift net contributed respectively 57.8% and 42.2% to the traditional gear share of the annual pelagic landings. Pelagic landings in the WC-South only amounted to 4,548 metric tons or 14% of the non-SSME pelagic landings in 1999. Sardine represented 22.8% of the annual landing, followed by tuna (16.1%), Spanish mackerel (9.9%), Indian mackerel (9.2%), round scad (8.9%), Japanese mackerel (7.6%), horse mackerel (7.3%), marlin & sailfish (2.7%), and other miscellaneous pelagic species (15.6%). Overall, scombrids represented 47.3% of the WC-South pelagic landings in 1999, followed by carangids (24.2%), clupeids (22.8%) and other miscellaneous pelagic families (5.7%).

In Kuala Penyu, pelagic species make up 78.3% of the annual landings during the 1997-1999 period. Seine net and gill net contributed respectively 58.9% and 41.1% to the annual pelagic landings. Pelagic landings in Kuala Penyu amounted to 2,245 metric tons in 1999. Round scad represented 17.3% of the pelagic landing, followed by tuna (16.6%), Japanese mackerel (15.3%), Spanish mackerel (13.0%), sardine (12.8%), Indian mackerel (9.4%), marlin (4.4%), sail fish (3.6%), selar scad (3.3%), and other miscellaneous pelagic species (4.3%). Overall, scombrids represented 62.3% of the Kuala Penyu pelagic landings in 1999, followed by carangids (22.1%), clupeids (12.8%) and other miscellaneous pelagic families (2.8%).

In Beaufort, pelagic species make up 41.9% of the annual landings during the 1997-1999 period. Seine net, gill net and hook & line contributed respectively 66.5% and 18.3% to the annual pelagic landings. Overall, commercial gears contributed 85.0% to the annual pelagic landings in Beaufort. Pelagic landings in Beaufort amounted to 995 metric tons in 1999. Tuna represented 32.0% of the pelagic landing, followed by horse mackerel (30.7%), Indian mackerel (18.4%), Spanish mackerel (7.5%), queen fish (6.8%), hardtail scad (2.2%), barracuda (1.7%) and golden trevally (0.7%). Overall, scombrids represented 57.9% of the Beaufort pelagic landings in 1999, followed by carangids (40.4%) and barracudas (1.7%).

In Sipitang, pelagic species make up 67.3% of the annual landings during the 1997-1999 period. Seine net and hook & line contributed respectively 79.7% and 16.9% to the annual pelagic landings. Overall, commercial gears contributed 83% to the annual pelagic landings. Seine net and gill net contributed respectively 96% and 4% to the commercial gear share of the annual pelagic landings. Pelagic landings in Kuala Penyu amounted to 911 metric tons in 1999. Sardine represented 80.7% of the pelagic landings, followed by anchovy (8.0%), Spanish mackerel (3.5%), barracuda (2.5%), hardtail scad (2.1%), and other miscellaneous pelagic species (3.2%). Overall, clupeids represented 80.7% of the Sipitang pelagic landings in 1999, followed by engraulids (8.0%), scombrids (4.3%), carangids (3.6%), and other miscellaneous pelagic families (3.4%), In Papar, pelagic species make up 57.5% of the annual landings during the 1997-1999 period. *Selambau* lift net, gill net and hook & line contributed respectively 46.2%, 33.0% and 20.9% to the annual pelagic landings. Overall, traditional gears contributed 67.1% to the annual pelagic landings in Papar. *Selambau* lift net and hook & line contributed respectively 68.9% and 31.1% to the traditional gear share of the annual pelagic landings. Pelagic landings in Papar amounted to 396 metric tons in 1999. Spanish mackerel represented 12.5% of the pelagic landings, followed by tuna (9.3%), selar scad (8.6%), yellow stripped trevally (8.6%), black pomfret (7.9%), Indian mackerel (5.3%), sailfish (5.8%), barracuda (5.5%), hardtail scad (5.4%), rainbow runner (5.1%), queen fish (5.0%), round scad (3.8%), horse mackerel (3.3%), sardine (3.0%), and other miscellaneous pelagic species (9.9%). Overall, carangids represented 42.3% of the Papar pelagic landings in 1999, followed by scombrids (33.9%), black pomfret (7.9%), barracuda (5.5%), clupeids (3.0%) and other miscellaneous pelagic families (7.4%).

Sardine represented 18.7% of the WC-South annual pelagic landings during the 1997-1999 period, followed by tuna (17.3%), round scad (11.2%), Indian mackerel (8.9%), anchovy (0.8%) and miscellaneous pelagic species (43.1%).

During the 1997-1999 period, Sipitang contributed 61.8% to the WC-South annual sardine landings, followed by Kuala Penyu (33.0%), Papar (5.1%) and Beaufort (0.1%). Sardines are mainly landed by seine net in the WC-South area (**Figure 271c**), except for Papar where sardines are only landed by *selambau* lift net (**Figure 271e**). Overall, commercial gears had contributed 95% to the annual sardine landings during the 1997-1999 period.

Kuala Penyu contributed 44.8% to the WC-South annual tuna landings during the 1997-1999 period, followed by Beaufort (44.1%), Sipitang (5.6%) and Papar (5.5%). Gill net is the principal tuna landing gear in Kuala Penyu and Papar (**Figure 273e**). In Papar, hook & line contributed 39% to the annual tuna landings. In Sipitang and Beaufort, seine is the principal landing gear contributing more than 70% to the annual tuna landings. Commercial gears contributed more than 90% to the WC-South annual tuna landings.

During the 1997-1999 period, Kuala Penyu contributed 74.4% to the WC-South annual round scad landings, followed by Papar (25.5%) and Sipitang (0.1%). No round scad landings were recorded in Beaufort. *Selambau* lift net is the principal landing gear in Papar (**Figure 270e**). On the other hand, gill net and hook & line are the principal landing gear in Sipitang. Seine net is the principal landing gear in Kuala Penyu.

Kuala Penyu contributed 46.9% to the WC-South annual Indian mackerel annual landings during the 1997-1999 period, followed by Beaufort (33.3%), Papar (12.9%) and Sipitang (6.9%). Seine net is the principal landing gear in the WC-South area, except for Papar where *selambau* lift net and gill net are the main landing gears (**Figure 269e**).

Anchovies are only landed in Sipitang during the 1997-1999 period, where seine net is the main landing gear (**Figure 272e**). No anchovy landings were recorded in Papar, Beaufort and Kuala Penyu during the 3-year period. Overall, seine net is the principal anchovy landing gear in the WC-South area (**Figure 272c**).

Kuala Penyu contributed 45.0% to the WC-South annual miscellaneous pelagic species landings during the 1997-1999 period. Different gears are being deployed to land this miscellaneous pelagic portion in each district. In Papar, the main landing gears are gill net, hook & line and selambau lift net (**Figure 274e**). On the other hand, seine net is the principal gear in Beaufort, with hook & line and gill net as secondary landing gears. In Sipitang, hook & line is the principal landing gear. Kuala Penyu contributed the bulk of the miscellaneous pelagic fish landings, where gill net and seine net are the principal landing gears. Overall, gill net and seine net are the WC-South principal landing gears, with hook & line playing the role as the secondary landing gear (**Figure 274c**).

During the 1997-1999 period, round scad represented 20.0% of the non-SSME annual pelagic landings, followed by tuna (14.0%), Indian mackerel (12.9%), sardine (5.5%), anchovy (0.2%) and miscellaneous pelagic species (47.4%).

WC-South contributed 52.4% to the non-SSME annual round scad landings during the 1997-1999 period. Seine net and *selambau* lift net are the principal and secondary round scad landing gears in the WC-South area. These gears contributed respectively 74.5% and 25.5% to the annual round scad landings during the 1997-1999 period (**Figure 270c**). On the other hand, trawl net, seine net and *selambau* lift net are the round scad principal landing gears in the WC-North area (**Figure 270d**). Overall, commercial gears contributed respectively 74.5% and 69.4% to the WC-South and WC-North round scad annual landings.

During the 1997-1999 period, WC-North contributed 81% to the non-SSME annual tuna landings. Seine net and gill net are the principal and secondary tuna landing gear in the WC-North area. These gears contributed respectively 64.3% and 26.8% to the annual tuna landings during the 1997-1999 period (**Figure 273c**). Overall, commercial gears contributed 91.1% to the WC-North annual tuna landings. Seine net and gill net contributed respectively 70.6% and 29.4% to the commercial gear share of the annual tuna landings. Hook & line is the only traditional gear used in the WC-North tuna fisheries, contributing 8.9% to the WC-North annual tuna landings. On the other hand, gill net and seine net are the principal tuna landing gears during the 1997-1999 period. These gears contributed respectively 54.4% and 37.6% to the WC-South annual tuna landings (**Figure 274c**).

WC-North contributed 89.4% to the non-SSME annual Indian mackerel landings during the 1997-1999 period. Trawl net and seine net are the principal and secondary landing gears in the WC-North area, respectively contributing 65.0% and 30.1% to the Indian mackerel annual landings (**Figure 269c**). Overall, commercial gears contributed 95.8% to the WC-North Indian mackerel annual landings. Trawl net contributed 67.8% to the commercial gear share of the Indian mackerel annual landings, followed by seine net (31.4%) and gill net (0.7%). On the other hand, *selambau* lift net contributed 65.1% to the traditional gear share of the annual landings, followed by miscellaneous gears (32.6%) and hook & line (2.3%). Seine net is the principal landing gear in the WC-South area, contributing 84.1% to the annual Indian mackerel landings during the 1997-1999 period. Overall, commercial gears contributed 90% to the annual Indian mackerel landings in the WC-North area. Seine net and gill net contributed respectively 93.4% and 6.6% to the commercial gear share of the annual landings. On the other hand, *selambau* lift net and hook & line contributed respectively 93.9% and 6.1% to the traditional gear share of the annual Indian mackerel landings in the WC-South area.

WC-South contributed 52.4% to the non-SSME annual sardine landings during the 1997-1999 period. Seine net is the principal landing gear in the non-SSME area. Seine net contributed respectively 94.5% and 81.2% to the annual sardine landings in the WC-South and WC-North areas during the 1997-1999 period (**Figure 271c**). Overall, commercial gears contributed respectively 95.0% and 81.6% to the WC-South and WC-North annual sardine landings. Seine net and gill net contributed respectively 99.5% and 0.5% to the commercial gear share of the WC-South annual sardine landings. On the other hand, seine net and trawl net contributed respectively 99.5% and 0.5% to the commercial gear share of the WC-North annual sardine landings. *Selambau* lift net is an important artisanal component of the sardine fisheries. This gear contributed respectively 5.1% and 18.3% to the annual sardine landings in the WC-South and WC-North areas during the 1997-1999 period.

Trawl net, seine net and gill net are the principal pelagic gears in SSME-1, which contributed respectively 36.7%, 28.4% and 22.0% to the annual pelagic landings during the 1997-1999 period (**Figure 268a**). Commercial gears contributed 87.1% to the annual pelagic landings in the SSME-1 area. During the 3-year period, trawl net contributed 42.1% to the commercial gear share of the SSME-1 annual pelagic landings, followed by seine net (32.6%) and gill net (25.3%). On the other hand, hook & line contributed 82.9% to the traditional gear share of the annual pelagic landings, followed by *bagang* lift net (16.3%) and miscellaneous gears (0.8%). During the 1997-1999 period, Kudat contributed 94.4-96.1% (mean: 95.2%) to the SSME-1 annual pelagic landings, followed by Pitas (3.6%, range: 2.8-4.3%) and Kota Marudu (1.1%, range: 1.0-1.3%). Fishing gears with dominant pelagic fishes in the SSME-1 annual pelagic landings are *bagang* lift net, seine net and gill net (**Figure 262a**).

The anchovy fishery is a very small component of the non-SSME pelagic fisheries sector, with only 0.2% contribution to the annual pelagic landings. This fishery is seasonal in nature and landed as by-catches of both commercial and traditional gears. Compared to the SSME area, the anchovy fishery in the non-SSME area is not an important target species until recently in late 2000, where a *bagang*-based anchovy fishery had been initiated in the Kimanis Bay off Papar with some 10-odd units already in operation. WC-South contributed 55.1% to the non-SSME annual anchovy landings during the 1997-1999 period. Anchovies are mainly landed by seine nets in the WC-South area (**Figure 272c**). In the WC-North area, anchovies are caught by miscellaneous gears (72%) and *selambau* lift net,

WC-North contributed 84.6% to the annual miscellaneous pelagic landings during the 1997-1999 period. This pelagic portion had been landed by traditional gears (target species of hook & line operations) as well as part of the by-catches of both commercial demersal and pelagic gears. In the WC-North area, trawl net is the principal landing gear contributing 72.6% to the annual landings (**Figure 274c**). Commercial gears contributed 85.4% to the WC-North annual landings. Trawl net contributed 85.0% to the commercial gear share of the annual landings, followed by seine net (8.2%) and gill net (6.8%). Hook & line contributed 49.7% to the traditional gear share of the annual landings, followed by miscellaneous gears (34.7%) and *selambau* lift net (15.6%). On the other hand, gill net and seine net are the principal landing gears in the WC-South area, contributing respectively 42.4% and 34.1% to the annual landings. Overall, commercial gears contributed 76.6% to the annual landings. Gill net contributed 55.4% to the commercial gear share of the WC-South annual landings, followed by seine net (44.5%) and trawl net (0.1%). Hook & line and *selambau* lift net contributed respectively 78.2% and 21.8% to the WC-South traditional gear share of the annual landings.

<u>SSME Area</u>

During the 1991-1999 period, pelagic landings in the SSME area fluctuated around 30,400-73,160 metric tons (**Figure 254e**). Pelagic landings had initially increased by 140.7% to its peak of 73,149 metric tons in 1996, before declining down to 57,400-66,620 metric tons in 1997-1999. Pelagic fishes make up 48-54% (mean 50.2%) of the annual landings between 1991 and 1999 (**Figure 254f**). The pelagic portion of the annual landings had increased by 8.6%, from 49.9% in 1991 to 54.2% in 1996, and then declined by 11.1% to 48.2% in 1999. The decline in the pelagic share of the annual landings during the 1997-1999 period had been due to increased contribution from demersal landing gears (**Figure 140e**).

Seine net is the principal pelagic gear in the SSME area, which contributed 46.3% to the SSME annual pelagic landings during the 1997-1999 period. Besides seine net, other important landing gears are *bagang* lift net (15.9% annual contribution), gill net (15.2%), hook & line (13.4%), trawl net (7.9%) and miscellaneous gears (1.3%) (**Figure 267a**). Overall, commercial gears contributed 69.4% to the SSME annual pelagic landings. Seine net contributed 66.7% to the commercial gear share of the annual pelagic landings, followed by gill net (22.0%) and trawl net (11.3%). The pelagic fishery in the SSME area is very diverse where traditional gears play important roles in the annual landings. During the 1997-1999 period, *bagang* lift net contributed 52.0% to the traditional gear share of the annual pelagic landings, followed by hook & line (43.9%) and miscellaneous gears (4.2%). Fishing gears with dominant pelagic fishes in the SSME annual pelagic landings are seine net, *bagang* lift net and gill net (**Figure 262d**).

During the 1991-1999 period, SSME-3 contributed 54-75% (mean: 68.6%) to the SSME share of the annual pelagic landings, followed by SSME-2 (18.1%, range: 15-25%) and SSME-1 (13.3%, range: 9-21.6%). SSME-3 share had increased by 34.3% during the 9-year period, from 56.0% in 1991 to its peak of 75.2% in 1996, before declining to 70.5% in 1999. Both SSME-1 and SSME-2 shares had declined throughout the 9-year period. SSME-1 share had declined by 11.5%, from 10.0% in 1991 to 8.9% in 1999. On the other hand, SSME-2 share had initially increased by 26.4%, from 13.8% in 1991 to 17.5% in 1994, before declining gradually to 11.5% in 1999. SSME-3 share on the other hand, had increased by 93.7%, from 30.3% in 1991 to 58.7% in 1996, and then gradually declined to 48.7% in 1999.

In SSME-3, pelagic fishes are more dominant in the annual landings (**Figure 211**) compared to SSME-1 (**figure 173**) and SSME-2 (**Figure 192**). Seine net, *bagang* lift net and hook & line contributed to the high pelagic landings in SSME-3 (**Figure 205**). On the other hand, demersal gear contribution is more dominant in SSME-1 (**Figure 167**) and SSME-2 (**Figure 186**).

During the 1991-1999 period, tuna make up 18.4% of the SSME annual pelagic landings, followed by sardine (17.3%), round scad (12.9%), Indian mackerel (11.0%), anchovy (5.2%) and other miscellaneous pelagic species (35.3%) (**Figures 259e**-**259f**). During the 9-year period, round scad, sardine and miscellaneous species shares of the annual pelagic landings had increased respectively by 109.3%, 197.1% and 26.4%. On the other hand, Indian mackerel, anchovy and tuna share of the annual pelagic landings had respectively declined by 36.5%, 46.1% and 65.2%. During the 1997-1999 period, sardine make up 23.0% of the SSME annual pelagic landings, followed by tuna (12.7%), round scad (12.1%), Indian mackerel (7.2%), anchovy (5.0%) and other miscellaneous pelagic species (40.0%).

In 1999, pelagic landings in the SSME area amounted to 66,617 metric tons. Sardine make up 19.8% of the pelagic landing, followed by round scad (15.8%), tuna (11.7%), Indian mackerel (7.8%), Spanish mackerel (5.4%), horse mackerel (4.6%), barracuda (4.1%), anchovy (4.0%), Japanese mackerel (3.4%), queen fish (3.3%) and other miscellaneous pelagic species (20.1%). Overall, carangids make up 32.5% of the SSME pelagic landings in 1999, followed by scombrids (28.5%), clupeids (19.8%), and other pelagic families (19.2%).

Sardine landings in the SSME area fluctuated around 2,052-17,678 metric tons during the 1991-1999 period, contributing 52-91% to the state annual sardine landings (**Figures 259q**-**259r**). Landings had increased by 761.5% from 2,052 metric tons in 1991 to its peak of 17,678 metric tons in 1996, declined by 20.4% to 13,308-15,530 metric tons (mean 14,066 metric tons) in 1997-1999. Its share of the state annual sardine landings had increased from 53.0% in 1991 to 89-91% between 1996-1999. During the 1991-1999 period, SSME-3 contributed 52-90% (mean: 78.0%) to the SSME share of the annual sardine landings, followed by SSME-2 (13.6%, range: 3-37%) and SSME-1 (8.5%, range: 1-16%). SSME-3 share of the SSME annual sardine landings had increased by 60.6%, from 51.8% in 1991 to 83.2% in 1999. SSME-3 share had initially increased by 73.6% to its peak of 89.9% in 1994, which then declined to 77.1% in 1997 before increasing to 82.8-83.2% in 1998-1999. On the other hand, SSME-2 share had declined by 88.4%, from 37.2% in 1991 to only 4.3% in 1999. While SSME-1 share had declined by 93.1%, from 11.0% in 1991 to 0.8% in 1993, increased by 2,003.9% to 15.9% in 1997, and then declined again to 12.5-13.8% in 1998-1999. During the 1997-1999 period, SSME-3 contributed 81.0% to the SSME share of the annual sardine landings, followed by SSME-1 (14.1%) and SSME-2 (4.9%). Seine net and *bagang* lift net are the principal and secondary landing gears in the SSME area, contributing respectively 88.2% and 11.4% to the annual sardine landings during the 1997-1999 period (**Figure 271a**). In SSME-1, seine net contributed 91.7% to the annual sardine landings (**Figure 271b**). On the other hand, seine net contributed 71% to the SSME-2 annual sardine landings. Other important sardine landing gears in the SSME-2 area are trawl net, gill net and miscellaneous gears that contributed respectively 9.4%, 9.0% and 10.6% to the annual landings. Seine net and *bagang* lift net contributed respectively 79.3% and 20.7% to the SSME-3 annual sardine landings.

Tuna landings in the SSME area fluctuated around 6,118-11,698 metric tons during the 1991-1999 period, contributing 60-94% to the state annual tuna landings (**Figures 259u-259v**). Landings had increased by 14.1% from 10,308 metric tons in 1991 to its peak of 11,698 metric tons in 1996, declined by 3.5% to 6,118-93,43 metric tons (mean 7,776 metric tons) in 1997-1999. Its share of the state annual tuna landings had increased from 93.8% in 1991 to 60-67% between 1996-1999. During the 1991-1999 period, SSME-3 contributed 53-91% (mean: 75.7%) to the SSME share of the annual tuna landings, followed by SSME-1 (12.4%, range: 4-31%) and SSME-2 (11.9%, range: 5-17%). SSME-3 share of the SSME annual tuna landings had increased by 39.4%, from 65.2% in 1991 to 90.9% in 1999. On the other hand, SSME-2 share had initially increased by 69.6%, from 18.0% in 1991 to 30.6% in 1992, and since 1993 had declined down to only 4.4% in 1999. While SSME-2 share had declined by 71.9%, from 16.8% in 1991 to only 4.7% in 1999. During the 1997-1999 period, SSME-3 contributed 85.6% to the SSME share of the annual sardine landings, followed by SSME-2 (7.6%) and SSME-1 (6.8%). Seine net is the principal tuna landing gear in the SSME area, which had contributed 81.8% to the annual tuna landings during the 1997-1999 period (**Figure 273a**). Other important landing gears are gill net and hook & line, which had contributed 9.1% each to the tuna annual landings. In SSME-1, gill net is the principal landing gear, which had contributed 91.4% to the annual tuna landings (**Figure 273b**). Seine net only contributed 8.6% to the annual tuna landings in the SSME-1 area. On the other hand, gill net contributed 46.2% to the SSME-2 annual tuna landings. Other important tuna landing gears in the SSME-2 area are seine net and hook & line that contributed respectively 31.0% and 22.9% to the annual landings. Seine net and hook & line contributed respectively 91.4% and 8.6% to the SSME-3 annual tuna landings.

Round scad landings in the SSME area fluctuated around 2,329-10,805 metric tons during the 1991-1999 period, contributing 35-72% to the state annual round scad landings (**Figures 259o-259p**). Landings had increased by 363.9% from 2,329 metric tons in 1991 to its peak of 10,805 metric tons in 1996, declined by 44.4% to 5,799-6,218 metric tons (mean 6,008 metric tons) in 1997-1998, and increased again by 77.8% to 10,683 metric tons in 1999. Its share of the state annual round scad landings had increased from 34.8% in 1991 to 58-72% between 1992-1996, and declined to 48-49% in 1997-1999 before increasing to 66.2% in 1999. During the 1991-1999 period, SSME-3 contributed 38-88% (mean: 73.5%) to the SSME share of the annual round scad landings, followed by SSME-1 (14.9%, range: 6-31%) and SSME-2 (11.6%, range: 4-31%). SSME-3 share of the SSME annual round scad landings had increased by 134.4%, from 37.7% in 1991 to 88.5% in 1999. On the other hand, SSME-2 share had declined by 83.7%, from 31.4% in 1991 to only 5.1% in 1999. SSME-2 share had initially declined by 88.3% to 3.7% in 1996, and increased to 5-9% between 1997-1999. While SSME-1 share had declined by 77.4%, from 30.8% in 1991 to 7.0% in 1993, increased to 20-22% between 1994-1995, and then declined gradually to only 6% in 1999. During the 1997-1999 period, SSME-3 contributed 81.4% to the SSME share of the annual round scad landings, followed by SSME-1 (11.4%) and SSME-2 (7.2%). Seine net is the principal landing gear in the SSME area, contributing 78.6% to the annual round scad landings during the 1997-1999 period (**Figure 270a**). Other important secondary gears in the SSME round scad fishery are *bagang* lift net and trawl net, which contributed respectively

12.6% and 8.7% to the SSME annual landings. In SSME-1, trawl net is the principal gear that had contributed 83.8% to the annual round scad landings, with only 15.3% contribution from seine net (**Figure 270b**). In SSME-2, seine net contributed 100% to the annual round scad landings. On the other hand, seine net and *bagang* lift net contributed respectively 84.8% and 15.2% to the SSME-3 annual round scad landings.

Indian mackerel landings in the SSME area fluctuated around 3,748-8,806 metric tons during the 1991-1999 period, contributing 39-76% to the state annual Indian mackerel landings (**Figures 259m-259n**). Landings had increased by 127.9% from 3,773 metric tons in 1991 to its peak of 8,806 metric tons in 1993, declined by 57.4% to 4,347 metric tons in 1998 before increasing to 5,250 metric tons in 1999. Its share of the state annual Indian mackerel landings had increased by 95.9% from 34.8% in 1991 to 75.7% in 1993, and since then had declined down to 49.2% in 1998 before increasing to 58.1% in 1999. During the 1991-1999 period, SSME-3 contributed 49-74% (mean: 62.9%) to the SSME share of the annual Indian mackerel landings, followed by SSME-1 (23.4%, range: 14-39%) and SSME-2 (13.8%, range: 9-20%). SSME-3 share of the SSME annual Indian mackerel landings had declined by 18.1%, from 62.3% in 1991 to 51.0% in 1999. SSME-3 share had increased 19.4% to its peak of 74.4% in 1996, and since then had declined to 49-51% in 1998-1999. SSME-2 share had declined by 46.0%, from 19.5% in 1991 to 10.6% in 1999. SSME-2 share had initially declined by 54.9% to 8.8% in 1996, increased to 19.2% in 1997, before declining to 11-12% in 1998-1999. On the other hand, SSME-1 share had increased by 111.7%, from 18.2% in 1991 to 38.4% in 1999. SSME share had initially increased by 56.3% to 28.4% in 1994, and then declined to 16-17% in 1995-1996 before increasing to 38-39% in 1998-1999. During the 1997-1999 period, SSME-3 contributed 53.2% to the SSME share of the annual Indian mackerel landings, followed by SSME-1 (33.0%) and SSME-2 (13.8%). Seine net and trawl net are the principal landing gears in the SSME area. During the 1997-1999 period, these gears contributed respectively 41.6% and 32.4% to the annual Indian mackerel landings (**Figure 269a**). Other important secondary gears in the SSME Indian mackerel fishery are hook & line *bagang* lift net, which contributed respectively 12.0% and 11.5% to the SSME annual landings. In SSME-1, trawl net is the principal gear that had contributed 84.4% to the annual Indian mackerel landings, with only 13.7% contribution from seine net (**Figure 269b**). In SSME-2, seine net contributed 81.6% to the annual Indian mackerel landings. Other secondary landing gears in the SSME-2 area are miscellaneous gears and trawl net, which had contributed respectively 11.4% and 7.0% to the annual Indian mackerel landings. Seine net contributed 49.3% to the SSME-3 annual Indian mackerel landings. Other important landing gears include hook & line, *bagang* lift net and trawl net, which contributed respectively 22.5%, 21.7% and 5.6% to the SSME-3 annual Indian mackerel landings.

Anchovy landings in the SSME area fluctuated around 1,572-5,410 metric tons during the 1991-1999 period, contributing 97-100% to the state annual anchovy landings (**Figures 259s-259t**). Landings had increased by 138.5% from 2,268 metric tons in 1991 to its peak of 5,410 metric tons in 1996, before declining gradually to 2,676 metric tons in 1999. Its share of the state annual anchovy landings had declined slightly by 3.2%, from 100% in 1991 to 96.8% in 1999. During the 1991-1999 period, SSME-3 contributed 91-97% (mean: 93.7%) to the SSME share of the annual anchovy landings, followed by SSME-1 (3.9%, range: 1-7%) and SSME-2 (2.4%, range: 1-6%). SSME-3 share of the SSME annual anchovy landings had declined by 5.1%, from 95.93% in 1991 to 90.9% in 1999. SSME-3 share had initially increased by 1.3% to its peak of 97.2% in 1996, and since then had declined to 91-94% in 1997-1999. SSME-1 share had increased by 111.8% from 3.2% in 1991 to 6.8% in 1999. While SSME-2 share had increased by 142.7% from 0.9% in 1991 to 2.3% in 1999. During the 1997-1999 period, SSME-3 contributed 92.5% to the SSME share of the annual anchovy landings, followed by SSME-1 (5.5%) and SSME-2 (2.0%). *Bagang* lift net is the principal landing gear in the SSME area. Other landing gears include trawl net, miscellaneous gears and seine net. During the 1997-1999 period, *bagang* lift net contributed 95.2% to the SSME annual anchovy landings, followed by trawl net (2.7%), miscellaneous gears (2.0%) and seine net (0.1%) (**Figure 272a**). In SSME-1, trawl net and *bagang* lift net contributed respectively 59.8% and 37.0% to the annual anchovy landings (**Figure 272b**). On the other hand, miscellaneous gears and trawl net contributed 95.5% and 4.5% to the SSME-2 annual anchovy landings. In SSME-3, *bagang* lift net contributed 100% to the annual anchovy landings.

Miscellaneous pelagic landings in the SSME area fluctuated around 30,400-73,159 metric tons during the 1991-1999 period, making up 54-78% to the state annual landings (**Figures 259w-259x**). In 1999, Spanish mackerel make up 13.2% of the SSME miscellaneous pelagic landings, followed by horse mackerel (11.2%), barracuda (10.0%), Japanese mackerel (8.4%), queen fish (8.1%), threadfin (7.8%), mullet (6.8%), hardtail scad (5.6%), selar scad (5.5%) and other pelagic species (23.6%). Overall, carangids make up 41.5% of the 1999 miscellaneous pelagic landings, followed by scombrids (22.2%), Sphyraenids (10.0%) shads (3.2%) and other pelagic families (23.0%). Landings had increased by 140.7% from 30,400 metric tons in 1991 to its peak of 73,159 metric tons in 1996, before declining gradually to 66,617 metric tons in 1999. Its share of the state annual landings had increased by 27.6%, from 54.2% in 1991 to 69.1% in 1999, with peak contribution of 72-78% between 1994-1996. During the 1991-1999 period, SSME-3 contributed 54-75% (mean: 65.0%) to the SSME share of the annual landings, followed by SSME-2 (20.9%, range: 15-25%) and SSME-1 (14.2%, range: 9-22%). SSME-3 share of the SSME annual landings had increased by 25.9%, from 56.0% in 1991 to 70.5% in 1999. SSME-3 share had initially increased by 34.3% to its peak of 75.4% in 1996, and since then had declined to 67-71% in 1997-1999. SSME-1 share had declined by 34.7% from 25.5% in 1991 to 16.7% in 1999. While SSME-1 share had declined by 30.6% from 18.5% in 1991 to 12.8% in 1999. During the 1997-1999 period, SSME-3 contributed 78.6% to the SSME share of the annual miscellaneous pelagic landings, followed by SSME-2 (18.1%) and SSME-2 (13.3%). This portion of the annual pelagic landings had been landed by various kinds of fishing gears in the SSME area, with gill net and hook & line as primary gears and seine net, *bagang* lift net and trawl net as secondary gears (**Figure 274a**). In the SSME-1 area, gill net contributed 37.9% to the annual landings, followed by trawl net (30.5%), hook & line (26.9%), seine net (3.0%), *bagang* lift net (1.6%) and other miscellaneous gears (0.1%) (**Figure 274b**). In SSME-2, gill net is the principal landing gear contributing 63.8% to the annual landings, followed by hook & line (18.9%), trawl net (7.0%), seine net (5.2%) and other miscellaneous gears (5.2%). On the other hand, hook & line contributed 34.3% to the annual landings in the SSME-3 area, followed by *bagang* lift net (22.8%), seine net (20.4%), gill net (13.5%), trawl net (8.0%) and other miscellaneous gears (1.0%).

During the 1991-1999 period, pelagic landings in the SSME-1 had increased by 52.0%, from 5,615 metric tons in 1991 to 8,534 metric tons in 1999 (**Figure 259g**). Pelagic landings had initially increased to its peak of 9,566 metric tons in 1992, fluctuated around 6,500-7,500 metric tons between 1993-1997, before increasing to 8,500 metric tons between 1998-1999. During the 9-year period, pelagic fishes represented 29.8% of the annual fish landings. The pelagic portion of the annual landings had decreased by 49.0% during the 9-year period, from 47.7% in 1991 to only 24.4% in 1999 (**Figure 173**). The substantial contribution from trawl net that comprised mainly of demersal species, had attributed to the low pelagic share of the annual landings (**Figures 167-168**). Compared to trawl net landing (**Figure 217d**), landings from seine net (**Figure 223d**) and gill net (**Figure 229d**), had not increased much during the 9-year period. Mackerel represented 17.0% of the annual pelagic landings during the 9-year period, followed by tuna (16.4%), round scad (13.4%), anchovy (1.4%) and other miscellaneous pelagic species (38.6%) (**Figure 259h**). Except for tuna and round scad, the landing portions of other pelagic species had increased throughout the years. During the 1997-1999 period, the annual pelagic landing composition comprised of sardine (24.4%), mackerel (18.2%), round scad (9.6%), tuna (6.3%), anchovy (2.1%) and miscellaneous pelagic species (39.4%).

Pelagic landings in the SSME-1 area amounted to 8,534 metric tons in 1999. Indian mackerels represented 23.5% of the annual landing, followed by sardine (19.4%), horse mackerel (13.8%), Spanish mackerel (9.1%), round scad (7.9%), yellow striped trevally (5.0%), tuna (4.0%), barracuda (2.7%), queen fish (2.5%), anchovy (2.1%) and other miscellaneous pelagic species (2.1%). Overall, scombrids represented 37.1% of the SSME-1 pelagic landings in 1999, followd by carangids (34.7%), clupeids (19.4%), and other pelagic families (8.8%).

During the 1991-1999 period, Indian mackerel make up 17.0% of the SSME-1 annual pelagic landings, followed by tuna (16.4%), round scad (13.4%), sardine (13.1%), anchovy (1.4%) and other miscellaneous pelagic species (38.6%) (**Figures 259g**-**259h**). Both Indian mackerel and sardine landings had significantly increased during the 9-year period, making up the bulk of the annual pelagic landings in recent years. The significant increase in sardine landings since 1994 was due to the introduction of purse seining, which contributed most of the sardine landings in recent years. On the other hand, annual tuna landings had declined throughout the years, from 1,000-3,000 metric tons in the early 90s to only 346 metric tons in 1999. Its share of the annual pelagic landings had declined from 21-33% in 1991-1993 to only 4-8% in 1997-1999. Round scad landings had also declined during the 9-year period. Round scad landings had initially increased from 718 metric tons in 1991 to its peak 2,115 metric tons in 1995, and since then had declined gradually throughout the years to only 681 metric tons in 1999. Its share of the annual pelagic landings had peaked around 22-28% in 1994-1995, and had declined to only 8% in 1999. Except in Pitas, anchovy is not an important component of the overall SSME-1 pelagic fisheries, where annual landings had only fluctuated around 44-182 metric tons during the 1991-1999 period, making up 0.7-2.4% of the annual pelagic landings. During the 1997-1999 period, sardines make up 24.4% of the annual pelagic landings, followed by Indian mackerel (18.2%), round scad (9.6%), tuna (6.3%), anchovy (2.1%) and other miscellaneous pelagic species (29.4%) (**Figure 259h**).

Commercial gears contributed 88.1% to the annual pelagic landings in Kudat during the 1997-1999 period (**Figure 268b**). Trawl net contributed 37.4% to the commercial gear share of the annual pelagic landings, followed by seine net (37.0%) and gill net (25.6%). On the other hand, hook & line and miscellaneous gears contributed respectively 99.2% and 0.8% to the traditional gear share of the annual pelagic landings. Pelagic landings in Kudat amounted to 8,156 metric tons in 1999. Indian mackerel represented 24.4% of the annual landing, followed by sardine (19.1%), horse mackerel (14.5%), Spanish mackerel (9.1%), round scad (8.3%), yellow striped trevally (5.3%), tuna (3.8%), barracuda (2.8%), queen fish (2.4%), rainbow runner (1.7%), mullets (1.6%) and other miscellaneous pelagic species (7.2%). Overall, scombrids represented 37.6% of the Kudat pelagic landings in 1999, followed by carangids (36.1%), clupeids (19.1%), and other pelagic families (7.2%).

During the 1991-1999 period, Indian mackerel make up 17.9% of the annual pelagic landings in Kudat, followed by tuna (16.8%), round scad (14.3%), sardine (13.0%), anchovy (0.6%) and other miscellaneous pelagic species (37.5%) (**Figures 260a**-**260b**). During the 9-year period, both Indian mackerel and sardine landings had respectively increased by 193.5% and 714.7%, making up the bulk of the annual landings in recent years. Indian mackerel landings had increased from 679 metric tons in 1991 to 1,262-1,903 metric tons between 1992-1994, declined to 794-969 metric tons between 1995-1997, and then increased to 1,694-1,993 metric tons in 1998-1999 or 21.2-24.5% of the annual pelagic landings. Sardine landings had only fluctuated around 14-191 metric tons in the early 90s, and with the introduction of purse seining in 1994, landings had significantly increased from only 292 metric tons in 1994 to 2,084 metric tons in 1997-1998 before declining to 1,556 metric tons in 1999. The sardine share of the annual pelagic landings had increased from only 0.2-3.6% in 1991-1993 to 23-29% in 1996-1998, and before declining to 19.2% in 1999. On the other hand, tuna landings had decreased by 83.4%, from 1,859 metric tons or 34.8% of the pelagic landings in 1991 to only 308 metric tons or 3.8%

of the pelagic landings in 1999. Round scad landings in Kudat had declined during the 9-year period. Landings had initially increased from 527-718 metric tons between 1991-1993 to 1,081-2,115 metric tons between 1994-1996, before declining to 681-883 metric tons between 1997-1999. Its share of the annual pelagic landings had increased from 6-13% in 1991-1993 to 17-30% in 1994-1996, and then declined down to 8-11% in 1997-1999. Anchovy landings only make up 0.6% of the annual pelagic landings during the 1991-1999 period, with trawl net contributing the bulk of the annual landings. Anchovy landings fluctuated around 1-58 metric tons between 1991-1996, peaking around 146 metric tons in 1997, before declining to 25-77 metric tons in 1998-1999. During the 1997-1999 period, sardine make up 24.7% of the annual pelagic landings, followed by Indian mackerel (18.9%), round scad (10.1%), tuna (6.2%), anchovy (1.1%) and miscellaneous pelagic species (38.9%) (**Figure 260b**).

Bagang lift net and gill net contributed respectively 56.3% and 33.6% to the annual pelagic landings in Pitas during the 1997-1999 period. Overall, traditional gears contributed 66.4% to the annual pelagic landings. *Bagang* lift net contributed 84.8% to the traditional gear share of the annual pelagic landings, followed by hook & line (14.9%) and miscellaneous gears (0.3%). On the other hand, gill net contributed 100% to the commercial gear share of the annual pelagic landings. Pelagic landings in Pitas amounted to 335 metric tons in 1999. Anchovy represented 31.5% of the annual landing, followed by sardine (28.2%), Spanish mackerel (13.4%), tuna (7.4%), queen fish (4.5%), mullet (0.5%), horse mackerel (0.5%), yellow stripped trevally (0.4%) and other miscellaneous pelagic species (0.9%). Overall, scombrids represented 32.1% of the Pitas pelagic landings in 1999, followed by carangids (5.6%) and other pelagic species (62.3%).

During the 1991-1999 period, anchovy make up 23.6% of the annual pelagic landings in Pitas, followed by sardine (21.1%), tuna (8.3%), Indian mackerel (3.0%) and other miscellaneous pelagic species (44.0%) (**Figures 260e**-**260f**). No round scad landings were recorded in Pitas during the 9-year period. Landings of the above species had all increased during the 9-year period, with significant increases noted for tuna (3,700.0%), Indian mackerel (316.7%) and sardine (168.6%). Anchovy and other miscellaneous pelagic species landings had only increased respectively by 45.8% and 22.0% during the 9-year period. Anchovy is the *prima dona* of the pelagic fisheries in Pitas, with *bagang* lift net being the principal gear. However, due to significant contribution from tuna, Indian mackerel and sardine landings, the anchovy share of the annual pelagic landings had declined by 24.5%, from 41.6% in 1991 to 31.4% in 1999. During the 1997-1999 period, anchovy make up 26.3% of the annual pelagic landings, followed by sardine (21.3%), tuna (10.0%), Indian mackerel (4.8%), and other miscellaneous pelagic species (37.6%) (**Figure 260f**).

Gill net and hook & line contributed respectively 97.1% and 2.9% to the annual pelagic landings in Kota Marudu during the 1997-1999 period. Kota Marudu pelagic landings in 1999 amounted to 82 metric tons. Mullets represented 55.1% of the annual landing, followed by queen fish (8.0%), barracuda (5.9%), horse mackerel (4.2%), marlin (2.6%), Spanish mackerel (0.7%) and other miscellaneous pelagic species (23.5%). Carangids represented 12.2% of the Kota Marudu pelagic landings in 1999, followed by scombrids (3.3%) and other pelagic families (84.5%). During the 1991-1999 period, tuna only make up 12.4% of the annual pelagic landings in Kota Marudu, followed by Indian mackerel (0.7%) and other miscellaneous pelagic species (86.8%) with mullets making up the bulk of the landings (**Figures 260c**-**260d**).

During the 1997-1999 period, sardines make up 24.4% of the SSME-1 annual pelagic landings. Kudat contributed 96.3% to the SSME-1 annual sardine landings, followed by Pitas (3.5%) and Kota Marudu (0.2%). Seine net is the principal sardine landing gear, contributing respectively 91.7% and 95.2% to the annual sardine landings in the SSME-1 area and Kudat (**Figure 271b** &

271f). On the other hand, gill net and *bagang* lift net are the principal landing gears respectively in Kota Marudu and Pitas.

Indian mackerel make up 18.5% of the SSME-1 annual pelagic landings during the 1997-1999 period, with Kudat and Pitas respectively contributing 99.6% and 0.4% to the annual Indian mackerel landings. No Indian mackerel landings were recorded in Kota Marudu. Trawl net and seine net are the principal and secondary landing gears in the SSME-1 area and Kudat (**Figure 269b** & **Figure 269f**). In Kudat, these gears contributed respectively 84.7% and 13.8% to the annual Indian mackerel landings during the 1997-1999 period. Only 1.5% of the annual landings come from gill net contribution. Overall, commercial gears contributed 100% of the annual Indian mackerel landings in Kudat. On the other hand, hook & line and gill net are the principal landing gears in Pitas. During the 1997-1999 period, these gears contributed respectively 47.7% and 31.6% to the annual Indian mackerel landings. Overall, traditional gears contributed 68.3% to the annual Indian mackerel landings in Pitas. Hook & line and *bagang* lift net contributed respectively 69.8% and 30.2% to the traditional gear share of the annual Indian mackerel landings.

During the 1997-1999 period, round scad make up 9.6% of the SSME-1 annual pelagic landings, with kudat and Pitas respectively contributing 99.9% and 0.1% to the SSME-1 annual round scad landings. No round scad landings were recorded in Kota Marudu. In Kudat, trawl net and seine net are the principal and secondary landing gears, respectively contributing 83.8% and 15.3% to the annual round scad landings during the 1997-1999 period (**Figure 270f**). Gill net only contributed 0.9% to the annual round scad landings. Commercial gears contributed 100% to the annual round scad landings in Kudat. On the other hand, miscellaneous gears landed the small round scad contribution from Pitas. Overall, trawl net and seine net contributed respectively 83.8% and 15.3% to the annual round scad landings in the SSME-1 area (**Figure 270b**).

Tunas only make up 6.1% of the SSME-1 annual pelagic landings during the 1997-1999 period. Kudat contributed 95.5% to the SSME-1 annual tuna landings, followed by Pitas (3.8%) and Kota Marudu (0.6%). In Kudat, gill net and seine net contributed respectively 85.9% and 14.1% to the annual tuna landings (**Figure 274f**). On the other hand, gill net is the principal gear in Kota Marudu and Pitas, where no landings from other gears were recorded. Overall, gill net and seine net contributed respectively 86.5% and 13.5% to the 1997-1999 annual tuna landings in the SSME-1 area (**Figure 274b**).

Anchovies only make up 1.6% of the SSME-1 annual pelagic landings during the 1997-1999 period, with Kudat and Pitas respectively contributing 63% and 37% to the SSME-1 annual anchovy landings. No anchovy landings were recorded in Kota Marudu. Trawl net is the principal landing gear in Kudat, where contribution from other gears only make up 5% of the annual anchovy landings (**Figure 273f**). On the other hand, anchovy is the target species of the *bagang* lift net fishery in Pitas. In 1999, anchovies make up 31.5% of the total *bagang* lift net landings. The anchovy fishery is the backbone of the capture fisheries sector in Pitas, which is the main source of dried anchovies in the SSME-1 area. Anchovies landed in Kudat were only sold in the local fish markets because the quality of the landings does not make up the grade for processing. Premium grade dried anchovies are boiled in-situ and sun-dried immediately after being hauled up. During the 1991-1999 period, anchovies make up 23.6% (range: 12-42%) of the annual pelagic landings in Pitas (**Figure 260f**). Overall, trawl net and *bagang* lift net are the primary and secondary anchovy landing gears in the SSME-1 area (**Figure 273b**).

During the 1997-1999 period, miscellaneous pelagic species make up 38.9% of the SSME-1 annual pelagic landings. Kudat contributed 92.5% to the SSME-1 annual miscellaneous pelagic landing, followed by Pitas (4.9%) and Kota Marudu (2.6%). Gill net contributed 35.6% to the annual landings in Kudat, followed by trawl net (33.0%), hook & line (28.1%), seine net (3.2%)

and miscellaneous gears (0.1%) (**Figure 275f**). In 1999, carangids make up 69.9% of the Kudat miscellaneous pelagic landings, followed by scombrids (18.0%), barracuda (5.3%), mullets (3.0%), shads (0.8%) and other pelagic families (2.9%). Gill net contributed 50.9% to the annual landings in Pitas, followed by *bagang* lift net (32.0%) and hook & line (17.1%). In 1999, scombrids make up 62.2% of the Pitas miscellaneous pelagic landings, followed by carangids (28.0%), mullets (5.8%), shads (2.4%) and barracuda (1.7%). While gill net and hook & line contributed respectively 96.8% and 3.2% to the annual landings in Kota Marudu. In 1999, mullets make up 65.8% of the Kota Marudu miscellaneous pelagic landings, followed by carangids (20.4%), barracuda (7.1%), scombrids (3.9%) and shads (2.8%). Overall, gill net, trawl net and *bagang* lift net are the primary miscellaneous pelagic landing gears in the SSME-1 area. In 1999, carangids make up 62.6% of the SSME-1 miscellaneous pelagic landings, followed by scombrids (22.1%), barracuda (6.3%), mullets (4.8%), shads (1.1%) and other pelagic families (3.1%).

Pelagic landings in the SSME-2 had increased by 43.2%, from 7,757 metric tons in 1991 to 11,108 metric tons in 1999 (**Figure 259i**). Pelagic landings had initially increased to its peak of 13,478 metric tons in 1994, and since then had fluctuated around 10,300-11,800 metric tons between 1995-1999. During the 9-year period, pelagic fishes represented only 34.2% of the annual landings. The pelagic portion of the annual landings had initially increased by 28.6% from 29.2% in 1991 to 37.6% in 1993, and since then had declined to around 32-35% between 1996-1999 (**Figure 192**). The increasing trawl net and gill net landings throughout the years, comprising mainly of demersal species, had attributed to the low pelagic portion in the annual landings (**Figures 186-187**). Compared to trawl net contribution (**Figure 217d**), landing contribution from other pelagic gears including seine net (**Figure 223d**) and gill net (**Figure 229d**), which comprised mainly of pelagic fishes, had not increased much during the 9-year period. Tuna represented 10.9% of the annual pelagic landings during the 9-year period, followed by Indian mackerel (7.2%), round scad (6.1%), anchovy (0.5%) and miscellaneous pelagic species (68.3%) (**Figure 259j**). Except for anchovy, landing of other pelagic indicator species had all decreased throughout the 9-year period. During the 1997-1999 period, the annual pelagic landing composition comprised of sardine (6.2%), Indian mackerel (5.4%), tuna (5.4%), round scad (4.6%), anchovy (0.6%) and miscellaneous pelagic species (77.8%).

In 1999, pelagic landings in the SSME-2 area amounted to 11,108 metric tons or 33.0% of the total landings. Spanish mackerels make up 13.7% of the pelagic landings, followed by mullets (13.0%), threadfin (12.0%), queenfish (10.2%), barracuda (7.2%), sardine (5.1%), black pomfret (4.9%), Indian mackerel (4.9%), round scad (4.9%), Chinese pomfret (4.8%), horse mackerel (4.0%), Japanese mackerel (4.0%), tuna (3.3%) and other miscellaneous pelagic species (7.9%). Overall, carangids make up 27.5% of the SSME-2 pelagic landings in 1999, followed by scombrids (25.9%), mullids (13.0%), polynemids (12.0%), sphyraenids (7.2%), clupeids (5.1%), shads (1.8%) and other pelagic families (19.6%).

Gill net and hook & line are the principal pelagic gears in SSME-2, which contributed respectively 52.8% and 15.9% to the annual pelagic landings during the 1997-1999 period (**Figure 268a**). Commercial gears contributed 78.2% to the annual pelagic landings in the SSME-2 area. During the 3-year period, gill net contributed 67.5% to the commercial gear share of the annual pelagic landings, followed by seine net (24.3%) and trawl net (8.2%). On the other hand, hook & line and miscellaneous gears contributed respectively 72.9% and 27.1% to the traditional gear share of the annual pelagic landings. During the 1997-1999 period, Sandakan and Beluran contributed respectively 82-89% (mean 86.7%) and 11-18% (mean 13.3%) to the SSME-2 annual pelagic landings. Fishing gears with dominant pelagic fishes in the SSME-2 annual pelagic landings are seine net and gill net (**Figure 262b**).

Gill net and seine net contributed respectively 47.7% and 21.8% to the annual pelagic landings in Sandakan during the 1997-1999 period (**Figure 268b**). Overall, commercial gears contributed 75.1% to the annual pelagic landings. Gill net contributed 63.5% to the commercial gear share of the annual pelagic landings, followed by seine net (29.0%) and trawl net (7.5%). On the other hand, hook & line and miscellaneous gears contributed respectively 73.4% and 26.6% to the traditional gear share of the annual pelagic landings.

During the 1991-1999 period, tuna make up 12.4% of the annual pelagic landings in Sandakan, followed by Indian mackerel (7.9%), sardine (7.2%), round scad (6.9%), anchovy (0.6%) and other miscellaneous pelagic species (65.1%) (**Figures 260g**-**260h**). Except for anchovy that only make up less than 1% of the annual pelagic landings, landings of the other four indicator species had all declined during the 9-year period. The annual landing trends for these species were almost similar during the 9-year period. Indian mackerel landings had initially increased from 737 metric tons in 1991 to 1,296-1,447 metric tons between 1992-1993, and since then had declined down to 498-604 metric tons in 1998-1999. Its share of the annual pelagic landings had declined from 11-14% in 1991-1993 to only 5-7% in 1997-1999. Round scad landings also had initially increased from 732 metric tons in 1991 to 1,024-1,161 metric tons in 1992-1992, and since then had declined down to 455-549 metric tons in 1997-1999. During the 9-year period, its share of the annual pelagic landings had declined from around 9-11% in 1991-1993 down to only 4-6% in 1997-1999. Sardine landings had increased from 763 metric tons in 1991 to 1,146 metric tons in 1993, and since then had declined to 500-600 metric tons in consecutive years. Its share of the annual pelagic landings declined from 9-11% in 1991-1993 to 5-7% between 1994-1999. Tuna make up 16-25% of the annual pelagic landings in the early 90s, with annual landings between 1,600-1,700 metric tons, and since 1995 the landings had declined steadily down to only 371 metric tons in 1999. Its share of the annual pelagic landings had declined to only 4-5% in 1998-1999. During the 9-year period, anchovies only make up less than 1% of the annual pelagic landings. Landings had initially increased from 21 metric tons in 1991 to its peak of 101 metric tons in 1993, and since then declined to around 50 metric tons in the late 90s. On the other hand, landings of other miscellaneous pelagic species had increased by 158.3% during the 9-year period, from 3,034 metric tons in 1991 to 10,513 metric tons in 1999. Its share of the annual pelagic landings had increased by 82.9%, from 43.3% in 1991 to 79.1% in 1999. During the 1991-1999 period, landing contribution from the 5 indicator species had declined by 64.3% from 56.7% in 1991 to only 20.3% in 1998-1999 (**Figure 260h**). During the 1997-1999 period, tuna make up 6.3% of the annual pelagic landings, followed by Indian mackerel (5.8%), sardine (5.8%), round scad (5.4%), anchovy (0.6%) and other miscellaneous pelagic species (76.1%). In 1999, pelagic landings in Sandakan amounted around 10,066 metric tons. Spanish mackerel represented 15.4% of the pelagic landing, followed by threadfin (11.9%), queen fish (11.2%), barracuda (8.1%), mullet (7.1%), black pomfret (5.6%), Indian mackerel (5.5%), round scad (5.4%), sardine (5.4%), Chinese pomfret (5.1%), Japanese mackerel (4.5%), horse mackerel (4.2%), tuna (3.7%) and various other miscellaneous pelagic species (6.9%). Carangids make up 35.9% of the Sandakan pelagic landings in 1999, followed by scombrids (29.1%), polynemids (11.9%), clupeids (5.4%), mullids (7.1%), and other pelagic families (10.6%).

Gill net and hook & line contributed respectively 86.4% and 11.6% to the annual pelagic landings in Beluran during the 1997-1999 period (**Figure 268c**). Overall, commercial gears contributed 98.3% to the annual pelagic landings. Gill net contributed 87.9% to the commercial gear share of the annual pelagic landings in Beluran, followed by trawl net (11.8%) and seine net (0.3%). On the other hand, hook & line and miscellaneous gears contributed respectively 58.8% and 41.2% to the traditional gear share of the annual pelagic landings.

The pelagic fishery sector in Beluran is dominated by estuarine-based gears with mullets, shads and other estuarine species making up more than 65% of the annual pelagic landings. The main pelagic fishing grounds in Beluran are restricted within the Labuk Bay. Fishermen rarely go out to the open seas because of piracy problems. There were many incidents of pirate attacks in the past, where fishing boats and together with their catches were taken by force, and fishermen were either harmed in one way or the other and forced to swim back to shore in their “birthday suits” or undergarments.

During the 1991-1999 period, landings of the five indicator species only make up a very small portion of the annual pelagic landings, except in 1996-1997 (**Figures 260i-260j**). In 1996-1999, sardine and Indian mackerel respectively make up 17.3% and 3.1% of the annual pelagic landings. During the 9-year period, miscellaneous pelagic species make up around 95% of the annual pelagic landings in Beluran. Sardine only makes up 4.2% of the annual pelagic landings, followed by Indian mackerel (0.8%), round scad (0.2%) and anchovy (0.1%). In recent years, contribution from the 5-indicator species had slightly increased making up around 10% of the annual pelagic landings. During the 1997-1999 period, sardine make up 7.1% of the annual pelagic landings, followed by Indian mackerel (2.3%) and anchovy (0.2%). Pelagic landings in Beluran amounted to 1,248 metric tons in 1999. Mullets represented 60.6% of the landing, followed by threadfin (12.4%), sickle fish (12.0%), shad – *Pelonia* spp. (2.9%), sardine (2.8%), Chinese pomfret (2.8%), horse mackerel (2.7%), queen fish (2.0%), chacunda shad (1.0%) and anchovy (0.7%). Mullets represented 60.6% of the Beluran pelagic landings in 1999, followed by carangids (16.8%), polynemids (12.4%), shads (3.9%), clupeids (2.8%), stromateids (2.8%) and engraulids (0.7%).

Sardines make up 6.2% of the SSME-2 annual pelagic landings during the 1997-1999 period. Seine net is the principal sardine landing gear in the SSME-2 area, which had contributed 65.7% to the annual landings, followed by trawl net (13.2%), miscellaneous gears (10.9%) and gill net (10.2%) (**Figure 271b**). Sandakan and Beluran contributed respectively 76.7% and 23.3% to the annual sardine landings during the 1997-1999 period. Gill net and miscellaneous gears contributed respectively 85.7% and 14.3% to the annual sardine landings in Sandakan (**Figure 272g**). On the other hand, trawl net and gill net contributed respectively 56.4% and 43.6% to the annual sardine landings in Beluran.

During the 1997-1999 period, Indian mackerel makes up 5.4% of the SSME-2 annual pelagic landings. Seine net is the principal Indian mackerel landing gear in the SSME-2 area, which had contributed 77.9% to the annual landings, followed by miscellaneous gears (12.0%) and trawl net (10.1%) (**Figure 269b**). Sandakan and Beluran contributed respectively 90% and 10% to the SSME-2 annual Indian mackerel landings during the 1997-1999 period. Seine net and miscellaneous gears contributed 86.1% and 13.4% to the annual Indian mackerel landings in Sandakan (**Figure 269g**). On the other hand, trawl net contributed 100% of the annual Indian mackerel landings in Beluran.

Tunas make up 5.4% of the SSME-2 annual pelagic landings during the 1997-1999 period. Gill net is the principal tuna landing gear in the SSME-2 area, with seine net and hook & line being the secondary landing gears. Sandakan contributed all the tuna landings during the 1997-1999 period, with no tuna landings recorded in Beluran (**Figure 274g**). Gill net contributed 47.4% to the SSME-2 annual tuna landings, followed by seine net (29.1%) and hook & line (23.5%) (**Figure 274b**).

During the 1997-1999 period, round scads make up 4.6% of the SSME-2 annual pelagic landings. Seine net is the principal landing gear for round scads in the SSME area (**Figure 270b**). No round scad landings were recorded in Beluran, with Sandakan being the SSME-2 main contributor (**Figure 270g**).

Anchovy only make up 0.6% of the SSME-2 annual pelagic landings during the 1997-1999 period. Anchovy landings were only recorded in Sandakan (**Figure 273g**), with miscellaneous gears contributing 100% of the landings.

During the 1997-1999 period, miscellaneous pelagic species make up 77.8% of the SSME-2 annual pelagic landings. Pelagic fishes that fall under this group, excluding the 5 indicator pelagic species, were landed by various gears, with gill net being the principal landing gear (**Figure 275b**). Sandakan and Beluran contributed respectively 99.8% and 0.2% to the miscellaneous pelagic landings during the 1997-1999 period. Gill net contributed 60.9% to the annual landings in Sandakan, followed by hook & line (22.4%), miscellaneous gears (6.8%), seine net (6.2%) and trawl net (3.7%) (**Figure 275g**). Spanish mackerel make up 19.5% of the Sandakan miscellaneous pelagic landings in 1999, followed by threadfin (15.0%), queenfish (14.1%), barracuda (10.2%), mullet (8.9%), black pomfret (7.0%), Chinese pomfret (6.4%), Japanese mackerel (5.7%), horse mackerel (5.2%), shad (2.0%), wolf herring (1.5%), ribbon fish (1.4%) and yellow-stripped trevally (1.3%). Overall, carangids make up 38.4% of the miscellaneous pelagic landings, followed by scombrids (25.1%), polynemids (15.0%), sphyraenids (10.2%), shads (2.0%), chirocentrids (1.5%) and trichurids (1.4%). On the other hand, gill net contributed 94.9% of the miscellaneous pelagic landings in Beluran, followed by trawl net (2.3%), hook & line (1.4%), miscellaneous gears (1.0%) and seine net (0.5%). Mullets make up 62.8% of the Beluran miscellaneous pelagic landings in 1999, followed by queenfish (14.5%), polynemids (12.9%), shad (4.1%), stromateids (2.9%) and horse mackerel (2.8%).

Pelagic landings in the SSME-3 had increased by 175.9%, from 17,028 metric tons in 1991 to 46,975 metric tons in 1999 (**Figure 259k**). Pelagic landings had initially increased by 223.2% to its peak of 55,043 metric tons in 1996, declined to 39,512 metric tons in 1997 before increasing to 46,975 metric tons in 1999. During the 9-year period, pelagic fishes represented only 67-81% (mean 73.2%) of the annual landings. The pelagic portion of the annual landings had initially increased by 7.6% from 75.2% in 1991 to 80.9% in 1993, and since then had declined to around 67-68% between 1997-1999 (**Figure 211**). The increasing seine net and hook & line landings throughout the years, comprising mainly of pelagic species, had attributed to the high pelagic portion in the SSME-3 annual landings (**Figures 205**-**206**). Tuna represented 21.2% of the annual pelagic landings during the 9-year period, followed by sardine (21.0%), round scad (14.8%), Indian mackerel (11.3%), anchovy (7.5%) and miscellaneous pelagic species (24.2%) (**Figure 259l**). Except for round scad and sardine, landing of the other indicator species had all decreased throughout the 9-year period. During the 1997-1999 period, the annual pelagic landing composition in the SSME-3 area comprised of sardine (27.2%), tuna (15.8%), round scad (14.5%), anchovy (6.8%), Indian mackerel (5.5%) and miscellaneous pelagic species (30.1%).

Pelagic landings in the SSME-3 amounted to 46,975 metric tons in 1999. Sardine represented 23.3% of the annual landing, followed by round scad (19.8%), tuna (15.0%), Indian mackerel (5.6%), horse mackerel (5.2%), anchovy (5.1%), Japanese mackerel (3.9%), barracuda (3.6%), selar (3.0%), hardtail scad (3.0%), Spanish mackerel (2.7%), queen fish (1.8%) and other miscellaneous pelagic species (7.7%). Carangids represented 35.5% of the SSME-3 pelagic landings in 1999, followed by scombrids (27.6%), clupeids (23.3%), engraulids (5.1%), sphyraneids (3.6%), polynemids (1.7%), shads (1.4%), trichiurids (1.1%), chirocentrids (0.6%) and stromateids (0.1%).

Seine net and *bagang* lift net are the principal pelagic gears in SSME-3, which had contributed respectively 56.8% and 22.6% to the annual pelagic landings during the 1997-1999 period (**Figure 268a**). Commercial gears contributed 63.8% to the annual pelagic landings in the SSME-3 area. During the 3-year period, seine net contributed 89.0% to the commercial gear share of the annual pelagic landings, followed by gill net (6.6%) and trawl net (4.4%). On the other hand, *bagang* lift net contributed 62.6% to the traditional gear share of the annual pelagic landings, followed by hook & line (36.6%) and miscellaneous gears (0.8%). During the 1997-1999 period, Kunak contributed 39-43% (mean: 41.2%) to the SSME-3 annual pelagic landings, followed by Lahad Datu (23.2%, range: 17-27%), Semporna (22.8%, range: 18-28%) and Tawau (12.7%, range: 12-13%). Fishing gears with dominant pelagic fishes in the SSME-3 annual pelagic landings are seine net, *bagang* lift net and gill net (**Figure 262c**).

Seine net and *bagang* lift net contributed respectively 64.2% and 29.2% to the annual pelagic landings in Kunak during the 1997-1999 period (**Figure 268c**). Overall, commercial gears contributed 65.3% to the annual pelagic landings in Kunak. Seine net and gill contributed respectively 98.3% and 1.7% to the commercial gear share of the annual pelagic landings. On the other hand, *bagang* lift net and hook & line contributed respectively 84.1% and 15.9% to the traditional gear share of the annual pelagic landings.

During the 1991-1999 period, sardine make up 26.2% of the annual pelagic landings in Kunak, followed by round scad (18.6%), tuna (13.9%), Indian mackerel (11.3%), anchovy (5.6%) and miscellaneous pelagic species (24.5%) (**Figures 260o**-**260p**). During the 9-year period, except for anchovy and tuna, landings of other pelagic indicator species had increased in different proportions. The most significant increase in annual landings was noted for both round scad and sardine. These fishes are the target species of the purse seine fleet owned by the two fish meal plants in Kunak. Round scad landings had increased by 1,862.6% during the 9-year period, from only 342 metric tons in 1991 to 6,712 metric tons in 1999. Round scad landings peaked at 7,514 metric tons in 1996, and declined to 3,000-3,800 metric tons in 1997-1998 before increasing to its present levels in 1999. Annual trends in the sardine landings were almost similar to the round scad landings. Sardine landings increased by 1,245.6%, from 640 metric tons in 1991 to 8,612 metric tons in 1999. Sardine landings peaked at 12,509 metric tons in 1996, declined to 6,800-7,200 metric tons in 1997-1998 before increasing to its present levels in 1999. About 14.5% of the seine net landings in Kunak in 1999, comprising mainly of sardine and round scad, were used as raw materials by the two existing fish meal plants[156]. In 1999, these species make up about 73.9% (13,991 metric tons) of the purse seine landings in Kunak. Indian mackerel landings had slightly increased by 43.4%, from 1,072 metric tons in 1991 to 1,537 metric tons in 1999. The Indian mackerel landings had initially increased to 4,923 metric tons in 1993, and since then had declined to 1,100 metric tons in 1997-1998 before increasing to 1,537 metric tons in 1999. On the other hand, tuna landings had declined by 69.3%, from 5,322 metric tons in 1991 to only 1,635 metric tons in 1999. Tuna landings peaked around 3,900-5,300 metric tons in the early 90s, and declined to 405 metric tons in 1997 before increasing to 1,635 metric tons in 1999. Anchovy landings had also declined during the 9-year period, from 1,663 metric tons in 1991 down by 82.1% to only 298 metric tons in 1999. Similar to tuna landings, peak anchovy landings around the 1,100-1,700 metric ton level were noted only in the early 90s, and the subsequent years had gradually declined down to its present level in 1999. Landings from the miscellaneous pelagic portion had increased by 134.9% during the 9-year period, from 1,862 metric tons in 1991 to 4,373 metric tons in 1999. Similar to round scad and sardine landing trends, landings of this pelagic group peaked around 8,959 metric tons in 1996, and declined to around 4,400-4,700 metric tons in 1998-1999. Except for round scad, sardine and the miscellaneous pelagic portion, the landing shares of the other pelagic indicator species had all declined during the 9-year period (**Figure 260p**). During the 1997-1999 period, sardine make up 36.4% of the annual pelagic landings in Kunak, followed by round scad (21.4%), Indian mackerel (6.1%), tuna (4.9%), anchovy (3.0%) and miscellaneous pelagic species (28.2%).

[156] Fish meal production in Kunak amounted to 603 metric tons in 1999. The raw materials used were estimated in the region of 2,027 metric tons landed by from purse seiners owned by the two fish meal plants.

Pelagic landings in Kunak amounted to 21,856 metric tons in 1999. Sardine represented 39.4% of the annual landing, followed by round scad (30.7%), tuna (7.5%), Indian mackerel (7.0%), selar (6.0%), hardtail scad (5.2%), anchovy (1.4%), horse mackerel (1.4%) and other miscellaneous pelagic species (10.3%). Carangids represented 43.7% of the Kunak pelagic landings in 1999, followed by clupeids (39.4%), carangids (14.7%), engraulids (1.4%), and other pelagic families (0.8%).

Hook & line and seine net contributed 60.0% and 23.4% to the annual pelagic landings in Lahad Datu during the 1997-1999 period (**Figure 268c**). Overall, traditional gears contributed 72.1% to the annual pelagic landings. Hook & line contributed 83.2% to the traditional gear share of the annual pelagic landings, followed by *bagang* lift net (15.7%) and miscellaneous gears (1.1%). On the other hand, seine net contributed 83.6% to the commercial gear share of the annual pelagic landings.

During the 1991-1999 period, the 5-pelagic indicator species only make up 22.7% of the annual pelagic landings in Lahad Datu. Miscellaneous pelagic species contributed 74.6% to the annual pelagic landings in Kunak, followed by tuna (7.7%), round scad (7.4%), Indian mackerel (6.4%), anchovy (2.1%) and sardine (1.9%) (**Figures 260q**-**260r**). Except for anchovy and tuna, landings from the other indicator species had all increased during the 9-year period. Tuna landings had declined by 37.3%, from 501 metric tons in 1991 to 314 metric tons in 1999. Anchovy landings declined by 29.2%, from 209 metric tons in 1991 to 148 metric tons in 1999. On the other hand, round scad landings had significantly increased from only 1 metric ton in 1991 to 1,859 metric tons in 1999. While Indian mackerel landings increased by 270.2%, from 218 metric tons in 1991 to 807 metric tons in 1999. Sardine landings increased by 164.8%, from 91 metric tons in 1991 to 241 metric tons in 1999. Landings of the miscellaneous pelagic portion increased by 524.6%, from only 1,840 metric tons in 1991 to 11,493 metric tons in 1999. During the 9-year period, except for sardine and the miscellaneous pelagic portion, landing contribution from the other indicator species had all declined during the 1991-1999 period (**Figure 260r**). During the 1997-1999 period, the miscellaneous pelagic portion make up 79.4% of the annual pelagic landings, followed by round scad (9.9%), Indian mackerel (5.9%), tuna (2.1%), sardine (1.6%) and anchovy (1.0%).

Pelagic landings in Lahad Datu amounted to 8,429 metric tons in 1999. Round scad represented 22.0% of the annual landing, followed by horse mackerel (19.4%), Japanese mackerel (11.9%), Indian mackerel (9.6%), barracuda (8.3%), yellow stripped trevally (7.5%), Spanish mackerel (7.3%), tuna (3.7%), sardine (2.9%), anchovy (1.8%) and other miscellaneous pelagic species (5.7%). Carangids represented 53.4% of the Lahad Datu pelagic landings in 1999, followed by scombrids (32.4%), sphyraenids (8.3%), clupeids (2.9%), engraulids (1.8%) and other pelagic families (1.2%).

Seine net is the main principal pelagic gear contributed 92.0% to the annual pelagic landings in Semporna during the 1997-1999 period (**Figure 268c**). Overall, commercial gears contributed 93.5% to the annual pelagic landings. Seine net and gill net contributed respectively 98.4% and 1.6% to the commercial gear share of the annual pelagic landings. On the other hand, hook & line and miscellaneous gears contributed respectively 95.4% and 4.6% to the traditional gear share of the annual pelagic landings.

During the 1991-1999 period, the 5-pelagic indicator species make up 87.1% of the annual pelagic landings in Semporna. Tuna contributed 42.1% to the annual pelagic landings, followed by sardine (20.7%), Indian mackerel (10.3%), round scad (8.8%) and miscellaneous pelagic species (18.1%) (**Figures 260m**-**260n**). Anchovy landings in Semporna were only recorded in 1995-1997, making up around 0.1% of the annual pelagic landings. Except for Indian mackerel, landings of the other indicator species had all increased during the 1991-1999 period, with high increases noted for tuna and sardine. Tuna landings had increased by 618.4%, from 724 metric tons in 1991 to 5,201 metric tons in 1999. Tuna landings peaked around 7,300-7,500 metric tons in 1996-1997, and declined to 3,700-5,200 metric tons in 1998-1999. Sardine landings increased by 1,758.8%, from only 294 metric tons in 1991 to its peak around 5,465 metric tons in 1998, and declined down to 2,263 metric tons in 1999. Round scad landings initially increased by 117.7%, from 536 metric tons in 1991 to its peak around 1,000-1,200 metric tons in 1995-1996, declined to 356 metric tons in 1998, and then increased to its present levels around 883 metric tons in 1999. The miscellaneous pelagic portion of the annual landings increased by 92.8%, from 652 metric tons in 1991 to 1,257 metric tons in 1999. Landings had initially increased by 313.3% to its peak around 2,500-2,700 metric tons in 1995-1996, and declined gradually to its present level in 1999. On the other hand, Indian mackerel landings had declined by 86.7%, from 962 metric tons in 1991 to only 128 metric tons in 1999. Landings had initially increased by 31.2% to its peak around 1,100-1,300 metric tons in 1995-1996 before declining to around 100 metric tons in 1998-1999. During the 9-year period, except for sardine and tuna, the landing contribution from the other indicator species had all declined (**Figure 260n**). Tuna make up 47.4% of the annual pelagic landings in Semporna during the 1997-1999 period, followed by sardine (33.0%), round scad (5.5%), Indian mackerel (1.8%) and miscellaneous pelagic species (12.3%).

Pelagic landings in Semporna amounted to 7,732 metric tons in 1999. Tuna represented 53.4% of the annual landing, followed by sardine (23.3%), round scad (9.1%), Japanese mackerel (7.2%), marlin (1.5%), horse mackerel (1.4%), Indian mackerel (1.3%), and other miscellaneous pelagic species (2.8%). Scombrids represented 64.4% of the Semporna pelagic landings in 1999, followed by clupeids (23.3%), carangids (10.6%), and other pelagic families (1.7%).

Bagang lift net and trawl net contributed respectively 55.4% and 25.5% to the annual pelagic landings in Tawau during the 1997-1999 period (**Figure 268c**). Overall, traditional gears contributed 56.5% to the annual pelagic landings. *Bagang* lift net contributed 98.1% to the traditional gear share of the annual pelagic landings, followed by miscellaneous gears (1.2%) and hook & line (0.7%). On the other hand, trawl net and gill net contributed respectively 58.6% and 41.4% to the commercial gear share of the annual pelagic landings.

During the 1991-1999 period, the 5-pelagic indicator species make up only 31.3% of the annual pelagic landings in Tawau. Anchovy make up 34.7% of the annual pelagic landings, followed by tuna (5.4%), Indian mackerel (4.7%), sardine (1.3%) and miscellaneous pelagic species (53.9%) (**Figures 260k-260l**). No round scad landings had been recorded in Tawau during the 9-year period. Both sardine and tuna landings were only recorded in the early 90s. The shifting of the Tawau-based purse seine fleet to other areas in the SSME-3 area had attributed to no landings of sardine and tuna in subsequent years. During the 1997-1999 period, anchovy make up 33.5% of the annual pelagic landings in Tawau, followed by Indian mackerel (2.7%) and miscellaneous pelagic species (63.9%).

Pelagic landings in Tawau amounted to 7,611 metric tons in 1999. Anchovy represented 26.1% of the pelagic landing, followed by barracuda (10.6%), threadfin (10.3%), queen fish (10.3%), miscellaneous shads (7.8%), Spanish mackerel (7.5%), horse mackerel (5.2%), ribbon fish (4.4%), wolf herring (4.0%), Indian mackerel (2.7%), and other miscellaneous pelagic species (11.1%). Engraulids represented 26.1% of the Tawau pelagic landings in 1999, followed by carangids (23.8%), scombrids (12.5%), sphyraenids (10.6%), polynemids (10.3%), shads (7.8%), trichurids (4.4%), chirocentrids (4.0%) and stromaetids (0.5%).

Sardines make up 27.2% of the SSME-3 annual pelagic landings during the 1997-1999 period. Kunak contributed 66.0% to the SSME-3 annual sardine landings, followed by Semporna (32.3%) and Lahad Datu (1.6%). Seine net and *bagang* lift net are the principal and secondary landing gears in Kunak, which had contributed respectively 71.1% and 28.9% to the annual sardine landings (**Figure 271h**). On the other hand, seine net and *bagang* lift net are respectively the principal sardine landing gears in Semporna and Lahad Datu.

During the 1997-1999 period, tuna make up 15.8% of the SSME-3 annual pelagic landings. Semporna contributed 81.0% to the SSME-3 annual tuna landings, followed by Kunak (15.3%) and Lahad Datu (3.7%). Seine net is the principal tuna landing gear in Semporna, Kunak and Lahad Datu (**Figure 273h**). In Semporna, seine net and hook & line contributed respectively 89.4% and 10.6% to the annual tuna landings.

Round scad make up 14.5% of the SSME-3 annual pelagic landings during the 1997-1999 period. Kunak contributed 71.9% to the SSME-3 annual round scad landings, followed by Lahad Datu (18.7%) and Semporna (9.5%). Seine net is the principal round scad landing gear in Kunak, Lahad Datu and Semporna (**Figure 270h**). In Kunak, seine net and *bagang* lift net contributed respectively 78.8% and 21.2% to the annual round scad landings.

During the 1997-1999 period, anchovy make up 6.8% of the SSME-3 annual pelagic landings. Tawau contributed 74.6% to the SSME-3 annual anchovy landings, followed by Kunak (21.2%) and Lahad Datu (4.2%). Contribution from Semporna only makes up 0.02% of the SSME-3 annual anchovy landings. *Bagang* lift net is the principal anchovy landing gear in Tawau, Kunak and Lahad Datu (**Figure 272h**). On the other hand, miscellaneous gears contributed the small anchovy landings in Semporna.

Indian mackerel make up 5.5% of the SSME-3 annual pelagic landings during the 1997-1999 period. Kunak contributed 53.8% to the SSME-3 annual Indian mackerel annual landings, followed by Lahad Datu (29.6%), Semporna (9.3%) and Tawau (7.3%). Seine net and *bagang* lift net are the principal and secondary landing gear in Kunak, which had contributed respectively 66.4% and 33.6% to the annual Indian mackerel landings (**Figure 269h**). In Lahad Datu, hook & line contributed 75.9% to the annual Indian mackerel landings, followed by *bagang* lift net (12.0%), seine net (8.9%) and gill net (3.1%). On the other hand, seine net and trawl net are respectively the principal Indian mackerel landing gear in Semporna and Tawau.

During the 1997-1999 period, the miscellaneous pelagic group make up 30.1% of the SSME-3 annual pelagic landings. Lahad Datu contributed 31.0% to the SSME-3 annual miscellaneous pelagic group landings, followed by Tawau (30.8%), Kunak (27.3%) and Semporna (10.8%).

Hook and line contributed 82.2% to the miscellaneous pelagic group landings in Lahad Datu, followed by *bagang* lift net (8.5%), gill net (6.8%) and seine net (1.2%). Overall, traditional gears contributed 92.0% to the annual miscellaneous pelagic group landings in Lahad Datu (**Figure 274h**). This group makes up 60.0% of the Lahad Datu pelagic landings in 1999. Horse mackerel make up 32.3% of the miscellaneous pelagic group landings, followed by Japanese mackerel (19.8%), barracuda (13.8%), yellow-stripped trevally (12.5%), Spanish mackerel (12.1%), hardtail scad (2.0%), selar scad (1.9%), mullet (1.4%), ribbon fish (1.4%), queen fish (1.1%), golden trevally (0.7%), black pomfret (0.3%), Chinese pomfret (0.3%), Chacunda shad (0.2%) and threadfin (0.1%).

Trawl net contributed 35.5% to the annual miscellaneous pelagic group landings in Tawau, followed by *bagang* lift net (34.6%), gill net (28.0%), miscellaneous gears (1.1%) and hook & line (0.7%) (**Figure 274h**). Overall, commercial gears contributed 63.5% to the annual miscellaneous pelagic group landings in Tawau. This group makes up 71.2% of the Tawau pelagic landings in 1999. Barracuda make up 14.9% of the miscellaneous pelagic group landing, followed by queen fish (15.2%), threadfin (14.4%), Spanish mackerel (10.6%), Chacunda shad (8.1%), horse mackerel (7.3%), ribbon fish (6.2%), wolf herring (5.6%), yellow-stripped trevally

(3.5%), hardtail scad (3.3%), Japanese mackerel (3.1%), slender shad (2.6%), mullet (2.4%), amberjack (1.1%), Chinese pomfret (0.7%), selar scad (0.4%), black pomfret (0.3%) and shad (0.2%).

Bagang lift net contributed 34.8% to the landings in Kunak, followed by seine net (31.7%), hook & line (27.9%), gill net (5.4%) and other miscellaneous gears (0.2%) (**Figure 274h**). Overall, traditional gears contributed 62.9% to the annual miscellaneous pelagic group landings in Kunak. This group makes up 14.0% of the Kunak pelagic landings in 1999. Selar scad make up 43.2% of the miscellaneous pelagic group landings, followed by hardtail scad (37.2%), horse mackerel (10.1%), barracuda (4.9%), Chacunda shad (1.4%), Spanish mackerel (1.1%), mullet (0.7%), queen fish (0.7%) and yellow-stripped trevally (0.6%).

Seine net contributed 77.1% to the landings in Semporna, followed by gill net (11.7%), hook & line (8.9%) and other miscellaneous gears (2.3%) (**Figure 274h**). Overall, commercial gears contributed 88.8% to the annual miscellaneous pelagic group landings in Semporna. This group makes up 12.9% of the Semporna pelagic landings in 1999. Japanese mackerel make up 55.9% of the miscellaneous pelagic group landing, followed by marlin (11.6%), horse mackerel (10.9%), ribbon fish (8.1%), Spanish mackerel (7.1%), barracuda (5.6%), selar scad (0.8%) and hardtail scad (0.1%).

Hook & line contributed 34.3% to the SSME-3 annual miscellaneous pelagic group landing, followed by *bagang* lift net (22.8%), seine net (20.4%), gill net (13.5%), trawl net (8.0%) and miscellaneous gears (1.0%) (**Figure 274b**). Overall, traditional gears contributed 58.1% to the SSME-3 annual miscellaneous pelagic group landings. This group makes up 31.1% of the pelagic landings in the SSME-3 area in 1999. Horse mackerel contributed 17.0% to the SSME-3 miscellaneous pelagic group landings, followed by Japanese mackerel (12.7%), barracuda (11.7%), horse mackerel (9.8%), selar scad (9.8%), hardtail scad (9.6%), Spanish mackerel (8.9%), queen fish (5.8%), yellow-stripped trevally (5.7%), threadfin (5.3%), ribbon fish (3.4%), Chacunda shad (3.4%), wolf herring (2.1%), mullet (1.5%), marlin (1.0%), slender shad (1.0%), amberjack (0.4%), Chinese pomfret (0.3%), golden trevally (0.2%), black pomfret (0.2%) and shad (0.1%).

Fisheries Economics

The average wholesale prices of pelagic, demersal fish and demersal invertebrate by fishing region are shown respectively in *Tables 194-196*. The retail value of fish landings by resource group and fishing districts for the 1999 period is given in **Table A53**. The average regional fish production volume and wholesale value per fisherman estimated from the 1998-1999 statistics is shown in **Figures 275a**-**275d** and **Tables A70**-**A71**. The average returns to fishermen by landing volume and wholesale value is estimated respectively at 9.58 metric tons and RM32,267.

Non-SSSME landing volume returns per fisherman (11.72 metric tons) is 25.2% higher compared to the SSME area (8.77 metric tons) (**Figure 275a**). In the SSME area, fishermen in the SSME-3 area have the highest landing volume returns (12.24 metric tons), followed by SSME-1 (7.81 metric tons) and SSME-2 (6.20 metric tons). Fishermen in Kunak have the highest landing volume returns (26.09 metric tons), followed by Lahad Datu (20.39 metric tons), Sandakan (19.55 metric tons), Kudat (11.16 metric tons), Tawau (8.84 metric tons), Semporna (6.84 metric tons), Beluran (0.96 metric tons), Pitas (0.78 metric tons) and Kota Marudu (0.58 metric tons) (**Figure 275b**).

Non-SSME landing wholesale value returns per fishermen (RM37,251) is 22.6% higher compared to the SSME area (RM30,380) (**Figure 275c**). In the SSME area, fishermen in the SSME-1 farea have the highest landing value returns (RM34,442), followed by SSME-3 (RM31.047) and SSME-2 (RM26,616). Fishermen in Sandakan has the highest landing value returns (RM91,078), followed by Kunak (RM52,653), Kudat (RM49,126), Lahad Datu (48,265), Tawau (29,649), Semporna (RM16,786), Kota Marudu (RM3,345), Pitas (RM2,708) and Beluran (RM1,264) (**Figure 275d**).

Table 151: *Annual breakdown of marine fish landings by resource type, Sabah 1991-1999*

Year	% annual		% Annual Demersal			% Annual Pelagic					
	Dem	Pel	Fin	Shp	Inv	Sar	Rsd	Mac	Anc	Tun	Oth
1991	48.2	51.8	63.9	23.9	12.2	17.4	11.9	6.9	4.0	19.6	40.1
1992	47.5	52.5	60.1	18.6	21.3	15.6	13.7	6.9	2.2	21.1	40.5
1993	51.4	48.6	59.6	11.7	28.7	15.4	13.9	10.3	2.1	18.8	39.4
1994	51.9	48.1	68.5	15.0	16.5	12.1	16.8	17.2	3.7	15.0	35.2
1995	50.4	49.6	69.8	13.1	17.1	10.4	17.9	20.7	3.8	16.9	30.3
1996	48.0	52.0	70.2	14.2	15.7	8.7	15.9	21.3	5.8	16.9	31.4
1997	52.9	47.1	73.8	10.9	15.4	8.8	14.5	17.9	4.2	17.1	37.6
1998	53.8	46.2	73.6	7.7	18.7	9.8	14.3	19.3	3.5	11.3	41.9
1999	53.5	46.5	75.3	10.0	14.7	9.4	16.7	15.5	2.9	12.3	43.2
91-99	50.8	49.2	68.3	13.9	17.8	12.0	15.1	15.1	3.6	16.6	37.7
97-99	53.4	46.6	74.2	9.5	16.3	9.3	15.2	17.6	3.5	13.6	40.9

Note: Dem – demersal; Pel – pelagic; Fin – fisnfish; Shp – shrimp; Inv – invertebrates; Sar – sardine; Rsd – round scad; Mac – mackerel; Anc – anchovy; tun – tuna; Oth – other pelagic species

Table 152: *Annual breakdown of marine fish landings by resource type, non-SSME 1991-1999*

Year	% annual		% Annual Demersal			% Annual Pelagic					
	Dem	Pel	Fin	Shp	Inv	Sar	Rsd	Mac	Anc	Tun	Oth
1991	45.8	54.2	75.4	16.4	8.1	23.3	17.0	7.1	0.0	2.6	50.0
1992	47.1	52.9	67.6	18.7	13.8	10.1	15.0	8.6	0.0	18.0	48.3
1993	50.6	49.4	64.8	16.3	18.9	11.9	12.3	6.1	0.1	17.0	52.6
1994	54.1	45.9	60.1	20.4	19.5	12.0	23.3	15.8	0.0	11.0	37.9
1995	55.8	44.2	60.4	15.6	24.0	15.2	25.9	23.2	0.1	11.8	23.8
1996	54.5	45.5	63.7	16.5	19.8	11.6	20.1	10.9	0.2	20.2	37.0
1997	59.0	41.0	77.4	6.2	16.4	14.0	24.6	5.6	0.4	18.9	36.5
1998	57.1	42.9	69.7	3.7	26.6	15.0	22.3	6.6	0.1	13.6	42.4
1999	56.8	43.2	74.4	6.6	19.0	12.7	18.3	5.4	0.3	13.3	49.9
91-99	53.4	46.6	68.2	13.4	18.5	14.0	19.9	9.9	0.1	14.0	42.0
97-99	57.6	42.4	73.8	5.5	20.7	13.9	21.7	5.9	0.3	15.3	42.9

Table 153: *Annual breakdown of marine fish landings by resource type, SSME 1991-1999*

Year	% annual		% Annual Demersal			% Annual Pelagic					
	Dem	Pel	Fin	Shp	Inv	Sar	Rsd	Mac	Anc	Tun	Oth
1991	50.1	49.9	55.7	29.2	15.1	12.4	7.7	6.8	7.5	33.9	31.8
1992	47.8	52.2	55.6	18.5	25.8	18.9	12.8	5.9	3.6	23.0	35.8
1993	51.7	48.3	57.3	9.7	33.0	17.0	14.7	12.3	3.0	19.6	33.4
1994	50.9	49.1	72.1	12.7	15.2	12.1	14.3	17.8	5.1	16.5	34.2
1995	48.4	51.6	74.0	12.0	14.0	8.7	15.3	19.9	5.0	18.6	32.5
1996	45.8	54.2	72.7	13.2	14.0	7.9	14.8	24.2	7.4	16.0	29.8
1997	49.7	50.3	71.5	13.8	14.7	6.5	10.1	23.2	5.9	16.3	38.0
1998	52.0	48.0	75.9	10.1	14.0	7.2	10.3	25.6	5.2	10.1	41.7
1999	51.8	48.2	75.8	11.9	12.3	7.9	16.0	20.1	4.0	11.8	40.2
91-99	49.8	50.2	67.8	14.6	17.6	11.0	12.9	17.3	5.2	18.4	35.3
97-99	51.2	48.8	74.4	11.9	13.7	7.2	12.1	23.0	5.0	12.7	40.0

Table 154: *Annual breakdown of marine fish landings by resource type, SSME-1 1991-1999*

Year	% annual		% Annual Demersal			% Annual Pelagic					
	Dem	Pel	Fin	Shp	Inv	Sar	Rsd	Mac	Anc	Tun	Oth
1991	52.3	47.7	72.0	17.1	10.9	12.2	12.8	4.0	1.3	33.1	36.6
1992	58.9	41.1	59.8	6.2	34.0	15.4	5.8	0.7	0.5	32.7	45.0
1993	80.1	19.9	48.6	2.9	48.5	19.4	8.1	0.7	0.7	20.6	50.5
1994	76.5	23.5	78.4	4.3	17.3	25.9	21.8	5.3	1.8	14.0	31.3
1995	72.5	27.5	78.7	7.9	13.3	11.3	27.7	12.2	1.6	16.6	30.7
1996	73.3	26.7	83.4	8.5	8.1	14.2	15.8	21.7	1.0	12.0	35.3
1997	70.2	29.8	79.7	6.9	13.4	10.7	10.5	28.3	2.4	7.9	40.3
1998	72.9	27.1	86.5	6.1	7.4	20.2	10.5	25.4	1.6	7.1	35.2
1999	75.6	24.4	86.8	8.3	4.8	23.6	8.0	19.5	2.1	4.1	42.7
91-99	70.3	29.7	74.9	7.6	17.5	17.0	13.4	13.1	1.4	16.5	38.6
97-99	72.9	27.1	84.3	7.1	8.5	18.2	9.7	24.4	2.0	6.4	39.4

Table 155: *Annual breakdown of marine fish landings by resource type, SSME-2 1991-1999*

Year	% annual		% Annual Demersal			% Annual Pelagic					
	Dem	Pel	Fin	Shp	Inv	Sar	Rsd	Mac	Anc	Tun	Oth
1991	70.8	29.2	46.7	35.6	17.6	9.5	9.4	9.8	0.3	22.3	48.7
1992	65.9	34.1	48.8	26.2	25.0	13.4	10.8	8.7	0.4	15.4	51.3
1993	62.4	37.6	61.1	15.8	23.1	10.1	8.1	8.9	0.8	7.8	64.4
1994	63.0	37.0	65.0	18.5	16.5	4.9	4.2	4.6	0.5	10.6	75.2
1995	63.2	36.8	65.9	17.1	17.0	5.8	5.1	5.7	0.5	14.0	68.9
1996	67.9	32.1	65.8	17.3	16.9	4.5	3.5	6.9	0.7	11.5	72.8
1997	65.4	34.6	65.7	15.4	18.9	6.9	5.1	8.9	0.7	8.3	70.1
1998	66.5	33.5	68.5	9.9	21.6	4.3	3.8	4.4	0.5	4.6	82.4
1999	67.0	33.0	67.9	12.7	19.4	5.0	4.9	5.2	0.5	3.3	81.0
91-99	65.8	34.2	61.7	18.7	19.6	7.2	6.1	7.0	0.5	10.9	68.3
97-99	66.3	33.7	67.4	12.7	20.0	5.4	4.6	6.2	0.6	5.4	77.8

Table 156: *Annual breakdown of marine fish landings by resource type, SSME-3 1991-1999*

Year	% annual		% Annual Demersal			% Annual Pelagic					
	Dem	Pel	Fin	Shp	Inv	Sar	Rsd	Mac	Anc	Tun	Oth
1991	24.8	75.2	68.0	20.8	11.3	13.8	5.2	6.2	12.8	39.5	22.6
1992	20.1	79.9	69.7	20.0	10.3	22.8	16.6	6.7	6.3	22.6	25.1
1993	19.1	80.9	76.7	16.4	6.9	19.3	18.6	15.9	4.4	24.1	17.5
1994	23.9	76.1	73.5	18.8	7.7	11.9	16.6	25.5	7.6	19.3	19.0
1995	29.3	70.7	77.9	10.6	11.5	9.1	15.8	25.3	6.9	20.2	22.7
1996	25.9	74.1	71.0	12.8	16.2	7.8	16.9	28.0	9.5	17.4	20.3
1997	33.0	67.0	69.8	18.5	11.7	5.6	11.3	26.0	7.9	20.0	29.2
1998	32.7	67.3	72.4	15.1	12.5	5.3	12.1	31.9	7.3	12.3	31.1
1999	32.4	67.6	70.9	15.1	14.0	5.7	20.1	23.7	5.2	15.2	30.1
91-99	26.8	73.2	72.2	16.5	11.3	11.3	14.8	21.0	7.5	21.2	24.2
97-99	32.7	67.3	71.0	16.2	12.7	5.5	14.5	27.2	6.8	15.8	30.1

Table 157: *Breakdown of total demersal landings by fishing region, 1991-1999 period*

Year	% FISHING REGION SHARE					TOTAL
	SSME-1	SSME-2	SSME-3	SSME	Non-SSME	
1991	11.8	36.0	10.7	41.6	58.4	52,300
1992	21.1	32.2	9.3	37.3	62.7	64,745
1993	33.0	26.9	9.5	30.5	69.5	79,663
1994	28.9	27.5	13.2	30.4	69.6	83,153
1995	24.0	24.2	21.0	30.9	69.1	83,960
1996	21.7	27.6	22.2	28.4	71.6	86,450
1997	19.1	21.3	21.1	38.4	61.6	92,191
1998	21.5	22.2	18.5	37.8	62.2	105,657
1999	23.9	20.4	20.3	35.4	64.6	110,801
91-99	19.5	21.5	14.3	29.0	55.4	84,324
97-99	22.3	21.9	20.5	38.2	64.7	102,883

Table 158: *Breakdown of demersal finfish landings by fishing region, 1991-1999 period*

Year	% FISHING REGION SHARE					TOTAL
	SSME-1	SSME-2	SSME-3	SSME	Non-SSME	
1991	13.2	26.3	11.4	49.1	50.9	33,430
1992	21.0	26.2	10.8	42.0	58.0	38,907
1993	26.9	27.6	12.3	33.2	66.8	47,466
1994	33.1	26.1	14.1	26.7	73.3	56,951
1995	27.0	22.8	23.4	26.7	73.3	58,599
1996	25.8	25.9	22.5	25.8	74.2	60,665
1997	20.7	18.9	20.0	40.4	59.6	68,003
1998	25.3	20.6	18.2	35.9	64.1	77,720
1999	27.5	18.4	19.1	34.9	65.1	83,478
91-99	24.5	23.7	16.9	35.0	65.0	58,358
97-99	24.5	19.3	19.1	37.1	62.9	76,400

Table 159: *Breakdown of shrimp landings by fishing region, 1991-1999 period*

Year	% FISHING REGION SHARE					TOTAL
	SSME-1	SSME-2	SSME-3	SSME	Non-SSME	
1991	8.4	53.6	9.3	71.4	28.6	12,495
1992	7.0	45.4	10.0	62.5	37.5	12,031
1993	8.1	36.1	13.3	57.5	42.5	9,344
1994	8.2	34.0	16.5	58.8	41.2	12,490
1995	14.5	31.5	17.0	63.1	36.9	10,993
1996	12.9	33.9	20.0	66.8	33.2	12,238
1997	12.1	30.1	36.0	78.2	21.8	10,027
1998	17.0	28.5	36.4	81.9	18.1	8,128
1999	20.0	26.0	30.8	76.8	23.2	11,058
91-99	12.0	35.5	21.0	68.6	31.4	10,978
97-99	16.4	28.2	34.4	79.0	21.0	9,738

Table 160: *Breakdown of demersal invertebrate landings by fishing region, 1991-1999 period*

Year	% FISHING REGION SHARE					TOTAL
	SSME-1	SSME-2	SSME-3	SSME	Non-SSME	
1991	10.5	52.0	9.9	72.3	27.7	6,375
1992	33.7	37.7	4.5	75.9	24.1	13,807
1993	55.9	21.7	2.3	79.9	20.1	22,853
1994	30.4	27.5	6.1	64.1	35.9	13,712
1995	18.7	24.0	14.0	56.7	43.3	14,369
1996	11.3	29.8	23.0	64.1	35.9	13,547
1997	16.6	26.2	16.1	58.9	41.1	14,160
1998	8.5	25.5	12.4	46.4	53.6	19,809
1999	7.9	26.9	19.4	54.2	45.8	16,265
91-99	21.5	30.1	12.0	63.6	36.4	14,989
97-99	11.0	26.2	16.0	53.2	46.8	16,745

Table 161: *Breakdown of pelagic landings by fishing region, 1991-1999 period*

Year	% FISHING REGION SHARE					TOTAL
	SSME-1	SSME-2	SSME-3	SSME	Non-SSME	
1991	10.0	13.8	30.3	54.2	45.8	56,137
1992	13.4	15.1	33.5	62.0	38.0	71,560
1993	8.7	17.1	42.7	68.5	31.5	75,452
1994	9.6	17.5	45.3	72.3	27.7	77,175
1995	9.3	14.3	51.5	75.1	24.9	82,502
1996	7.3	12.0	58.7	78.1	21.9	93,693
1997	9.1	12.7	48.1	69.9	30.1	82,075
1998	9.3	13.0	44.5	66.9	33.1	90,602
1999	8.9	11.5	48.7	69.1	30.9	96,410
91-99	9.5	14.1	44.8	68.5	31.5	80,623
97-99	9.1	12.4	47.1	68.6	31.4	89,696

Table 162: *Breakdown of mackerel landings by fishing region, 1991-1999 period*

Year	% FISHING REGION SHARE					TOTAL
	SSME-1	SSME-2	SSME-3	SSME	Non-SSME	
1991	7.0	7.5	24.1	38.6	61.4	9,772
1992	13.3	13.0	49.2	75.4	24.6	11,132
1993	10.9	11.1	53.6	75.6	24.4	11,641
1994	20.5	7.2	44.6	72.3	27.7	9,300
1995	10.1	8.0	45.5	63.5	36.5	8,539
1996	11.9	6.2	52.7	70.8	29.2	8,163
1997	11.1	10.0	30.9	52.0	48.0	7,202
1998	19.3	5.7	24.2	49.2	50.8	8,834
1999	22.3	6.1	29.7	58.1	41.9	9,034
91-99	14.0	8.3	39.4	61.7	38.3	9,291
97-99	17.6	7.3	28.3	53.1	46.9	8,357

Table 163: *Breakdown of sardine landings by fishing region, 1991-1999 period*

Year	% FISHING REGION SHARE					TOTAL
	SSME-1	SSME-2	SSME-3	SSME	Non-SSME	
1991	5.8	19.7	27.5	53.0	47.0	3,869
1992	1.3	18.9	32.3	52.5	47.5	4,948
1993	0.6	14.7	65.9	81.3	18.7	7,799
1994	2.9	4.6	67.1	74.6	25.4	13,306
1995	5.4	3.9	62.8	72.1	27.9	17,104
1996	7.4	3.9	77.4	88.7	11.3	19,924
1997	14.4	6.3	69.9	90.6	9.4	14,687
1998	12.3	3.0	73.4	88.6	11.4	17,524
1999	11.1	3.9	74.2	89.2	10.8	14,973
91-99	6.8	8.8	61.2	76.7	23.3	12,682
97-99	12.6	4.4	72.5	89.5	10.5	15,728

Table 164: *Breakdown of round scad landings by fishing region, 1991-1999 period*

Year	% FISHING REGION SHARE					TOTAL
	SSME-1	SSME-2	SSME-3	SSME	Non-SSME	
1991	10.7	10.9	13.1	34.8	65.2	6,699
1992	5.6	11.9	40.7	58.2	41.8	9,777
1993	5.0	9.9	57.2	72.2	27.8	10,491
1994	12.4	4.4	44.8	61.6	38.4	12,954
1995	14.3	4.1	45.6	64.0	36.0	14,784
1996	7.2	2.7	62.5	72.4	27.6	14,922
1997	6.6	4.5	37.7	48.9	51.1	11,866
1998	6.8	3.5	37.8	48.2	51.8	12,913
1999	4.2	3.4	58.6	66.2	33.8	16,144
91-99	8.1	6.1	44.2	58.5	41.5	12,283
97-99	5.9	3.8	44.7	54.4	45.6	13,641

Table 165: *Breakdown of anchovy landings by fishing region, 1991-1999 period*

Year	% FISHING REGION SHARE					TOTAL
	SSME-1	SSME-2	SSME-3	SSME	Non-SSME	
1991	3.2	0.9	95.9	100.0	0.0	2,268
1992	2.9	2.7	94.4	100.0	0.0	1,600
1993	2.8	6.3	89.6	98.7	1.3	1,592
1994	4.6	2.2	93.2	100.0	0.0	2,856
1995	3.8	1.9	93.7	99.4	0.6	3,118
1996	1.3	1.5	96.2	99.1	0.9	5,461
1997	5.2	2.0	90.2	97.4	2.6	3,461
1998	4.3	1.7	93.2	99.3	0.7	3,174
1999	6.6	2.2	88.0	96.8	3.2	2,764
91-99	3.9	2.4	92.7	99.0	1.0	2,922
97-99	5.4	2.0	90.5	97.8	2.2	3,133

Table 166: *Breakdown of tuna landings by fishing region, 1991-1999 period*

Year	% FISHING REGION SHARE					TOTAL
	SSME-1	SSME-2	SSME-3	SSME	Non-SSME	
1991	16.9	15.7	61.1	93.8	6.2	10,990
1992	20.7	11.0	35.9	67.6	32.4	15,102
1993	9.5	7.1	54.9	71.5	28.5	14,166
1994	8.9	12.4	58.3	79.7	20.3	11,564
1995	9.1	11.9	61.7	82.7	17.3	13,934
1996	5.2	8.2	60.5	73.9	26.1	15,840
1997	4.2	6.2	56.3	66.7	33.3	14,007
1998	5.9	5.3	48.8	60.0	40.0	10,204
1999	2.9	3.1	60.4	66.5	33.5	11,837
91-99	9.3	9.0	55.3	73.6	26.4	13,072
97-99	4.3	4.9	55.2	64.4	35.6	12,016

Table 167: *Breakdown of misc. pelagic landings by fishing region, 1991-1999 period*

Year	% FISHING REGION SHARE					TOTAL
	SSME-1	SSME-2	SSME-3	SSME	Non-SSME	
1991	9.1	16.8	17.0	42.9	57.1	22,539
1992	14.8	19.1	20.8	54.7	45.3	29,001
1993	11.1	27.9	19.0	58.0	42.0	29,763
1994	8.5	37.3	24.4	70.2	29.8	27,195
1995	9.4	32.5	38.5	80.4	19.6	25,023
1996	8.2	28.0	38.0	74.2	25.8	29,384
1997	9.8	23.6	37.4	70.8	29.2	30,851
1998	7.8	25.7	33.0	66.5	33.5	37,953
1999	8.7	21.6	33.9	64.3	35.7	41,658
91-99	9.7	25.8	29.1	64.7	35.3	30,374
97-99	8.8	23.6	34.8	67.2	32.8	36,821

Table 168: *Demersal landing breakdown by fishing region, Sabah 1991-1999*

Resource Landing Contribution	% SSME Share			% State Share		AVERAGE metric ton
	SSME-1	SSME-2	SSME-3	SSME	Non-SSME	
1991-1999						
Finfish	37.3	36.9	25.8	65.0	35.0	58,358
Shrimp	17.3	52.9	29.8	68.5	31.5	10,978
Invertebrate	32.0	47.7	20.3	63.6	36.4	14,989
TOTAL	34.5	40.7	24.8	65.5	34.5	84,324
1997-1999						
Finfish	38.8	30.7	30.5	62.9	37.1	76,400
Shrimp	20.8	35.7	43.5	79.0	21.0	9,738
Invertebrate	20.4	49.7	29.9	53.2	46.8	16,745
TOTAL	34.2	33.9	31.9	62.8	37.2	102,883

Table 169: *Pelagic landing breakdown by fishing region, Sabah 1991-1999*

Resource Landing Contribution	% SSME Share			% State Share		State
	SSME-1	SSME-2	SSME-3	SSME	Non-SSME	TOTAL metric ton
1991-1999						
Mackerel	23.4	13.8	62.8	61.7	38.3	9,291
Round Scad	14.9	11.6	73.5	58.5	41.5	12,283
Sardine	8.5	13.6	78.0	76.7	23.3	12,682
Anchovy	3.9	2.4	93.7	99.0	1.0	2,922
Tuna	12.4	11.9	75.7	73.6	26.4	13,072
Other Pelagics	15.7	39.9	44.4	64.7	35.3	30,374
TOTAL	14.2	20.9	65.0	68.4	31.6	80,623
1997-1999						
Mackerel	33.0	13.8	53.2	53.1	46.9	8,357
Round Scad	11.4	7.2	81.4	54.4	45.6	13,641
Sardine	14.1	4.9	81.0	89.5	10.5	15,728
Anchovy	5.5	2.0	92.5	97.8	2.2	3,133
Tuna	6.8	7.6	85.6	64.4	35.6	12,016
Other Pelagics	13.1	35.2	51.8	67.2	32.8	36,821
TOTAL	13.3	18.1	68.6	68.6	31.4	89,696

Table 170: *Resource landing breakdown by gear type, Sabah, 1997-1999*

Mean Annual Landing Breakdown	% FISHING GEAR SHARE								TOTAL
	TN	SN	GN	LN	HL	OT	COM	TRAD	
Pelagic Portion	23.3	93.4	53.2	88.7	37.4	15.9	48.1	47.7	48.0
Demersal Portion	76.7	6.6	46.8	11.3	62.6	84.1	51.9	52.3	52.0
	100%	100%	100%	100%	100%	100%	100%	100%	
Pelagic Portion	19.8	40.9	13.5	13.4	10.8	1.6	74.2	25.8	100%
Sardine	0.4	81.4	1.0	16.7	0.0	0.5	82.9	17.1	100%
Round Scad	20.7	58.8	0.1	20.4	0.0	0.0	79.6	20.4	100%
Mackerel	44.4	38.9	1.1	7.7	6.4	1.4	84.4	15.6	100%
Anchovy	2.6	1.3	0.0	93.4	0.0	2.6	4.0	96.0	100%
Tuna	0.0	73.8	17.2	0.0	9.0	0.0	91.0	9.0	100%
Others	29.4	12.1	25.6	8.8	21.1	3.1	67.1	32.9	100%
Demersal Portion	60.2	2.7	11.0	1.6	16.7	7.9	73.9	26.1	100%
Finfish	58.5	3.1	11.4	0.7	21.7	4.5	73.1	26.9	100%
Shrimp	69.4	0.6	20.5	1.2	0.0	8.2	90.5	9.5	100%
Invertebrate	62.6	1.8	2.6	6.2	2.8	24.1	67.0	33.0	100%
TOTAL	40.8	21.0	12.2	7.3	13.8	4.9	74.2	25.8	100%

Table 171: *Resource landing breakdown by gear type, SSME area, 1997-1999*

Mean Annual Landing Breakdown	% FISHING GEAR SHARE								TOTAL
	TN	SN	GN	LN	HL	OT	COM	TRAD	
Pelagic Portion	13.5	92.8	51.0	87.1	36.8	12.1	50.3	46.9	49.2
Demersal Portion	86.5	7.2	49.0	12.9	63.2	87.9	49.7	53.1	50.8
	100%	100%	100%	100%	100%	100%	100%	100%	
Pelagic Portion	7.9	46.3	15.2	15.9	13.4	1.3	69.4	30.6	100%
Sardine	0.5	80.6	1.1	17.3	0.0	0.5	82.2	17.8	100%
Round Scad	8.7	78.6	0.1	12.6	0.0	0.0	87.4	12.6	100%
Mackerel	32.4	41.6	1.0	11.5	12.0	1.5	75.0	25.0	100%
Anchovy	2.7	0.1	0.0	95.2	0.0	2.0	2.8	97.2	100%
Tuna	0.0	81.8	9.1	0.0	9.1	0.0	90.9	9.1	100%
Others	10.5	12.9	33.9	12.2	28.1	2.4	57.3	42.7	100%
Demersal Portion	48.8	3.5	14.2	2.3	22.2	9.0	66.5	33.5	100%
Finfish	44.5	4.1	15.8	1.1	29.8	4.7	64.4	35.6	100%
Shrimp	79.6	0.7	15.5	0.0	0.0	4.1	95.9	4.1	100%
Invertebrate	46.1	2.4	4.5	10.7	0.4	35.9	53.0	47.0	100%
TOTAL	28.7	24.5	14.7	9.0	17.9	5.2	69.4	30.6	100%

Table 172: *Resource landing breakdown by gear type, non-SSME area, 1997-1999*

Mean Annual Landing Breakdown	% FISHING GEAR SHARE								TOTAL
	TN	SN	GN	LN	HL	OT	COM	TRAD	
Pelagic Portion	31.6	95.3	61.3	95.5	40.5	24.7	44.8	51.2	45.7
Demersal Portion	68.4	4.7	38.7	4.5	59.5	75.3	55.2	48.8	54.3
	100%	100%	100%	100%	100%	100%	100%	100%	
Pelagic Portion	44.3	29.8	9.8	8.4	5.4	2.3	83.9	16.1	100%
Sardine	0.2	88.2	0.2	11.4	0.0	0.0	88.6	11.4	100%
Round Scad	35.7	34.2	0.0	30.1	0.1	0.0	69.8	30.2	100%
Mackerel	58.1	35.8	1.2	3.5	0.2	1.3	95.1	4.9	100%
Anchovy	0.0	54.7	0.5	12.7	0.0	32.2	55.1	44.9	100%
Tuna	0.0	59.2	32.0	0.0	8.7	0.0	91.3	8.7	100%
Others	62.5	10.8	10.9	2.7	8.8	4.4	84.2	15.8	100%
Demersal Portion	80.6	1.2	5.2	0.3	6.7	5.9	87.1	12.9	100%
Finfish	83.2	1.4	3.8	0.0	7.5	4.0	88.5	11.5	100%
Shrimp	37.5	0.1	36.2	5.0	0.0	21.2	73.8	26.2	100%
Invertebrate	85.2	0.9	0.0	0.0	6.0	8.0	86.1	13.9	100%
TOTAL	64.0	14.3	7.3	4.0	6.1	4.2	83.9	16.1	100%

Table 173: *Resource landing breakdown by gear type, West Coast North, 1997-1999*

Mean Annual Landing Breakdown	% FISHING GEAR SHARE								TOTAL
	TN	SN	GN	LN	HL	OT	COM	TRAD	
Pelagic Portion	31.9	94.0	78.8	94.9	37.3	32.8	42.2	53.5	43.7
Demersal Portion	68.1	6.0	21.2	5.1	62.7	67.2	57.8	46.5	56.3
	100%	100%	100%	100%	100%	100%	100%	100%	
Pelagic Portion	52.3	25.1	6.5	8.7	4.7	2.7	83.9	16.1	100%
Sardine	0.4	81.2	0.0	18.3	0.0	0.0	81.7	18.3	100%
Round Scad	39.0	30.4	0.0	30.5	0.1	0.0	69.4	30.6	100%
Mackerel	65.0	30.1	0.7	2.8	0.1	1.4	95.7	4.3	100%
Anchovy	0.0	0.0	0.0	28.2	0.0	71.8	0.0	100.0	100%
Tuna	0.0	64.3	26.8	0.0	8.9	0.0	91.1	8.9	100%
Others	72.6	7.0	5.8	2.3	7.3	5.1	85.4	14.6	100%
Demersal Portion	86.5	1.2	1.3	0.4	6.2	4.3	89.1	10.9	100%
Finfish	86.8	1.4	1.1	0.0	6.5	4.2	89.3	10.7	100%
Shrimp	58.4	0.0	18.8	13.2	0.0	9.6	77.2	22.8	100%
Invertebrate	89.3	0.8	0.0	0.0	5.9	4.0	90.1	9.9	100%
TOTAL	71.6	11.7	3.6	4.0	5.5	3.6	83.9	16.1	100%

Table 174: *Resource landing breakdown by gear type, West Coast South, 1997-1999*

Mean Annual Landing Breakdown	% FISHING GEAR SHARE								TOTAL
	TN	SN	GN	LN	HL	OT	COM	TRAD	
Pelagic Portion	0.5	98.8	47.8	100.0	53.5	0.0	67.8	41.3	61.4
Demersal Portion	99.5	1.2	52.2	0.0	46.5	100.0	32.2	58.7	38.6
	100%	100%	100%	100%	100%	100%	100%	100%	
Pelagic Portion	0.0	55.5	28.3	6.8	9.3	0.0	83.8	16.2	100%
Sardine	0.0	94.5	0.5	5.1	0.0	0.0	94.9	5.1	100%
Round Scad	0.0	74.4	0.0	25.5	0.0	0.0	74.4	25.6	100%
Mackerel	0.0	84.1	5.9	9.3	0.6	0.0	90.1	9.9	100%
Anchovy	0.0	99.2	0.8	0.0	0.0	0.0	100.0	0.0	100%
Tuna	0.0	37.6	54.4	0.0	8.0	0.0	92.0	8.0	100%
Others	0.1	34.1	42.4	5.1	18.3	0.0	76.6	23.4	100%
Demersal Portion	13.2	1.1	49.2	0.0	12.9	23.6	63.5	36.5	100%
Finfish	1.3	1.9	65.7	0.0	31.1	0.0	68.9	31.1	100%
Shrimp	24.7	0.2	46.8	0.0	0.0	28.2	71.8	28.2	100%
Invertebrate	2.8	2.3	0.4	0.0	7.5	87.0	5.5	94.5	100%
TOTAL	5.1	34.5	36.4	4.2	10.7	9.1	83.8	16.2	100%

Table 175: *Resource landing breakdown by gear type, Kota Belud, 1997-1999*

Mean Annual Landing Breakdown	TN	SN	GN	LN	HL	OT	COM	TRAD	TOTAL
	% FISHING GEAR SHARE								
Pelagic Portion	8.2	99.9	84.6	67.8	46.7	38.3	84.8	45.1	56.4
Demersal Portion	91.8	0.1	15.4	32.2	53.3	61.7	15.2	54.9	43.6
	100%	100%	100%	100%	100%	100%	100%	100%	
Pelagic Portion	0.0	1.4	41.3	8.5	27.5	21.3	42.7	57.3	100%
Sardine	0.0	0.0	0.0	100.0	0.0	0.0	0.0	100.0	100%
Round Scad	0.0	0.0	0.0	97.2	2.8	0.0	0.0	100.0	100%
Mackerel	0.0	0.1	0.0	0.6	8.7	90.6	0.1	99.9	100%
Anchovy	0.0	0.0	0.0	28.2	0.0	71.8	0.0	100.0	100%
Tuna	0.0	4.6	73.9	0.0	21.5	0.0	78.5	21.5	100%
Others	0.0	0.0	31.9	0.5	35.0	32.6	31.9	68.1	100%
Demersal Portion	0.1	0.0	9.7	5.3	40.5	44.3	9.9	90.1	100%
Finfish	0.1	0.0	7.2	0.0	38.8	53.8	7.3	92.7	100%
Shrimp	0.7	0.0	46.6	51.2	0.0	1.5	47.2	52.8	100%
Invertebrate	0.1	0.0	0.0	0.0	65.5	34.5	0.1	99.9	100%
TOTAL	0.1	0.8	27.5	7.1	33.2	31.4	42.7	57.3	100%

Table 176: *Resource landing breakdown by gear type, Tuaran, 1997-1999*

Mean Annual Landing Breakdown	TN	SN	GN	LN	HL	OT	COM	TRAD	TOTAL
	% FISHING GEAR SHARE								
Pelagic Portion			66.2	100.0	71.4	0.0	66.2	92.0	89.4
Demersal Portion			33.8	0.0	28.6	100.0	33.8	8.0	10.6
			100%	100%	100%	100%	100%	100%	
Pelagic Portion	0.0	0.0	7.5	78.6	13.9	0.0	7.5	92.5	100%
Sardine	0.0	0.0	0.0	100.0	0.0	0.0	0.0	100.0	100%
Round Scad	0.0	0.0	0.0	100.0	0.0	0.0	0.0	100.0	100%
Mackerel	0.0	0.0	76.8	23.2	0.0	0.0	76.8	23.2	100%
Anchovy									
Tuna	0.0	0.0	19.2	0.0	80.8	0.0	19.2	80.8	100%
Others	0.0	0.0	15.8	65.1	19.2	0.0	15.8	84.2	100%
Demersal Portion	0.0	0.0	32.1	0.0	46.9	21.0	32.1	67.9	100%
Finfish	0.0	0.0	54.9	0.0	45.1	0.0	54.9	45.1	100%
Shrimp	0.0	0.0	100.0	0.0	0.0	0.0	100.0	0.0	100%
Invertebrate	0.0	0.0	0.0	0.0	57.3	42.7	0.0	100.0	100%
TOTAL	0.0	0.0	10.1	70.2	17.4	2.2	7.5	92.5	100%

Table 177: *Resource landing breakdown by gear type, Kota Kinabalu, 1997-1999*

Mean Annual Landing Breakdown	% FISHING GEAR SHARE								TOTAL
	TN	SN	GN	LN	HL	OT	COM	TRAD	
Pelagic Portion	31.9	94.0	67.1	100.0	19.3	16.0	40.9	49.1	41.3
Demersal Portion	68.1	6.0	32.9	0.0	80.7	84.0	59.1	50.9	58.7
	100%	100%	100%	100%	100%	100%	100%	100%	
Pelagic Portion	62.1	29.6	1.7	5.0	1.2	0.4	93.5	6.5	100%
Sardine	0.5	85.1	0.0	14.5	0.0	0.0	85.5	14.5	100%
Round Scad	46.6	36.3	0.0	17.1	0.0	0.0	82.9	17.1	100%
Mackerel	66.2	30.6	0.2	2.7	0.0	0.3	97.1	2.9	100%
Anchovy									
Tuna	0.0	89.7	9.8	0.0	0.4	0.0	99.6	0.4	100%
Others	86.6	8.3	1.2	0.8	2.4	0.7	96.1	3.9	100%
Demersal Portion	93.3	1.3	0.6	0.0	3.5	1.3	95.2	4.8	100%
Finfish	92.6	1.5	0.6	0.0	4.3	1.1	94.6	5.4	100%
Shrimp	79.9	0.0	7.4	0.0	0.0	12.7	87.3	12.7	100%
Invertebrate	97.9	0.9	0.0	0.0	0.3	1.0	98.8	1.2	100%
TOTAL	80.4	13.0	1.1	2.1	2.5	0.9	93.5	6.5	100%

Table 178: *Resource landing breakdown by gear type, Papar, 1997-1999*

Mean Annual Landing Breakdown	% FISHING GEAR SHARE								TOTAL
	TN	SN	GN	LN	HL	OT	COM	TRAD	
Pelagic Portion			46.9	100.0	43.5	0.0	46.9	64.7	57.5
Demersal Portion			53.1	0.0	56.5	100.0	53.1	35.3	42.5
			100%	100%	100%	100%	100%	100%	
Pelagic Portion	0.0	0.0	33.0	46.2	20.9	0.0	33.0	67.0	100%
Sardine	0.0	0.0	0.0	100.0	0.0	0.0	0.0	100.0	100%
Round Scad	0.0	0.0	0.0	100.0	0.0	0.0	0.0	100.0	100%
Mackerel	0.0	0.0	28.1	71.9	0.0	0.0	28.1	71.9	100%
Anchovy									
Tuna	0.0	0.0	61.4	0.0	38.6	0.0	61.4	38.6	100%
Others	0.0	0.0	44.7	24.6	30.7	0.0	44.7	55.3	100%
Demersal Portion	0.0	0.0	50.4	0.0	36.7	12.8	50.4	49.6	100%
Finfish	0.0	0.0	56.4	0.0	43.6	0.0	56.4	43.6	100%
Shrimp	0.0	0.0	68.9	0.0	0.0	31.1	68.9	31.1	100%
Invertebrate	0.0	0.0	0.0	0.0	32.4	67.6	0.0	100.0	100%
TOTAL	0.0	0.0	40.4	26.5	27.6	5.4	33.0	67.0	100%

Table 179: *Resource landing breakdown by gear type, Beaufort, 1997-1999*

Mean Annual Landing Breakdown	% FISHING GEAR SHARE								TOTAL
	TN	SN	GN	LN	HL	OT	COM	TRAD	
Pelagic Portion	0.8	100.0	24.6		64.4	0.0	52.9	19.3	41.9
Demersal Portion	99.2	0.0	75.4		35.6	100.0	47.1	80.7	58.1
	100%	100%	100%		100%	100%	100%	100%	
<u>Pelagic Portion</u>	0.2	66.5	18.3	0.0	15.1	0.0	84.9	15.1	100%
Sardine	0.0	100.0	0.0	0.0	0.0	0.0	100.0	0.0	100%
Round Scad									
Mackerel	0.0	93.5	4.6	0.0	1.9	0.0	98.1	1.9	100%
Anchovy									
Tuna	0.0	75.2	14.4	0.0	10.4	0.0	89.6	10.4	100%
Others	0.3	53.7	24.4	0.0	21.6	0.0	78.4	21.6	100%
<u>Demersal Portion</u>	14.2	0.0	40.3	0.0	6.0	39.5	54.5	45.5	100%
Finfish	0.0	0.0	38.5	0.0	61.5	0.0	38.5	61.5	100%
Shrimp	18.1	0.0	46.7	0.0	0.0	35.2	64.8	35.2	100%
Invertebrate	0.0	0.0	0.0	0.0	0.0	100.0	0.0	100.0	100%
TOTAL	8.3	27.9	31.1	0.0	9.8	22.9	84.9	15.1	100%

Table 180: *Resource landing breakdown by gear type, Kuala Penyu, 1997-1999*

Mean Annual Landing Breakdown	% FISHING GEAR SHARE								TOTAL
	TN	SN	GN	LN	HL	OT	COM	TRAD	
Pelagic Portion	2.1	98.2	65.1		1.1	0.0	80.7	0.3	78.3
Demersal Portion	97.9	1.8	34.9		98.9	100.0	19.3	99.7	21.7
	100%	100%	100%		100%	100%	100%	100%	
<u>Pelagic Portion</u>	0.0	58.9	41.1		0.0	0.0	100.0	0.0	100%
Sardine	0.0	100.0	0.0		0.0	0.0	100.0	0.0	100%
Round Scad	0.0	100.0	0.0		0.0	0.0	100.0	0.0	100%
Mackerel	0.0	100.0	0.0		0.0	0.0	100.0	0.0	100%
Anchovy									
Tuna	0.0	0.3	99.7		0.0	0.0	100.0	0.0	100%
Others	0.0	42.8	57.1		0.0	0.0	100.0	0.0	100%
<u>Demersal Portion</u>	3.1	3.9	79.3		3.9	9.7	86.3	13.7	100%
Finfish	2.8	3.1	89.6		4.5	0.0	95.5	4.5	100%
Shrimp	2.3	0.0	97.7		0.0	0.0	100.0	0.0	100%
Invertebrate	5.7	10.4	0.6		0.0	83.3	16.7	83.3	100%
	2.1	98.2	65.1		1.1	0.0	80.7	0.3	78.3
TOTAL	97.9	1.8	34.9		98.9	100.0	19.3	99.7	21.7

Table 181: *Resource landing breakdown by gear type, Sipitang, 1997-1999*

Mean Annual Landing Breakdown	% FISHING GEAR SHARE								TOTAL
	TN	SN	GN	LN	HL	OT	COM	TRAD	
Pelagic Portion	0.0	98.6	16.7		62.4	0.0	68.5	61.9	67.3
Demersal Portion	100.0	1.4	83.3		37.6	100.0	31.5	38.1	32.7
	100%	100%	100%		100%	100%	100%	100%	
Pelagic Portion	0.0	79.7	3.3		16.9	0.0	83.1	16.9	100%
Sardine	0.0	99.3	0.7		0.0	0.0	100.0	0.0	100%
Round Scad	0.0	0.0	46.8		53.2	0.0	46.8	53.2	100%
Mackerel	0.0	88.7	11.1		0.2	0.0	99.8	0.2	100%
Anchovy	0.0	99.2	0.8		0.0	0.0	100.0	0.0	100%
Tuna	0.0	76.1	0.0		23.9	0.0	76.1	23.9	100%
Others	0.0	6.4	12.5		81.1	0.0	18.9	81.1	100%
Demersal Portion	42.1	2.3	34.2		21.0	0.4	78.6	21.4	100%
Finfish	0.0	5.3	16.3		78.4	0.0	21.6	78.4	100%
Shrimp	57.2	1.2	41.6		0.0	0.0	100.0	0.0	100%
Invertebrate	51.6	0.0	11.0		19.4	17.9	62.6	37.4	100%
TOTAL	13.8	54.4	13.5		18.2	0.1	83.1	16.9	100%

Table 182: *Resource landing breakdown by gear type, SSME-1, 1997-1999*

Mean Annual Landing Breakdown	% FISHING GEAR SHARE								TOTAL
	TN	SN	GN	LN	HL	OT	COM	TRAD	
Pelagic Portion	15.6	77.6	64.0	93.6	18.3	0.8	28.4	18.9	26.7
Demersal Portion	84.4	22.4	36.0	6.4	81.7	99.2	71.6	81.1	73.3
	100%	100%	100%	100%	100%	100%	100%	100%	
Pelagic Portion	36.7	28.4	22.0	2.1	10.7	0.1	87.1	12.9	100%
Sardine	0.0	91.7	4.9	3.5	0.0	0.0	96.5	3.5	100%
Round Scad	83.8	15.3	0.9	0.0	0.0	0.1	99.9	0.1	100%
Mackerel	84.4	13.7	1.6	0.1	0.2	0.0	99.7	0.3	100%
Anchovy	59.8	2.8	0.3	37.0	0.0	0.0	63.0	37.0	100%
Tuna	0.0	13.5	86.5	0.0	0.0	0.0	100.0	0.0	100%
Others	30.5	3.0	37.9	1.6	26.9	0.1	71.4	28.6	100%
Demersal Portion	72.4	3.0	4.5	0.1	17.5	2.6	79.9	20.1	100%
Finfish	73.0	3.2	3.0	0.0	20.5	0.2	79.2	20.8	100%
Shrimp	79.4	0.0	19.0	0.0	0.0	1.6	98.4	1.6	100%
Invertebrate	61.6	3.1	9.1	0.6	0.5	25.1	73.8	26.2	100%
TOTAL	62.9	9.8	9.2	0.6	15.7	1.9	87.1	12.9	100%

Table 183: *Resource landing breakdown by gear type, Kudat, 1997-1999*

Mean Annual Landing Breakdown	% FISHING GEAR SHARE								TOTAL
	TN	SN	GN	LN	HL	OT	COM	TRAD	
Pelagic Portion	15.4	77.6	70.5		18.0	2.1	30.6	17.3	28.0
Demersal Portion	84.6	22.4	29.5		82.0	97.9	69.4	82.7	72.0
	100%	100%	100%		100%	100%	100%	100%	
Pelagic Portion	32.9	32.6	22.5	0.0	11.9	0.1	88.1	11.9	100%
Sardine	0.0	95.2	4.8	0.0	0.0	0.0	100.0	0.0	100%
Round Scad	83.8	15.3	0.9	0.0	0.0	0.0	100.0	0.0	100%
Mackerel	84.7	13.8	1.5	0.0	0.0	0.0	100.0	0.0	100%
Anchovy	95.0	4.5	0.6	0.0	0.0	0.0	100.0	0.0	100%
Tuna	0.0	14.1	85.9	0.0	0.0	0.0	100.0	0.0	100%
Others	33.0	3.2	35.6	0.0	28.1	0.1	71.8	28.2	100%
Demersal Portion	70.5	3.7	3.7	0.0	21.1	1.1	77.8	22.2	100%
Finfish	68.2	3.9	3.1	0.0	24.5	0.3	75.2	24.8	100%
Shrimp	98.8	0.0	1.0	0.0	0.0	0.2	99.8	0.2	100%
Invertebrate	72.9	4.2	11.7	0.0	0.8	10.4	88.9	11.1	100%
TOTAL	59.9	11.8	9.0	0.0	18.5	0.8	89.1	10.9	100%

Table 184: *Resource landing breakdown by gear type, Kota Marudu, 1997-1999*

Mean Annual Landing Breakdown	% FISHING GEAR SHARE								TOTAL
	TN	SN	GN	LN	HL	OT	COM	TRAD	
Pelagic Portion	0.0		25.5		28.9	0.0	24.2	1.0	14.3
Demersal Portion	100.0		74.5		71.1	100.0	75.8	99.0	85.7
	100%		100%		100%	100%	100%	100%	
Pelagic Portion	0.0		97.1		2.9	0.0	97.1	2.9	100%
Sardine	0.0		100.0		0.0	0.0	100.0	0.0	100%
Round Scad									
Mackerel									
Anchovy									
Tuna	0.0		100.0		0.0	0.0	100.0	0.0	100%
Others	0.0		96.8		3.2	0.0	96.8	3.2	100%
Demersal Portion	3.4		47.2		1.2	48.2	50.6	49.4	100%
Finfish	7.2		80.9		11.8	0.2	88.0	12.0	100%
Shrimp	5.4		92.3		0.0	2.3	97.7	2.3	100%
Invertebrate	0.8		1.1		0.0	98.1	1.9	98.1	100%
TOTAL	2.9		54.3		1.5	41.3	97.1	2.9	100%

Table 185: *Resource landing breakdown by gear type, Pitas, 1997-1999*

Mean Annual Landing Breakdown	% FISHING GEAR SHARE								TOTAL
	TN	SN	GN	LN	HL	OT	COM	TRAD	
Pelagic Portion			55.9	93.6	34.8	0.4	55.9	53.3	54.2
Demersal Portion			44.1	6.4	65.2	99.6	44.1	46.7	45.8
			100%	100%	100%	100%	100%	100%	
Pelagic Portion			33.6	56.3	9.9	0.2	33.6	66.4	100%
Sardine			0.0	100.0	0.0	0.0	0.0	100.0	100%
Round Scad			0.0	0.0	0.0	100.0	0.0	100.0	100%
Mackerel			31.6	20.6	47.7	0.0	31.6	68.4	100%
Anchovy			0.0	100.0	0.0	0.0	0.0	100.0	100%
Tuna			100.0	0.0	0.0	0.0	100.0	0.0	100%
Others			50.9	32.0	17.1	0.0	50.9	49.1	100%
Demersal Portion			31.3	4.6	22.0	42.1	31.3	68.7	100%
Finfish			37.5	0.0	62.5	0.0	37.5	62.5	100%
Shrimp			72.8	0.0	0.0	27.2	72.8	27.2	100%
Invertebrate			6.9	10.4	0.0	82.8	6.9	93.1	100%
TOTAL			32.6	32.6	15.4	19.4	33.6	66.4	100%

Table 186: *Resource landing breakdown by gear type, SSME-2, 1997-1999*

Mean Annual Landing Breakdown	% FISHING GEAR SHARE								TOTAL
	TN	SN	GN	LN	HL	OT	COM	TRAD	
Pelagic Portion	8.3	97.1	48.0		31.6	14.8	37.8	24.2	33.7
Demersal Portion	91.7	2.9	52.0		68.4	85.2	62.2	75.8	66.3
	100%	100%	100%		100%	100%	100%	100%	
Pelagic Portion	6.4	19.0	52.8		15.9	5.9	78.2	21.8	100%
Sardine	9.4	71.0	9.0		0.0	10.6	89.4	10.6	100%
Round Scad	0.0	100.0	0.0		0.0	0.0	100.0	0.0	100%
Mackerel	7.0	81.6	0.0		0.0	11.4	88.6	11.4	100%
Anchovy	4.5	0.0	0.0		0.0	95.5	4.5	95.5	100%
Tuna	0.0	31.0	46.2		22.9	0.0	77.1	22.9	100%
Others	7.0	5.2	63.8		18.9	5.2	75.9	24.1	100%
Demersal Portion	36.0	0.3	29.0		17.6	17.1	65.3	34.7	100%
Finfish	21.4	0.0	41.3		26.0	11.3	62.7	37.3	100%
Shrimp	87.8	0.0	8.7		0.0	3.5	96.5	3.5	100%
Invertebrate	53.4	1.3	0.0		0.0	45.3	54.7	45.3	100%
TOTAL	26.1	6.6	37.0		17.0	13.3	78.2	21.8	100%

Table 187: *Resource landing breakdown by gear type, Sandakan, 1997-1999*

Mean Annual Landing Breakdown	% FISHING GEAR SHARE								TOTAL
	TN	SN	GN	LN	HL	OT	COM	TRAD	
Pelagic Portion	9.6	100.0	45.0		32.0	15.9	40.3	25.1	35.0
Demersal Portion	90.4	0.0	55.0		68.0	84.1	59.7	74.9	65.0
	100%	100%	100%		100%	100%	100%	100%	
<u>Pelagic Portion</u>	5.6	21.8	47.7		18.2	6.6	75.2	24.8	100%
Sardine	0.0	85.7	0.0		0.0	14.3	85.7	14.3	100%
Round Scad	0.0	100.0	0.0		0.0	0.0	100.0	0.0	100%
Mackerel	0.0	86.6	0.0		0.0	13.4	86.6	13.4	100%
Anchovy	0.0	0.0	0.0		0.0	100.0	0.0	100.0	100%
Tuna	0.0	29.1	47.4		23.5	0.0	76.5	23.5	100%
Others	3.7	6.2	60.9		22.5	6.8	70.8	29.2	100%
<u>Demersal Portion</u>	28.7	0.0	31.4		20.9	19.0	60.1	39.9	100%
Finfish	16.4	0.0	42.8		28.5	12.4	59.1	40.9	100%
Shrimp	93.5	0.0	0.0		0.0	6.5	93.5	6.5	100%
Invertebrate	48.4	0.0	0.0		0.0	51.6	48.4	51.6	100%
TOTAL	20.6	7.6	37.1		20.0	14.7	74.0	26.0	100%

Table 188: *Resource landing breakdown by gear type, Beluran, 1997-1999*

Mean Annual Landing Breakdown	% FISHING GEAR SHARE								TOTAL
	TN	SN	GN	LN	HL	OT	COM	TRAD	
Pelagic Portion	8.1	6.3	63.6		13.0	2.9	34.6	5.4	31.6
Demersal Portion	91.9	93.7	36.4		87.0	97.1	65.4	94.6	68.4
	100%	100%	100%		100%	100%	100%	100%	
<u>Pelagic Portion</u>	11.6	0.3	86.4		1.0	0.7	98.3	1.7	100%
Sardine	56.3	0.0	43.7		0.0	0.0	100.0	0.0	100%
Round Scad									
Mackerel	100.0	0.0	0.0		0.0	0.0	100.0	0.0	100%
Anchovy									
Tuna									
Others	2.3	0.5	94.9		1.4	1.0	97.6	2.4	100%
<u>Demersal Portion</u>	61.1	2.0	22.9		3.1	10.9	86.0	14.0	100%
Finfish	39.2	0.7	46.0		9.3	4.8	85.8	14.2	100%
Shrimp	82.3	0.0	17.7		0.0	0.0	100.0	0.0	100%
Invertebrate	54.0	7.5	0.0		0.0	38.5	61.5	38.5	100%
TOTAL	45.4	1.5	43.0		2.5	7.7	98.0	2.0	100%

Table 189: *Resource landing breakdown by gear type, SSME-3, 1997-1999*

Mean Annual Landing Breakdown	% FISHING GEAR SHARE								TOTAL
	TN	SN	GN	LN	HL	OT	COM	TRAD	
Pelagic Portion	14.1	94.2	51.2	87.0	46.5	8.7	72.2	62.2	68.2
Demersal Portion	85.9	5.8	48.8	13.0	53.5	91.3	27.8	37.8	31.8
	100%	100%	100%	100%	100%	100%	100%	100%	
Pelagic Portion	2.8	56.8	4.2	22.6	13.2	0.3	63.8	36.2	100%
Sardine	0.0	79.3	0.0	20.7	0.0	0.0	79.3	20.7	100%
Round Scad	0.0	84.8	0.0	15.2	0.0	0.0	84.8	15.2	100%
Mackerel	5.6	49.3	0.9	21.7	22.5	0.0	55.8	44.2	100%
Anchovy	0.0	0.0	0.0	100.0	0.0	0.0	0.0	100.0	100%
Tuna	0.0	91.4	0.0	0.0	8.6	0.0	91.4	8.6	100%
Others	8.0	20.4	13.5	22.8	34.3	1.0	41.8	58.2	100%
Demersal Portion	36.5	7.5	8.7	7.3	32.7	7.4	52.7	47.3	100%
Finfish	30.5	9.6	6.1	3.6	46.4	3.8	46.3	53.7	100%
Shrimp	73.0	1.7	19.7	0.0	0.0	5.7	94.3	5.7	100%
Invertebrate	22.4	3.7	8.4	36.0	1.0	28.6	34.5	65.5	100%
TOTAL	13.5	41.1	5.7	17.8	19.4	2.6	63.8	36.2	100%

Table 190: *Resource landing breakdown by gear type, Tawau, 1997-1999*

Mean Annual Landing Breakdown	% FISHING GEAR SHARE								TOTAL
	TN	SN	GN	LN	HL	OT	COM	TRAD	
Pelagic Portion	17.4		50.7	80.0	10.5	4.8	23.8	64.0	36.9
Demersal Portion	82.6		49.3	20.0	89.5	95.2	76.2	36.0	63.1
	100%		100%	100%	100%	100%	100%	100%	
Pelagic Portion	25.5		18.0	55.4	0.4	0.7	43.5	56.5	100%
Sardine									
Round Scad									
Mackerel	100.0		0.0	0.0	0.0	0.0	100.0	0.0	100%
Anchovy	0.0		0.0	100.0	0.0	0.0	0.0	100.0	100%
Tuna									
Others	35.5		28.0	34.6	0.7	1.1	63.6	36.4	100%
Demersal Portion	71.1		10.3	8.1	2.2	8.3	81.4	18.6	100%
Finfish	79.1		7.3	6.3	3.5	3.9	92.7	7.3	100%
Shrimp	71.2		22.5	0.0	0.0	6.3	93.7	6.3	100%
Invertebrate	33.3		0.0	33.0	0.0	33.7	33.3	63.7	100%
TOTAL	54.3		13.1	25.6	1.5	5.5	43.5	56.5	100%

Table 191: *Resource landing breakdown by gear type, Semporna, 1997-1999*

Mean Annual Landing Breakdown	% FISHING GEAR SHARE								TOTAL
	TN	SN	GN	LN	HL	OT	COM	TRAD	
Pelagic Portion	0.0	99.7	40.8		46.4	11.9	94.4	40.8	87.0
Demersal Portion	100.0	0.3	59.2		53.6	88.1	5.6	59.2	13.0
	100%	100%	100%		100%	100%	100%	100%	
Pelagic Portion	0.0	92.0	1.5		6.2	0.3	93.5	6.5	100%
Sardine	0.0	100.0	0.0		0.0	0.0	100.0	0.0	100%
Round Scad	0.0	100.0	0.0		0.0	0.0	100.0	0.0	100%
Mackerel	0.0	100.0	0.0		0.0	0.0	100.0	0.0	100%
Anchovy	0.0	0.0	0.0		0.0	100.0	0.0	100.0	100%
Tuna	0.0	89.4	0.0		10.6	0.0	89.4	10.6	100%
Others	0.0	77.1	11.7		8.9	2.3	88.8	11.2	100%
Demersal Portion	20.9	2.1	14.3		47.6	15.1	37.3	62.7	100%
Finfish	8.4	1.3	1.0		78.5	10.7	10.7	89.3	100%
Shrimp	92.6	0.0	6.2		0.0	1.2	98.8	1.2	100%
Invertebrate	13.2	4.7	46.2		5.3	30.7	64.1	35.9	100%
TOTAL	2.7	80.3	3.2		11.6	2.2	93.5	6.5	100%

Table 192: *Resource landing breakdown by gear type, Kunak, 1997-1999*

Mean Annual Landing Breakdown	% FISHING GEAR SHARE								TOTAL
	TN	SN	GN	LN	HL	OT	COM	TRAD	
Pelagic Portion		100.0	46.8	92.4	41.3	24.1	98.2	77.1	89.7
Demersal Portion		0.0	53.2	7.6	58.7	75.9	1.8	22.9	10.3
		100%	100%	100%	100%	100%	100%	100%	
Pelagic Portion		64.2	1.1	29.2	5.5	0.0	65.3	34.7	100%
Sardine		71.1	0.0	28.9	0.0	0.0	71.1	28.9	100%
Round Scad		78.8	0.0	21.2	0.0	0.0	78.8	21.2	100%
Mackerel		66.4	0.0	33.6	0.0	0.0	66.4	33.6	100%
Anchovy		0.0	0.0	100.0	0.0	0.0	0.0	100.0	100%
Tuna		100.0	0.0	0.0	0.0	0.0	100.0	0.0	100%
Others		31.7	5.4	34.8	27.9	0.2	37.1	62.9	100%
Demersal Portion		0.0	10.4	21.0	67.5	1.1	10.4	89.6	100%
Finfish		0.0	13.0	1.6	84.0	1.3	13.0	87.0	100%
Shrimp									
Invertebrate		0.0	0.0	100.0	0.0	0.0	0.0	100.0	100%
TOTAL		57.6	2.0	28.4	11.9	0.1	65.3	34.7	100%

Table 193: *Resource landing breakdown by gear type, Lahad Datu, 1997-1999*

Mean Annual Landing Breakdown	% FISHING GEAR SHARE								TOTAL
	TN	SN	GN	LN	HL	OT	COM	TRAD	
Pelagic Portion	0.0	96.9	67.2	86.6	49.3	15.6	70.2	51.6	55.7
Demersal Portion	100.0	3.1	32.8	13.4	50.7	84.4	29.8	48.4	44.3
	100%	100%	100%	100%	100%	100%	100%	100%	
<u>Pelagic Portion</u>	0.0	23.4	4.6	11.3	60.0	0.8	28.0	72.0	100%
Sardine	0.0	0.0	0.0	100.0	0.0	0.0	0.0	100.0	100%
Round Scad	0.0	100.0	0.0	0.0	0.0	0.0	100.0	0.0	100%
Mackerel	0.0	8.9	3.1	12.0	75.9	0.0	12.0	88.0	100%
Anchovy	0.0	0.0	0.0	100.0	0.0	0.0	0.0	100.0	100%
Tuna	0.0	100.0	0.0	0.0	0.0	0.0	100.0	0.0	100%
Others	0.0	1.2	6.8	8.5	82.2	1.2	8.0	92.0	100%
<u>Demersal Portion</u>	11.1	0.9	2.8	2.2	77.6	5.3	14.9	85.1	100%
Finfish	4.5	0.5	3.1	1.2	87.7	3.0	8.1	91.9	100%
Shrimp	86.3	9.4	1.7	0.0	0.0	2.7	97.3	2.7	100%
Invertebrate	40.9	0.0	0.0	18.4	0.0	40.7	40.9	59.1	100%
TOTAL	4.9	13.4	3.8	7.3	67.8	2.8	28.0	72.0	100%

Table 194: *Average wholesale price of pelagic fish in Sabah, 1999 (in RM/kg)*

ENGLISH NAME	LOCAL NAME	SSME 1	SSME 2	SSME 3	SSME	NON-SSME	Total	min	max
Chinese pomfret	*Bawal Putih*	5.81	7.62	9.70	8.35	10.81	8.71	5.81	17.00
Black pomfret	*Bawal Hitam*	6.84	7.48	5.53	6.34	8.23	7.15	5.00	9.08
Threadfin	*Kurau*	5.26	6.11	5.50	5.74	11.00	6.80	5.26	11.00
Spanish mackerel	*Tenggiri*	4.75	5.87	5.75	5.39	6.41	5.87	4.00	9.70
Horse mackerel-2	*Demudok*	5.63	5.52	4.35	5.04	6.11	5.47	3.83	10.00
Mullet	*Belanak*	4.63	5.08	3.98	4.41	5.82	4.92	2.47	10.00
Amberjack	*Aji-Aji*	3.76	NA	NA	3.76	4.95	4.35	3.76	4.95
Rainbow runner	*Pisang-2*	2.15	NA	NA	2.15	4.46	3.69	2.15	4.91
Selar scad	*Selar*	3.18	NA	3.03	3.06	3.95	3.56	2.00	4.66
Tuna	*Kayu/Tongkol*	3.60	3.58	3.38	3.47	3.44	3.45	1.93	5.27
Indian mackerel	*Kembong*	3.63	1.25	3.15	3.02	3.58	3.28	1.25	5.00
Horse mackerel-1	*Cermin*	4.44	2.17	2.58	3.24	NA	3.24	1.46	5.60
Golden trevally	*Gerong-2*	4.41	NA	2.00	3.21	NA	3.21	2.00	4.41
Barracuda	*Alu-Alu*	3.51	2.01	3.07	3.10	2.78	2.96	1.15	4.28
Hardtail scad	*Cincaru*	2.08	NA	2.23	2.19	3.18	2.74	1.30	5.00
Queen fish	*Talang*	3.43	1.57	1.83	2.37	3.03	2.65	1.50	3.70
Horse mackerel-3	*Ketang*	2.58	4.28	0.58	2.52	3.16	2.63	0.58	4.28
Japanese mackerel	*Tulai*	NA	1.62	2.67	2.40	3.07	2.63	1.62	3.50
Yellow-stripped trevally	*Selar Kuning*	3.50	1.23	2.28	2.51	2.95	2.57	1.23	4.80
Ribbon fish	*Timah*	9.94	0.93	0.79	3.11	1.34	2.35	0.50	9.94
Sailfish	*Layaran*	0.66	NA	NA	0.66	2.63	2.30	0.66	3.50
Indo Pacific tarpon	*Bulan-Bulan*	1.17	1.46	2.84	1.83	2.98	2.11	1.17	2.98
Round scad	*Selayang*	2.14	1.04	1.76	1.71	2.32	1.98	1.04	2.82
Longtail shad	*Beliak Mata*	1.67	NA	2.50	2.08	1.78	1.93	1.07	2.50
Marlin	*Todak*	1.29	NA	1.58	1.43	2.57	1.81	0.98	2.64
Chacunda Shad	*Kebasi*	1.65	0.91	1.36	1.42	2.00	1.50	0.64	2.77
Anchovy	*Bilis*	1.43	0.89	1.08	1.17	1.30	1.20	0.50	1.90
Shad	*Puput*	NA	NA	1.17	1.17	NA	1.17	1.17	1.17
Sardine	*Tamban*	1.03	1.41	1.28	1.20	0.93	1.10	0.61	1.63
Wolf herring	*Parang-2*	0.78	1.07	0.58	0.81	0.97	0.85	0.58	1.07

Table 195: *Average wholesale price of demersal fish in Sabah, 1999 (in RM/kg)*

ENGLISH NAME	LOCAL NAME	SSME 1	SSME 2	SSME 3	SSME	NON-SSME	Total	min	max
Grouper	*Kerapu*	13.24	8.41	4.75	8.39	7.03	7.90	3.02	27.94
Barramundi	*Siakap*	7.69	5.86	4.91	6.19	7.13	6.45	3.14	9.80
Snapper-3	*Merah*	6.13	5.04	5.23	5.49	5.73	5.57	0.13	10.00
False trevally	*Shrumbu*	3.87	NA	NA	3.87	5.51	4.69	3.87	5.51
Snapper-2	*Jenahak*	4.59	5.40	4.02	4.34	4.03	4.22	2.83	7.00
Sharp toothed bass	*Kerisi Bali*	2.84	4.97	3.48	3.62	5.55	4.10	2.84	6.11
Rabbit fish	*Dengkis*	4.69	3.74	2.99	3.40	4.46	3.82	2.17	8.00
Snapper-4	*Kunyit-Kunyit*	3.81	NA	NA	3.81	NA	3.81	3.81	3.81
Bombay duck	*Lumi-Lumi*	NA	NA	NA	NA	3.74	3.74	1.28	5.23
Sweet lips	*Kaci*	3.96	NA	2.42	2.93	4.61	3.60	2.00	5.41
Grunter	*Gerut-gerut*	3.46	3.55	5.00	3.79	3.32	3.58	2.65	5.00
Napoleon Wrasse-1	*Bayan*	2.42	NA	4.00	3.21	3.92	3.45	2.42	4.00
Snapper-5	*Tanda*	3.25	4.30	3.14	3.35	NA	3.35	2.17	4.50
Monocle bream	*Pasir-Pasir*	3.25	NA	NA	3.25	NA	3.25	3.25	3.25
Flatfish	*Sebelah*	3.83	1.51	1.94	2.31	4.49	3.24	0.89	4.92
Spotted sicklefish	*Daun Baharu*	3.24	NA	3.58	3.38	2.40	3.01	1.15	4.27
Coral fulsier	*Delah*	4.12	NA	2.46	3.01	2.92	2.97	1.00	4.47
Croaker	*Jarang Gigi*	NA	NA	2.90	2.90	NA	2.90	2.75	3.04
Silago whiting	*Puntung Damar*	1.39	4.83	3.17	2.70	2.92	2.82	1.09	4.83
Napoleon Wrasse-2	*Batu*	3.48	NA	1.91	2.43	2.96	2.64	1.50	4.42
Triggerfish	*Jebong*	1.43	NA	1.97	1.84	4.17	2.61	1.08	4.69
Catfish-2	*Semilang*	2.97	1.32	1.96	2.36	3.21	2.57	1.25	3.50
Threadfin bream	*Kerisi*	3.12	1.46	1.85	2.16	2.67	2.37	1.33	3.56
Jewfish	*Gelama*	2.91	1.14	1.17	2.03	2.18	2.09	1.00	4.80
Slipmouth	*Kikek*	1.33	2.25	1.86	1.83	2.28	2.06	1.12	3.40
Silver biddy	*Kapas Laut*	1.56	2.69	1.26	1.67	2.16	1.85	0.68	3.22
Ray	*Pari*	2.62	1.45	1.46	1.79	1.52	1.68	1.00	3.87
Shark	*Yu*	3.09	1.31	1.13	1.72	1.47	1.61	0.97	4.80
Tongue fish	*Lidah*	2.79	0.91	1.29	1.57	NA	1.57	0.91	2.79
Snapper-1	*Jahan*	1.56	NA	1.33	1.51	NA	1.51	0.80	3.00
Mixed fish	*Ikan Campor*	2.04	0.65	1.17	1.37	1.69	1.50	0.50	2.49
Goat fish	*Biji Nangka*	0.69	NA	1.44	1.25	1.95	1.39	0.69	1.95
Catfish-1	*Duri*	1.39	1.02	1.41	1.34	1.27	1.31	0.71	2.67
Conger eel	*Malong*	0.70	1.31	1.00	1.00	0.83	0.96	0.70	1.31
Lizard fish	*Mengkerong*	0.54	0.85	0.50	0.63	0.53	0.60	0.50	0.85
Trash fish	*Ikan Baja*	0.32	NA	0.42	0.39	0.15	0.33	0.15	0.68

Note: Ikan batu and bayan categorized as Napoleon Wrasse include Parrot Fish

Table 196: *Average wholesale price of demersal invertebrates in Sabah, 1999 (in RM/kg)*

ENGLISH NAME	LOCAL NAME	SSME 1	SSME 2	SSME 3	SSME	NON-SSME	Total	min	max
Horse shoe crab	*Berangkas*	4.50	NA	NA	4.50	NA	4.50	4.50	4.50
Pelagic crab	*KetamRenjong*	2.79	1.73	3.14	2.79	3.36	3.03	1.73	3.98
Mangrove crab	*Ketam Bakau*	3.73	3.91	3.00	3.66	5.07	4.48	2.08	6.00
Coral lobster	*Udang Karang*	47.17	NA	45.25	45.89	NA	45.89	18.00	72.50
Slipper lobster	*Udang Lobak*	5.73	NA	5.67	5.69	9.00	6.52	5.00	9.00
Tiger shrimp	*Udang Harimau*	20.83	42.88	32.69	29.07	25.04	27.60	9.33	45.00
Pink shrimp	*U. Merah Ros*	17.32	22.20	14.24	17.00	29.97	19.59	10.47	29.97
Yellow shrimp	*Udang Kuning*	13.21	16.52	11.83	13.30	16.74	13.79	5.67	18.00
Banana shrimp	*Udang Putih*	9.19	14.07	9.36	10.66	9.33	10.05	7.50	17.97
Sand shrimp	*Udang Pasir*	9.88	NA	7.00	8.44	11.08	9.32	7.00	11.08
Sharp rostrum shrimp	*Udang Minyak*	13.25	NA	4.75	7.58	NA	7.58	4.50	13.25
Rainbow shrimp	*U. Kulit Keras*	5.26	NA	1.50	4.32	3.44	4.15	1.50	10.75
Acetes shrimp	*Bubuk/U.baring*	3.33	NA	1.00	2.17	0.97	1.31	0.50	3.33
Misc. shrimp	*Lain-2 Udang*	10.67	NA	6.50	8.58	12.21	9.79	6.50	12.21
Abalone	*Abalon*	8.38	NA	14.00	11.19	9.33	10.57	8.38	14.00
Sea cucumber	*Trepang*	3.71	5.15	8.00	5.62	8.00	6.21	3.71	8.00
Squid	*Sotong Cumit*	3.30	1.37	3.40	3.08	4.29	3.58	1.37	5.26
Cuttlefish	*Sotong Katak*	3.01	1.27	3.40	2.98	3.70	3.16	1.27	5.00
Octopus	*Sotong Kereta*	1.27	1.11	4.13	2.66	3.13	2.75	1.11	4.75
Misc. shellfish	*Lain-Lain Siput*	1.78	2.44	2.54	2.22	3.45	2.57	0.50	4.58
Blood cockle	*Kerang*	1.21	NA	0.73	1.05	4.60	1.94	0.73	4.60

Figure 254a. Temporal distribution of marine fish landings by resource group in Sabah, 1991-1999

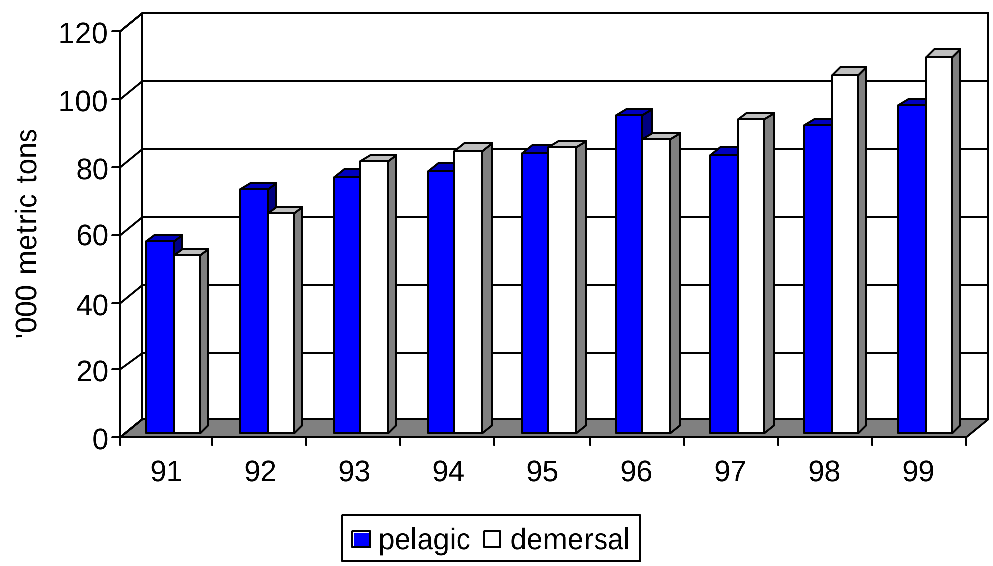


Figure 254b. Temporal distribution of marine fish landings by resource group in Sabah, 1991-1999 (% annual)

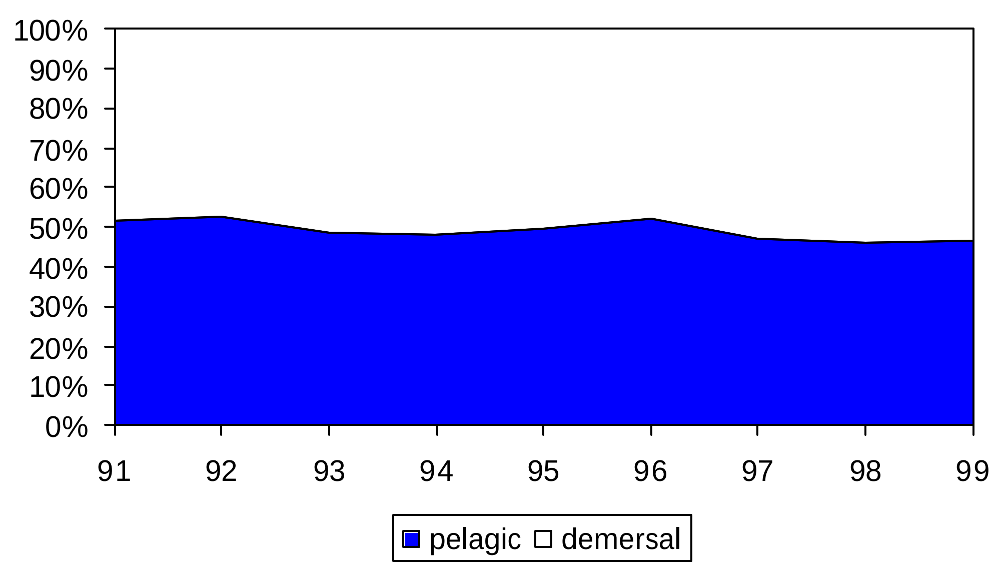


Figure 254c. Temporal distribution of marine fish landings by resource group in the non-SSME area, 1991-1999

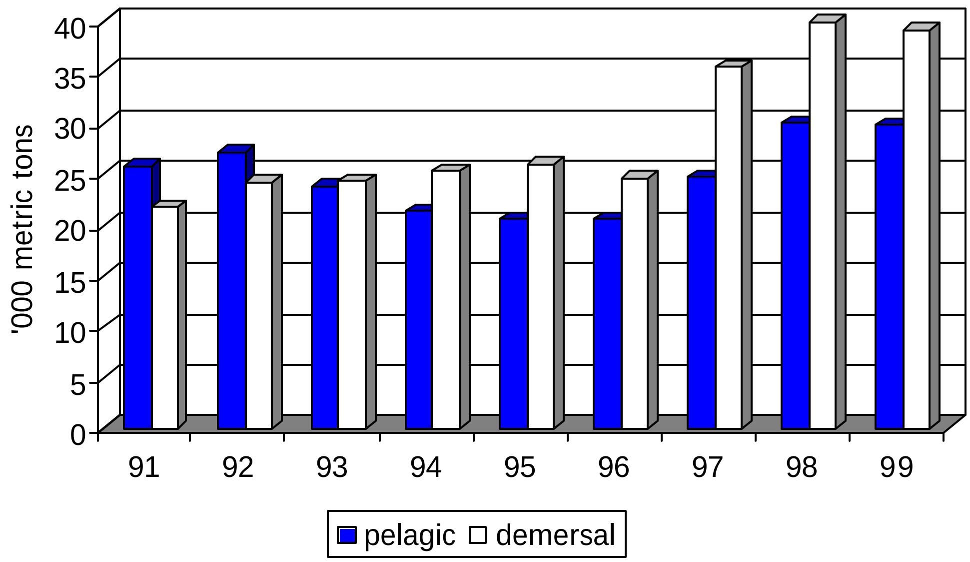


Figure 254d. Temporal distribution of marine fish landings by resource group in the non-SSME area, 1991-1999 (% annual)

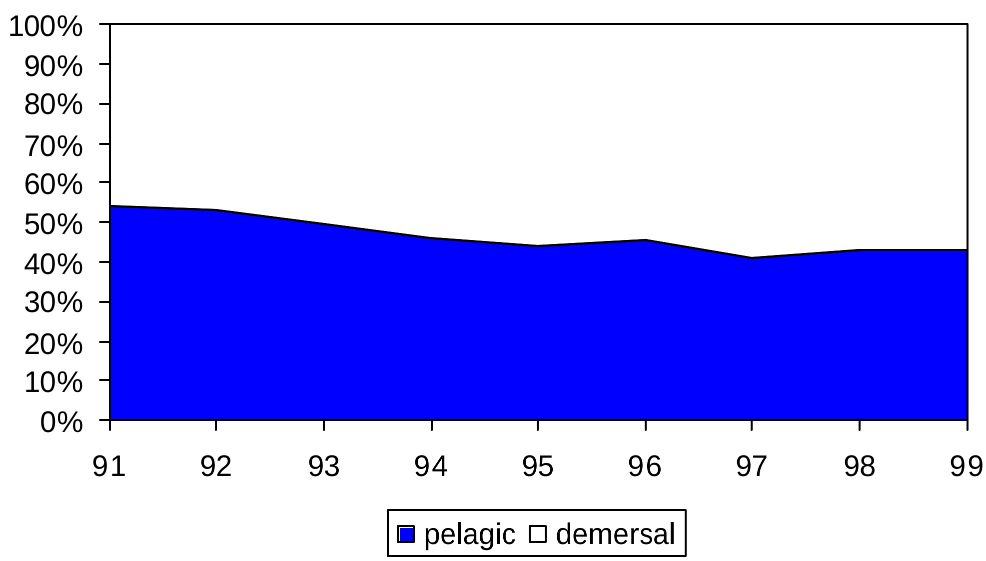


Figure 254e. Temporal distribution of marine fish landings by resource group in the SSME area, 1991-1999

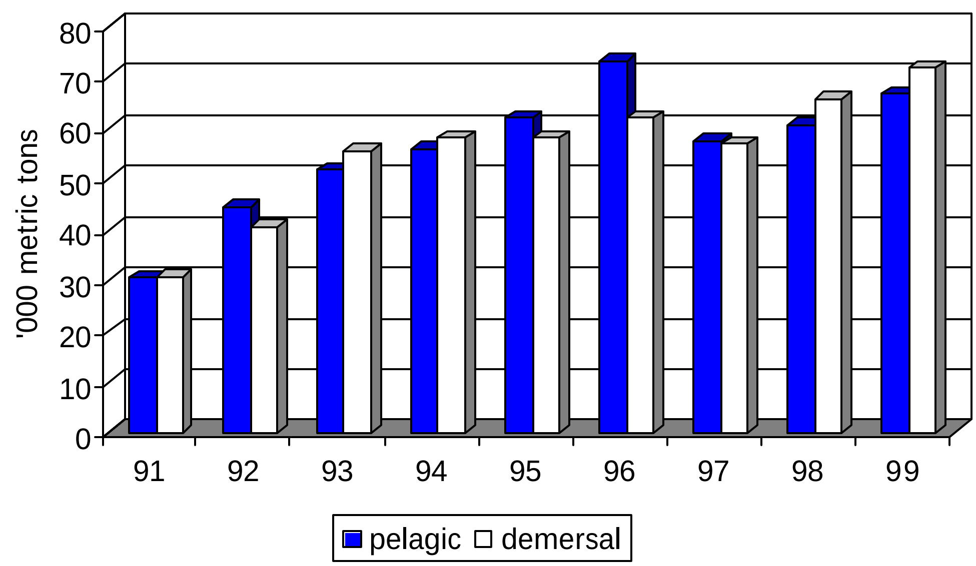


Figure 254f. Temporal distribution of marine fish landings by resource group in the SSME area, 1991-1999

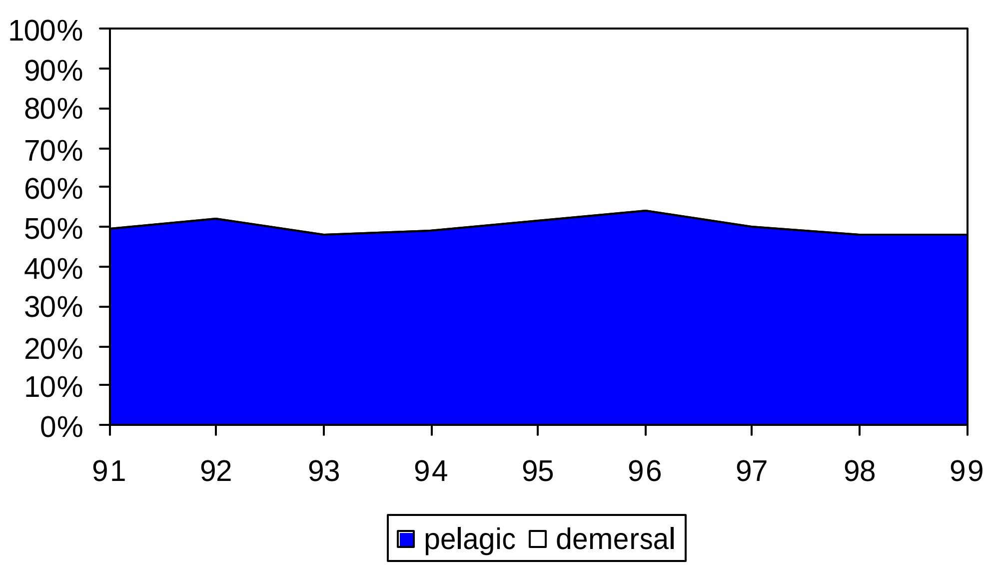


Figure 254g. Temporal distribution of demersal landings by fishing region in Sabah, 1991-1999

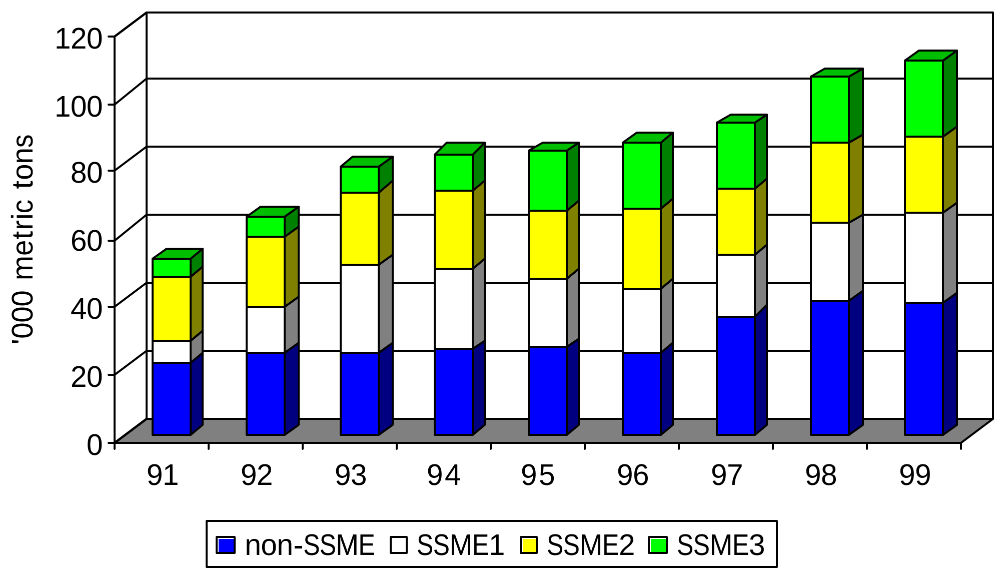


Figure 254h. Temporal distribution of demersal landings by fishing region in Sabah, 1991-1999

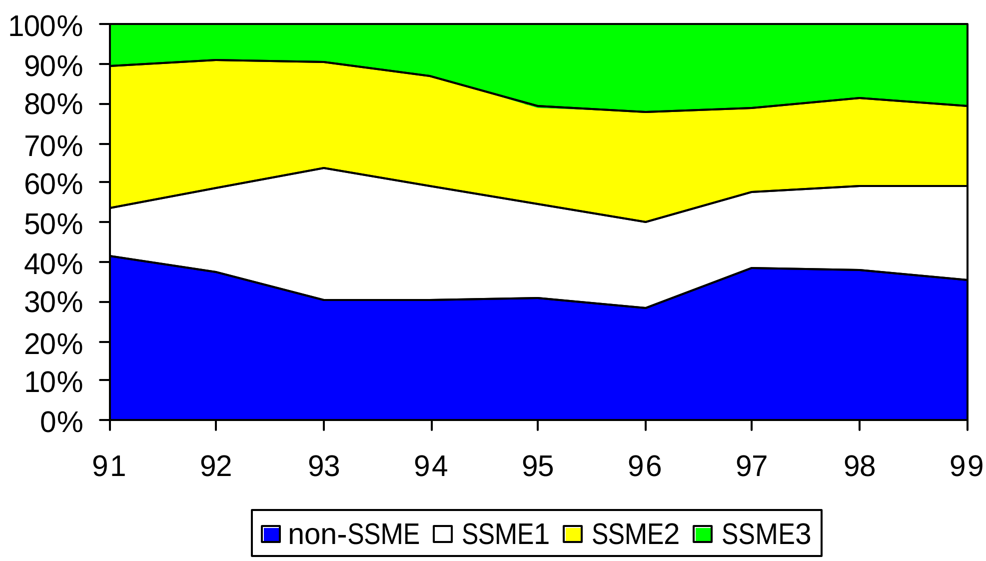


Figure 254i. Temporal distribution of demersal landings by fishing region in the SSME area, 1991-1999

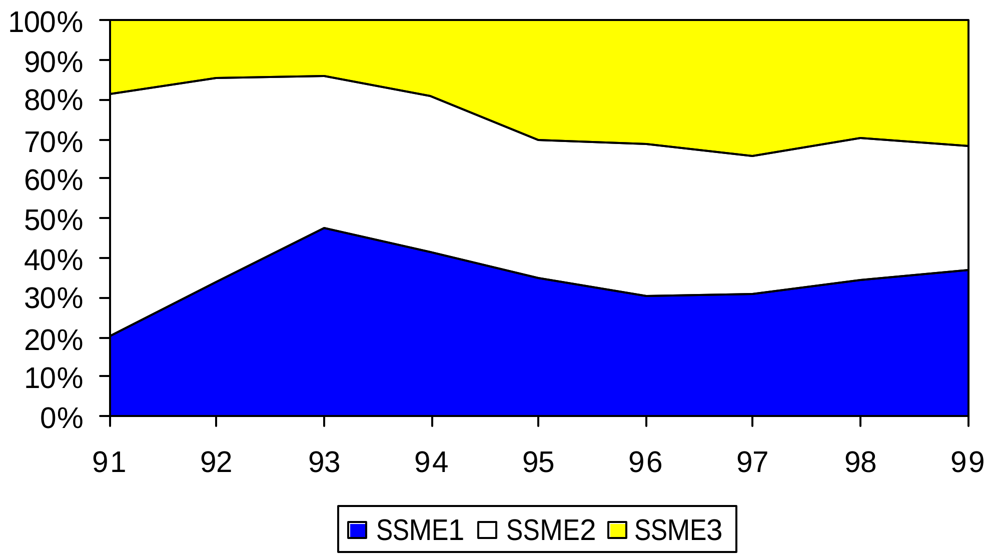


Figure 254j. Temporal distribution of demersal finfish landings by fishing region in Sabah, 1991-1999

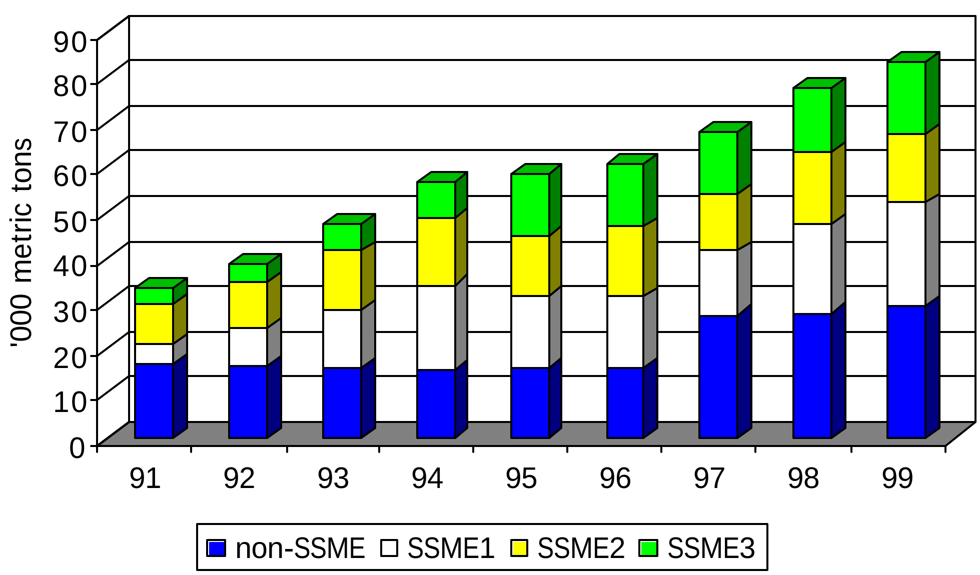


Figure 254k. Temporal distribution of demersal finfish landings by fishing region in Sabah, 1991-1999

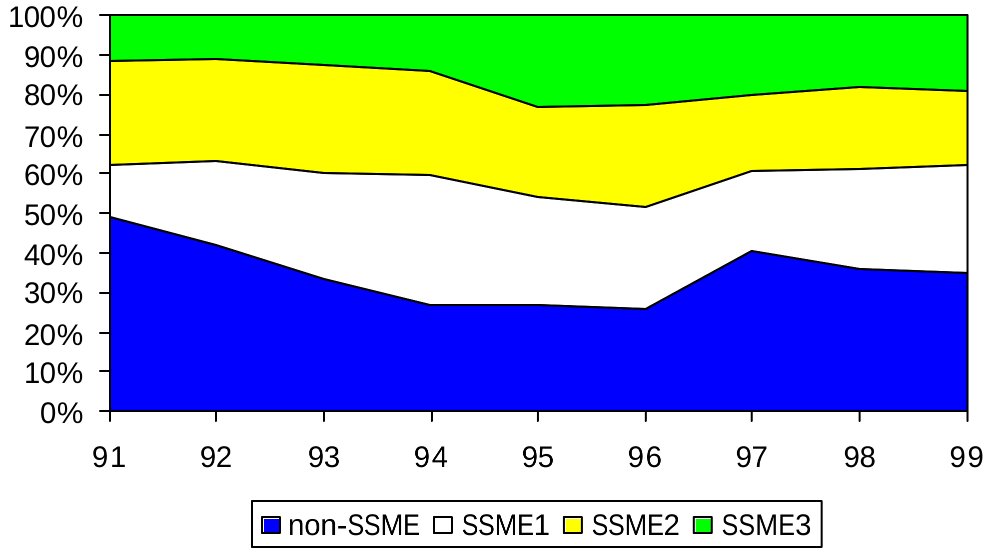


Figure 254l. Temporal distribution of demersal finfish landings by fishing region in the SSME area, 1991-1999

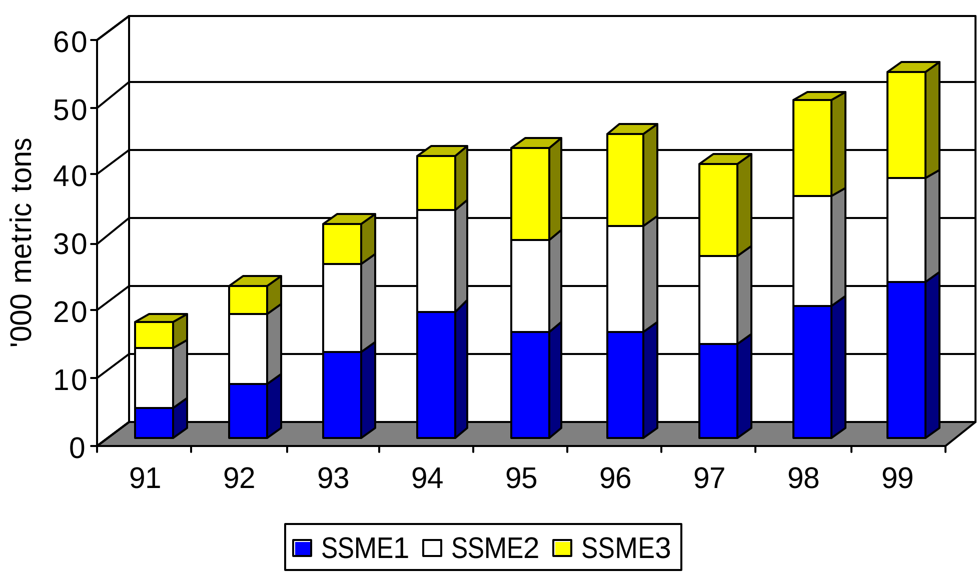


Figure 254m. Temporal distribution of demersal finfish landings by fishing region in the SSME area, 1991-1999

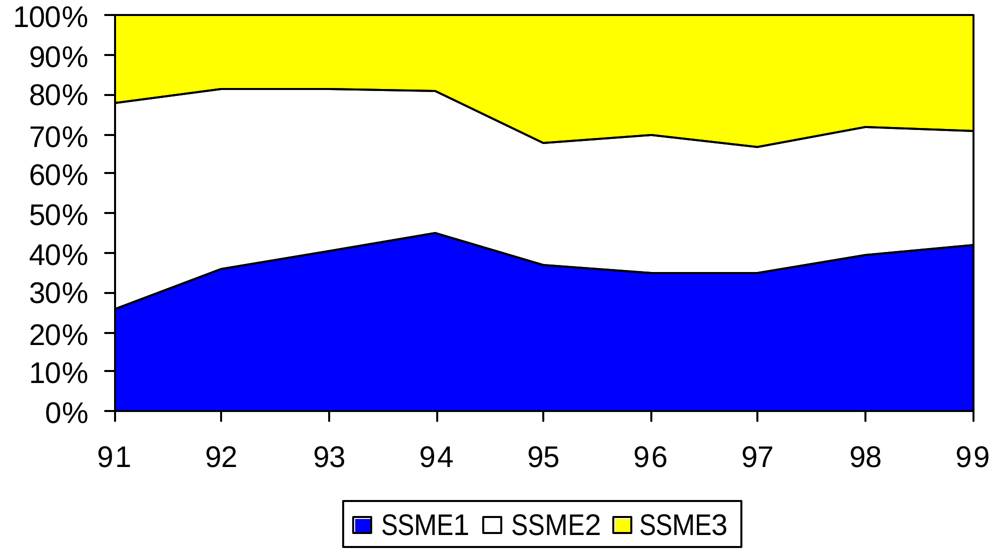


Figure 254n. Temporal distribution of demersal invertebrate landings by fishing region in Sabah, 1991-1999

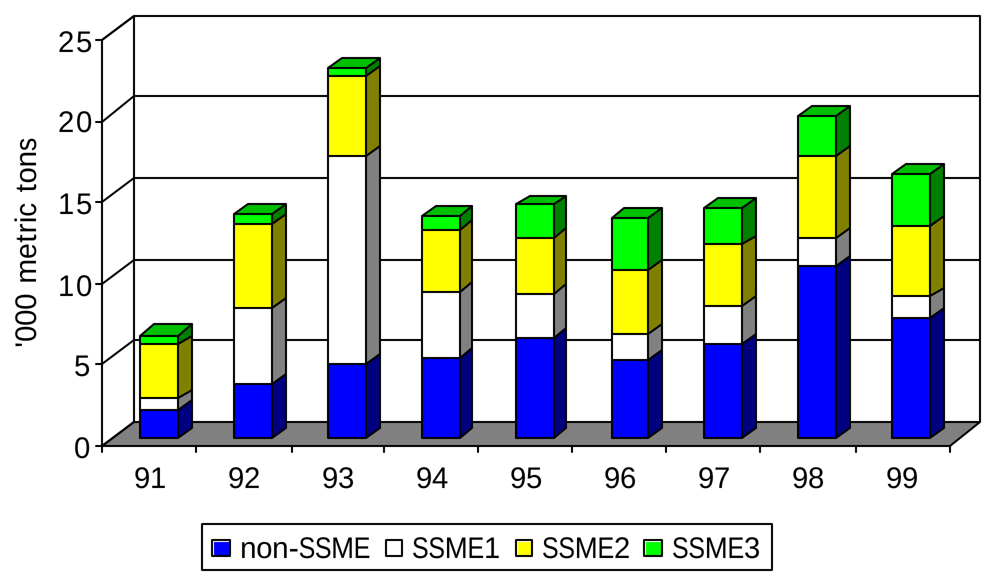


Figure 254o. Temporal distribution of demersal invertebrate landings by fishing region in Sabah, 1991-1999

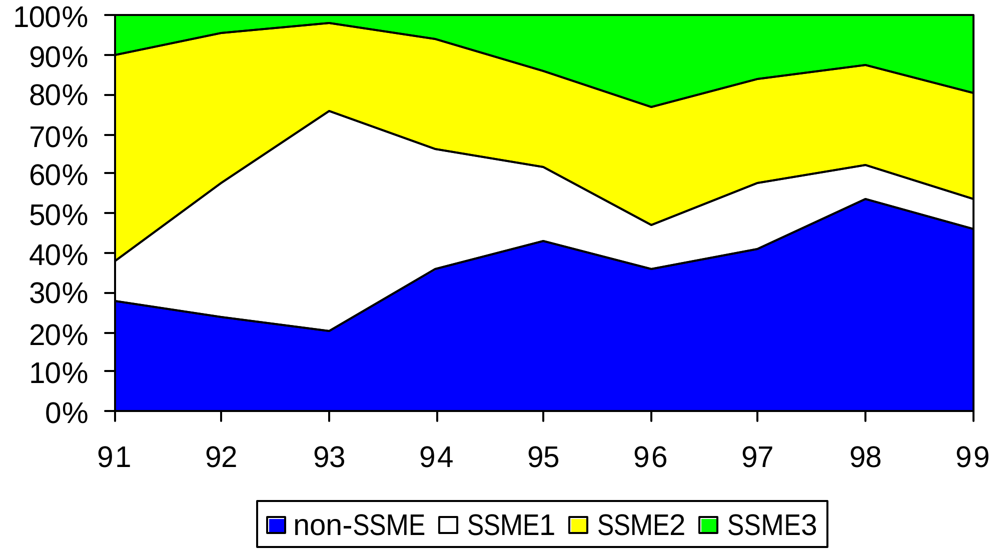


Figure 254p. Temporal distribution of demersal invertebrate landings by fishing region in the SSME area, 1991-1999

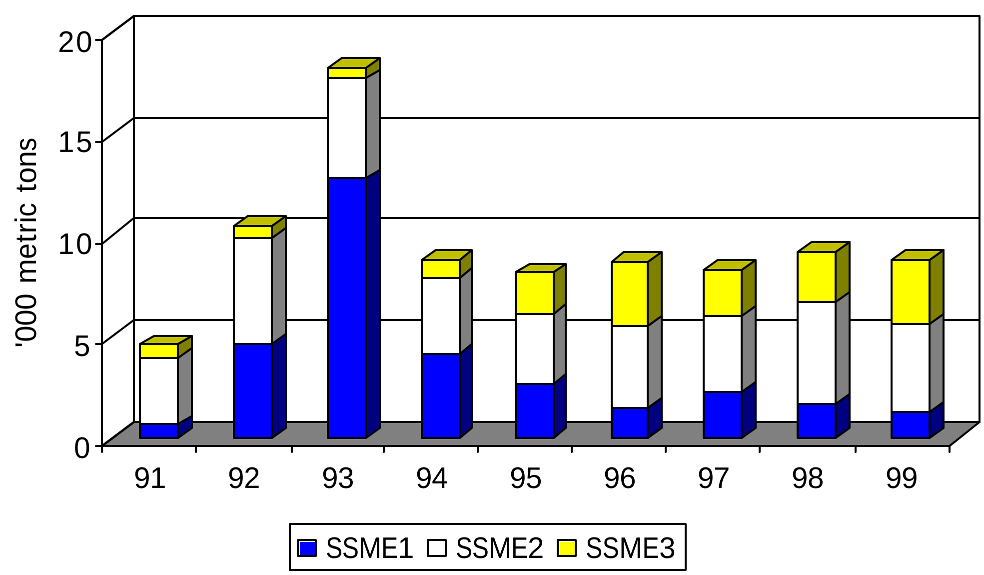


Figure 254q. Temporal distribution of demersal invertebrate landings by fishing region in the SSME area, 1991-1999

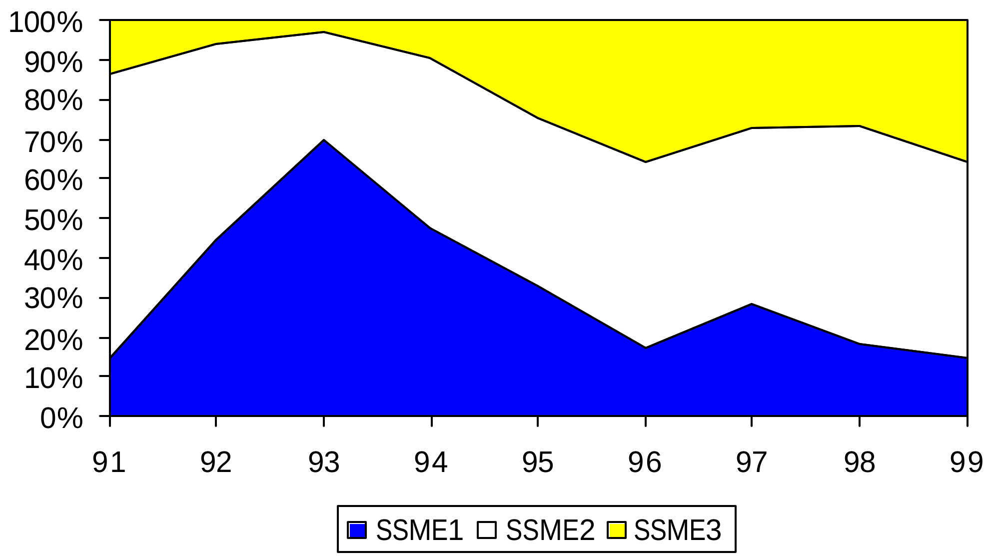


Figure 254r. Temporal distribution of shrimp landings by fishing region in the Sabah, 1991-1999

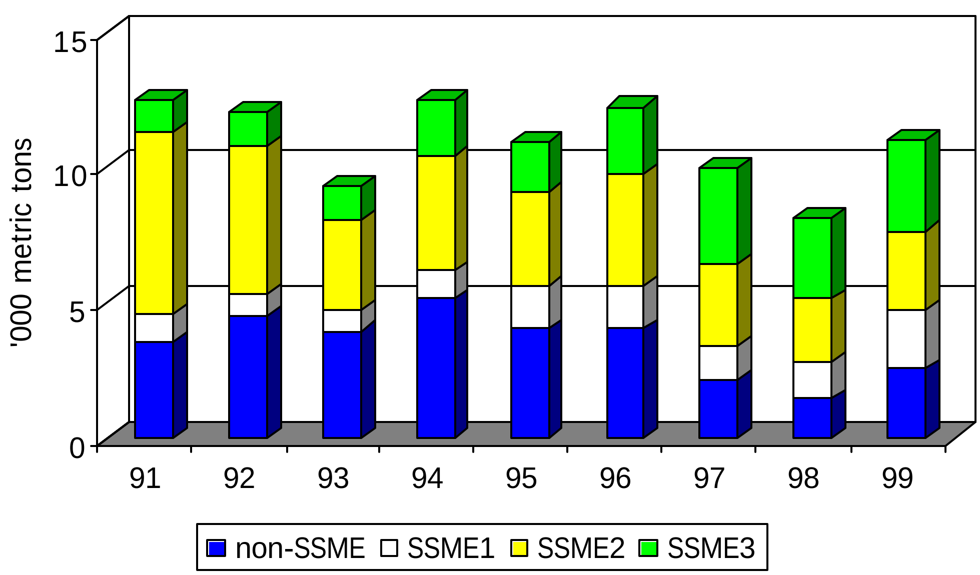


Figure 254s. Temporal distribution of shrimp landings by fishing region in the Sabah, 1991-1999

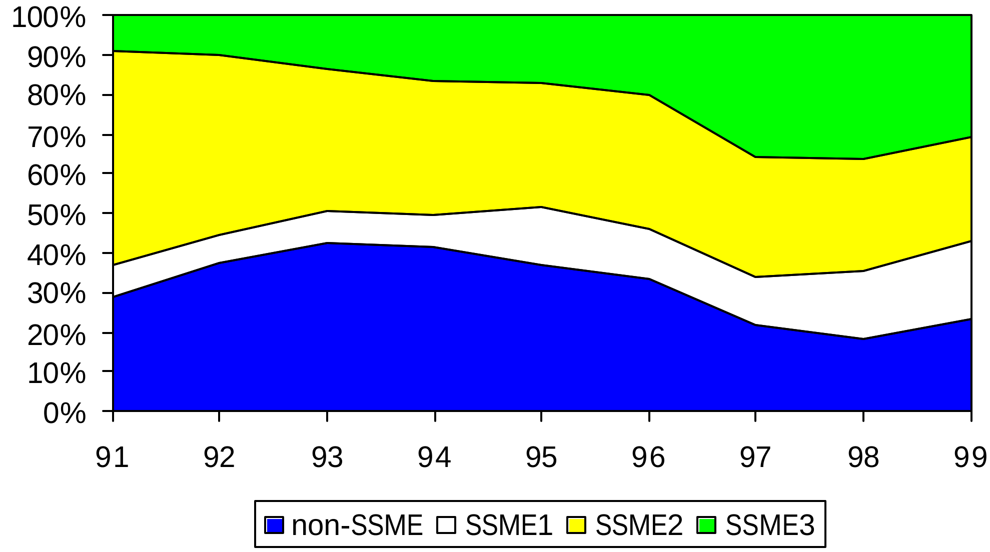


Figure 254t. Temporal distribution of shrimp landings by fishing region in the SSME area, 1991-1999

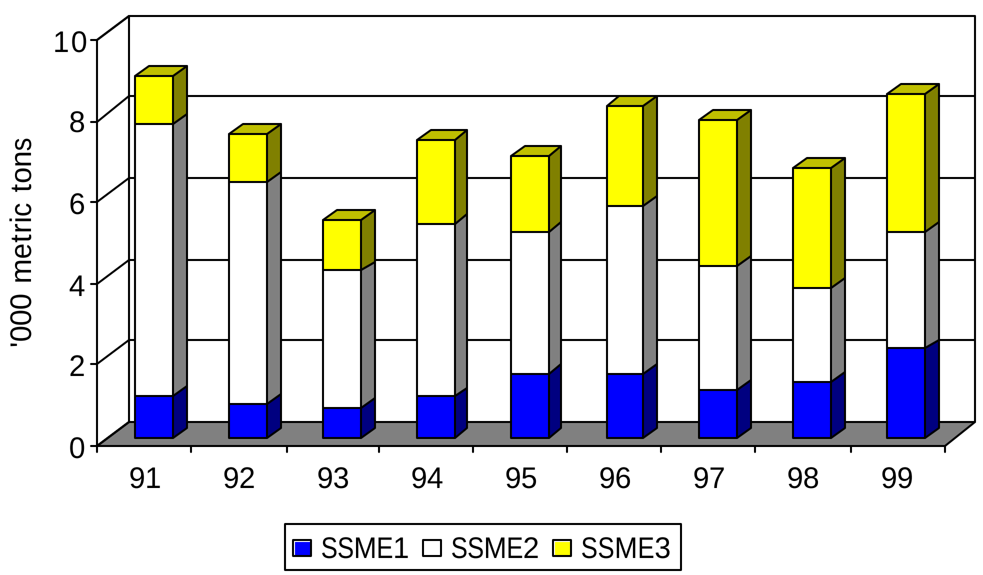


Figure 254u. Temporal distribution of shrimp landings by fishing region in the SSME area, 1991-1999

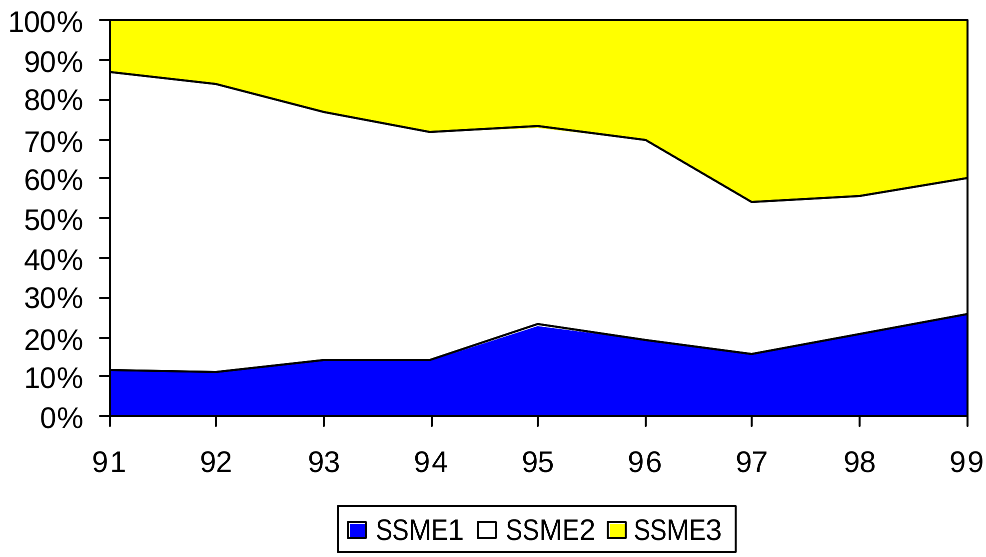


Figure 254v. Temporal distribution of pelagic landings by fishing region in Sabah, 1991-1999

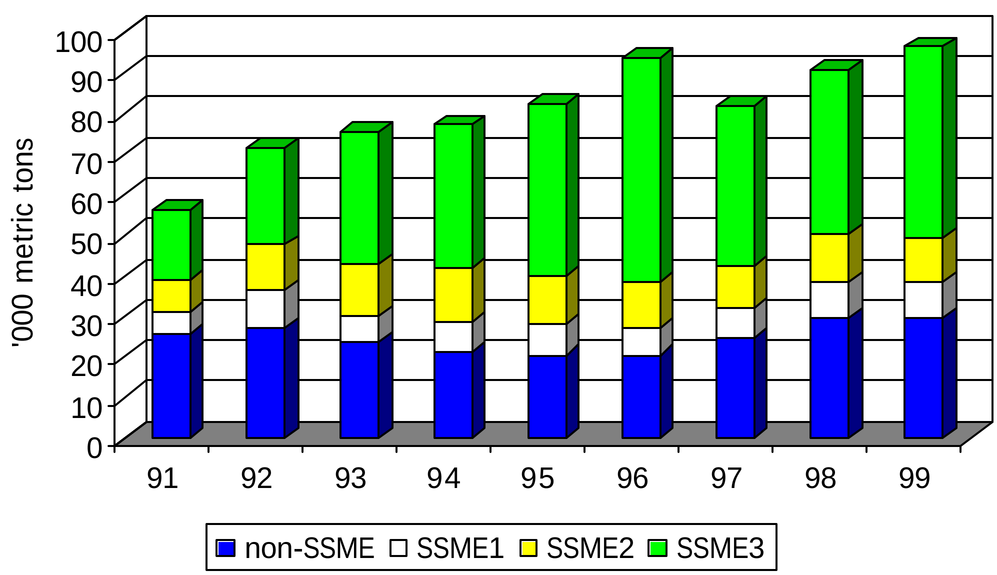


Figure 254w. Temporal distribution of pelagic landings by fishing region in Sabah, 1991-1999

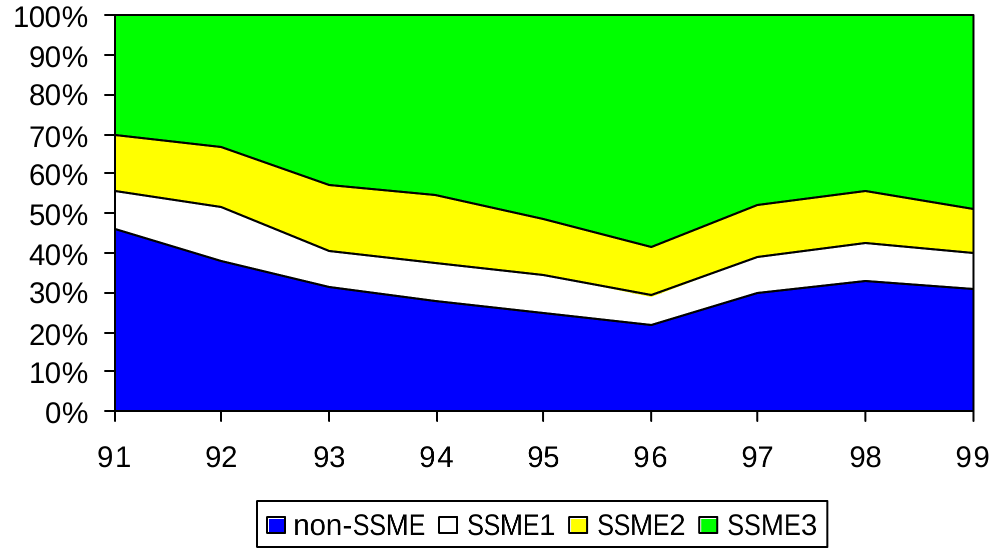


Figure 254x. Temporal distribution of pelagic landings by fishing region in the SSME area, 1991-1999

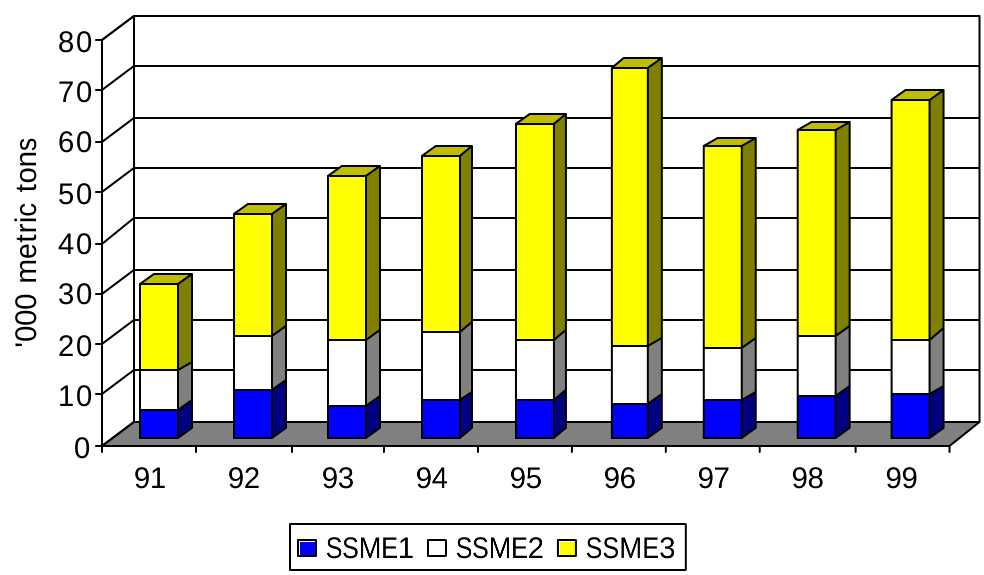


Figure 254y. Temporal distribution of pelagic landings by fishing region in the SSME area, 1991-1999

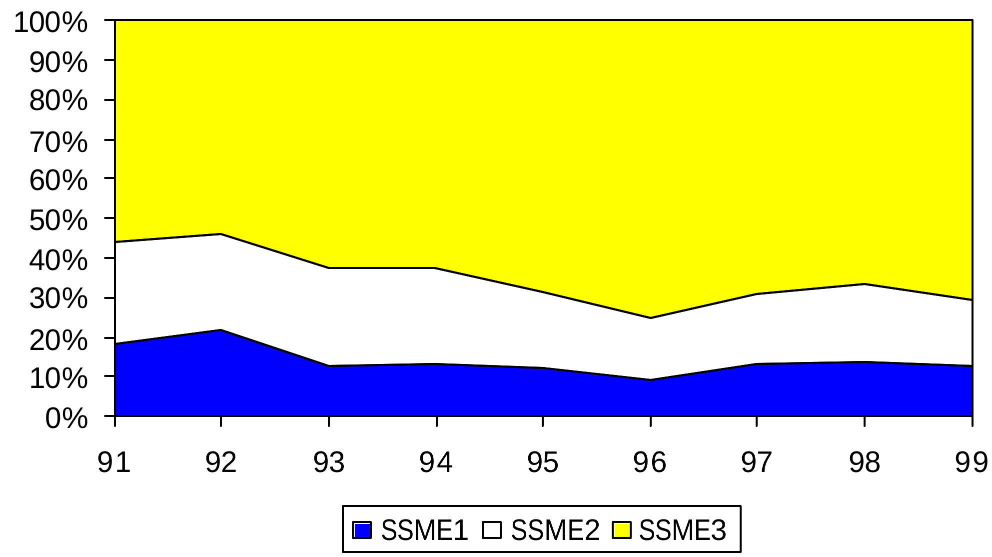


Figure 255a. Temporal distribution of demersal landings by resource type in Sabah, 1991-1999

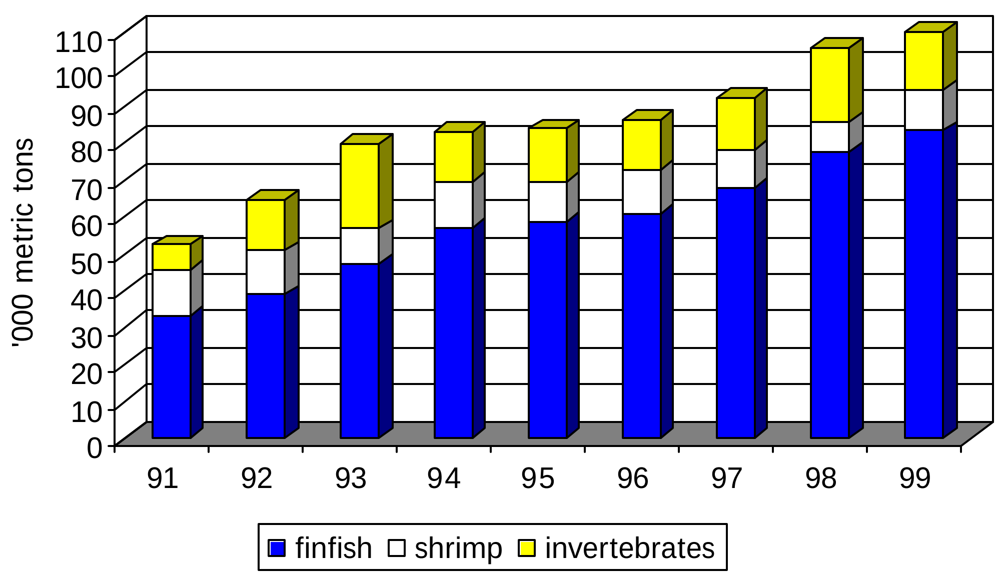


Figure 255b. Temporal distribution of demersal landings by resource type in Sabah, 1991-1999

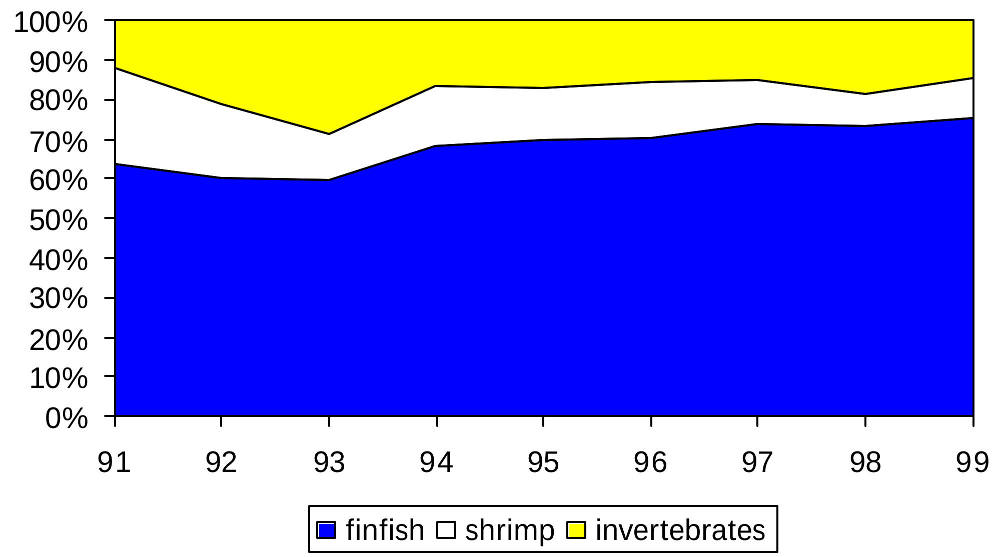


Figure 255c. Temporal distribution of demersal landings by resource type in the non-SSME area, 1991-1999

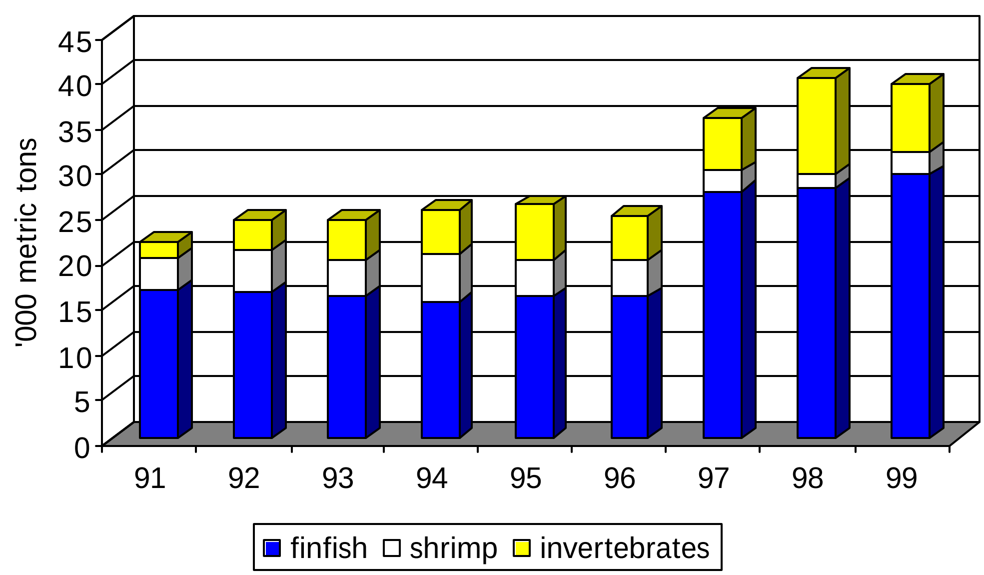


Figure 255d. Temporal distribution of demersal landings by resource type in the non-SSME area, 1991-1999

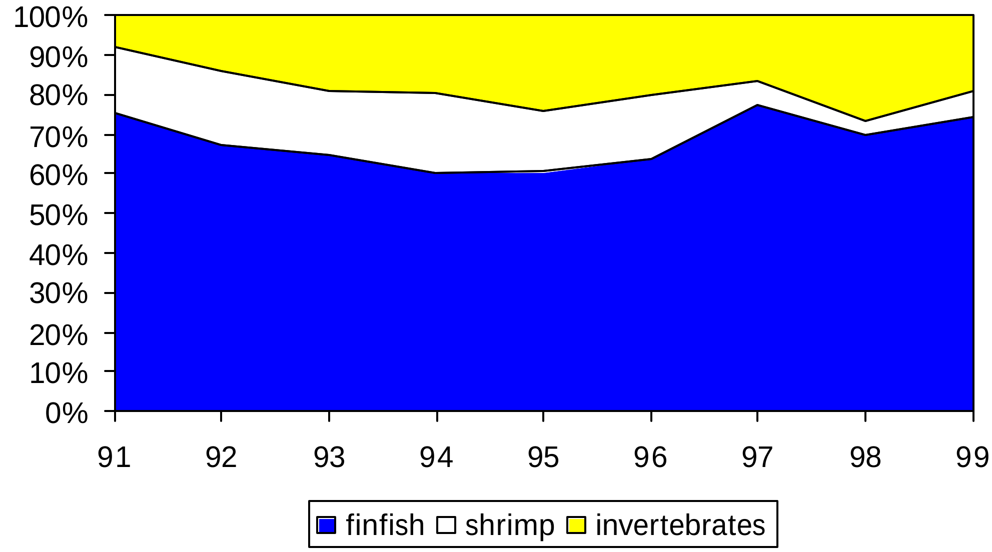


Figure 255e. Temporal distribution of demersal landings by resource type in the SSME area, 1991-1999

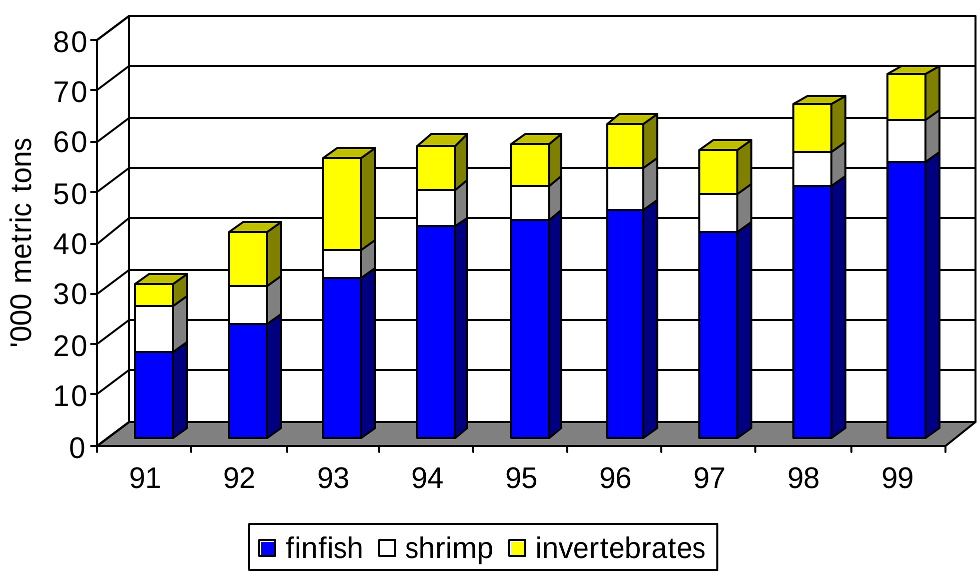


Figure 255f. Temporal distribution of demersal landings by resource type in the SSME area, 1991-1999

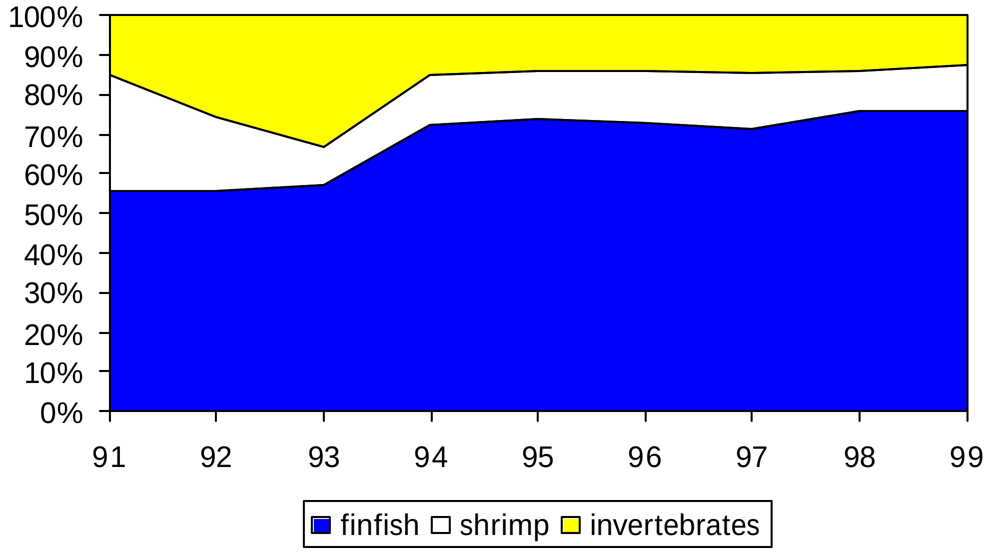


Figure 256a. Temporal distribution of demersal landings by resource type in the SSME-1 area, 1991-1999

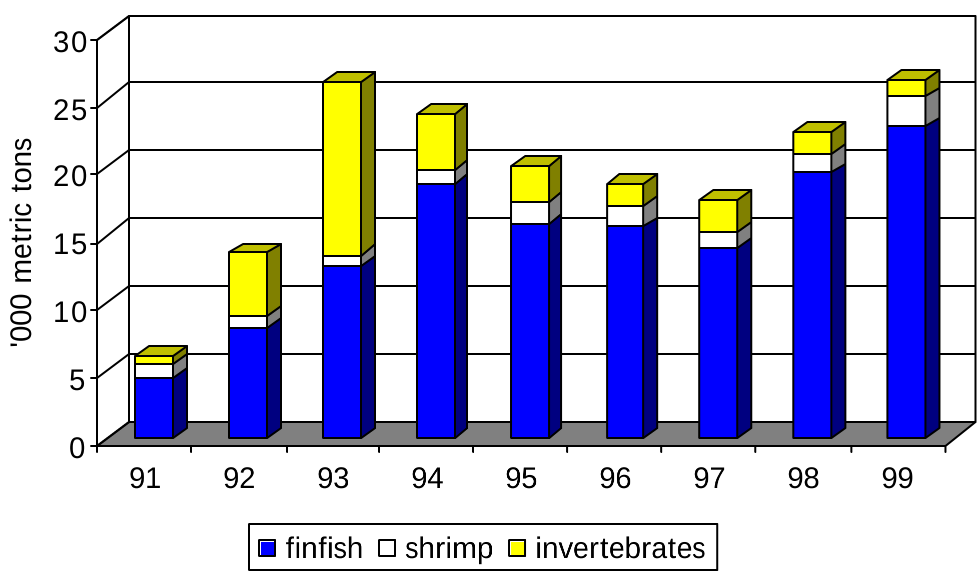


Figure 256b. Temporal distribution of demersal landings by resource type in the SSME-1 area, 1991-1999

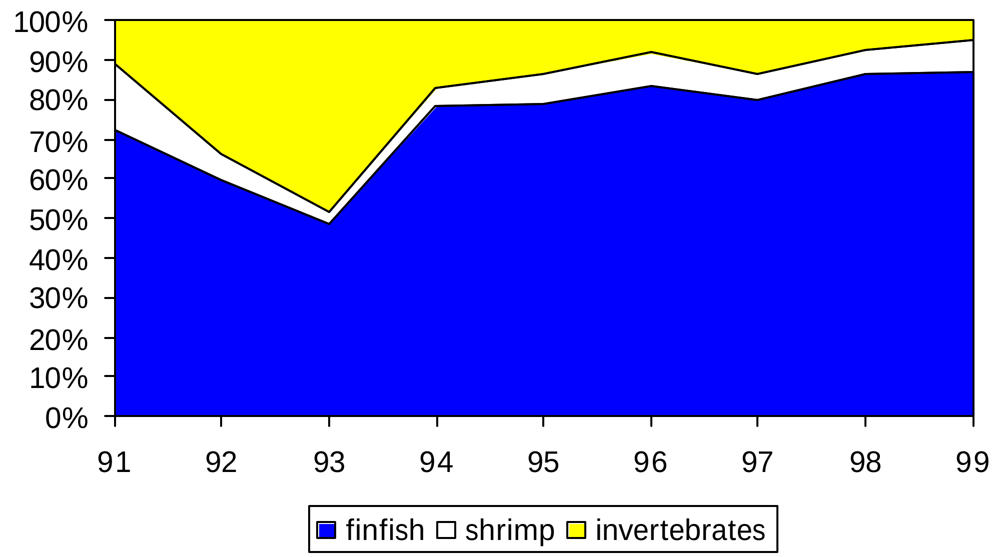


Figure 256c. Temporal distribution of regional demersal landings in the SSME-1 area, 1991-1999

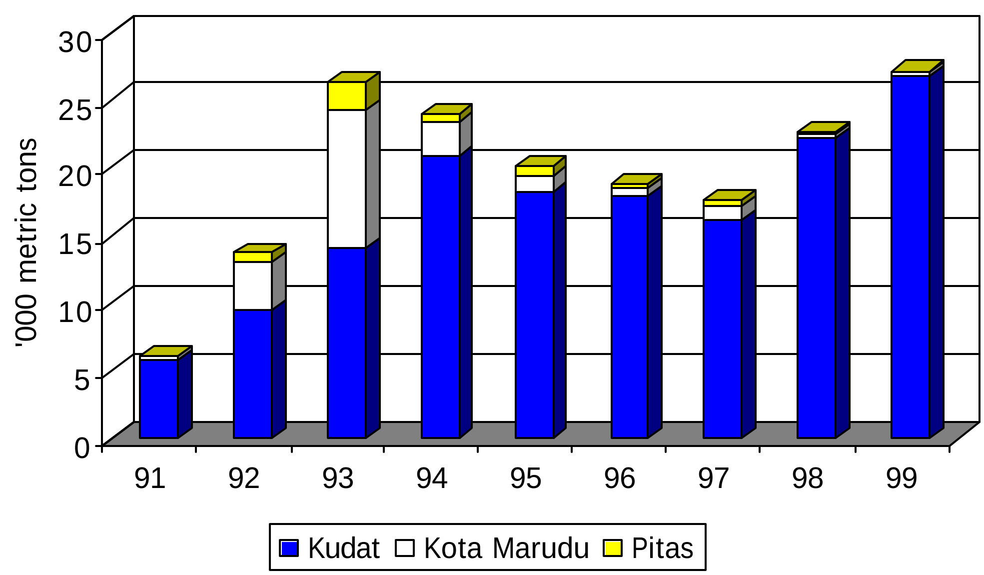


Figure 256d. Temporal distribution of regional demersal landings in the SSME-1 area, 1991-1999

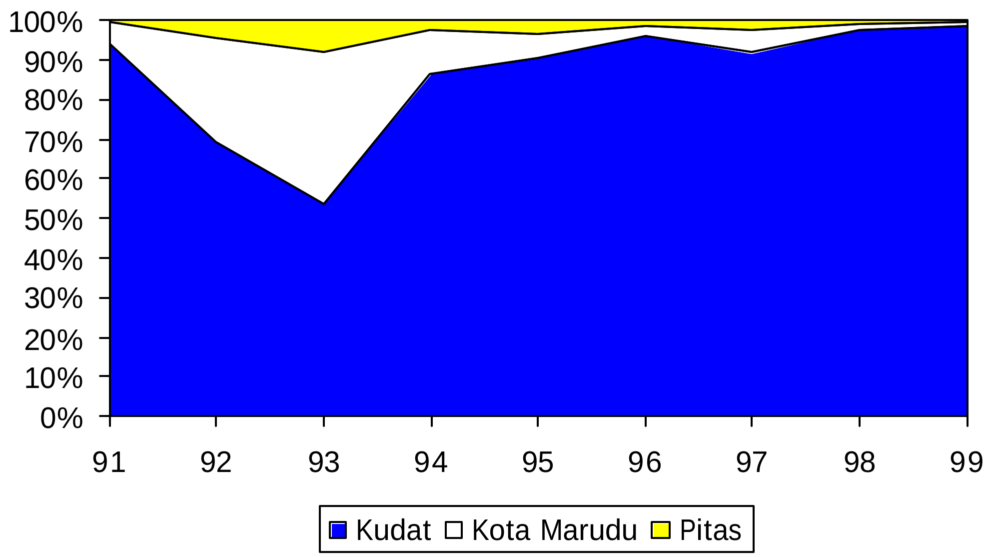


Figure 256e. Temporal distribution of regional demersal finfish landings in the SSME-1 area, 1991-1999

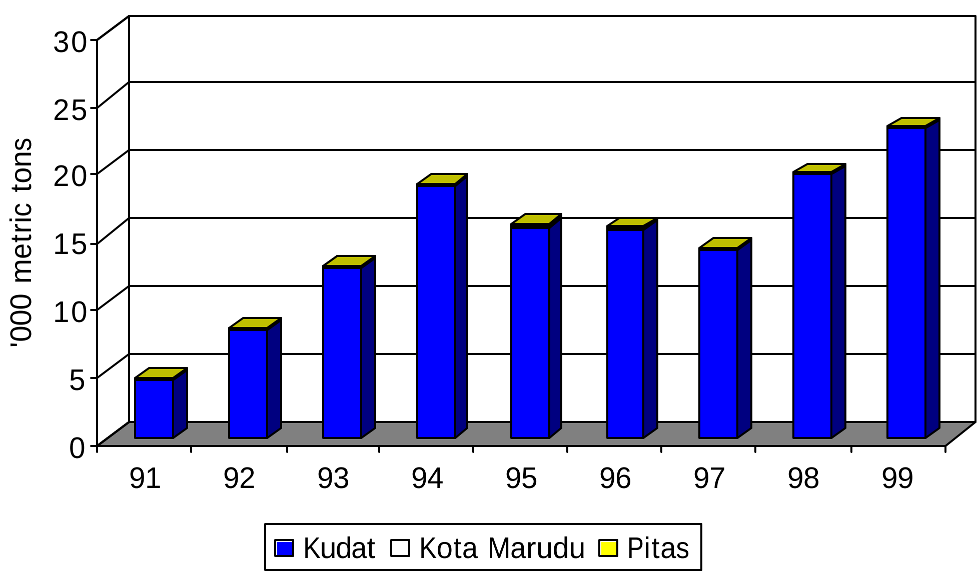


Figure 256f. Temporal distribution of regional demersal finfish landings in the SSME-1 area, 1991-1999

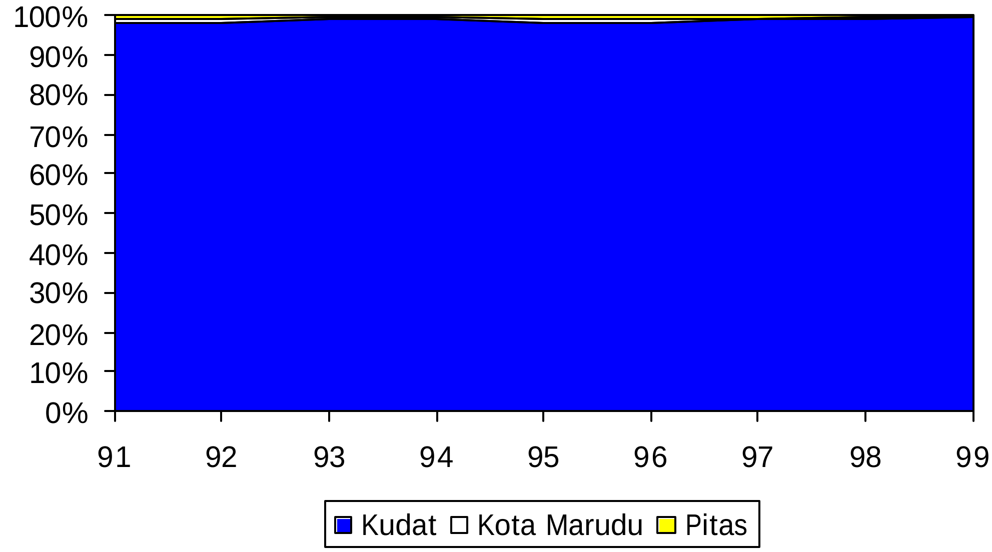


Figure 256g. Temporal distribution of regional demersal invertebrate landings in the SSME-1 area, 1991-1999

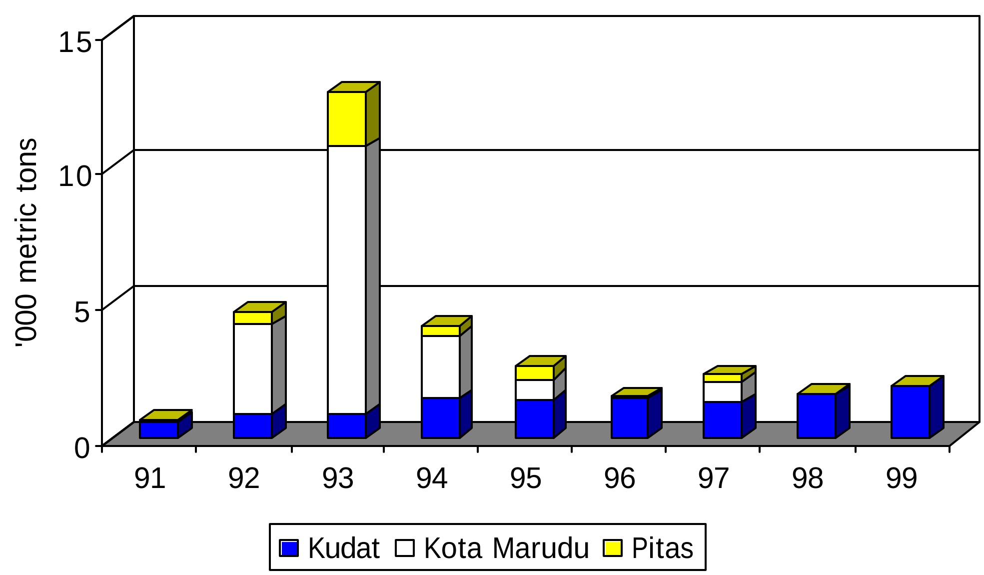


Figure 256h. Temporal distribution of regional demersal invertebrate landings in the SSME-1 area, 1991-1999

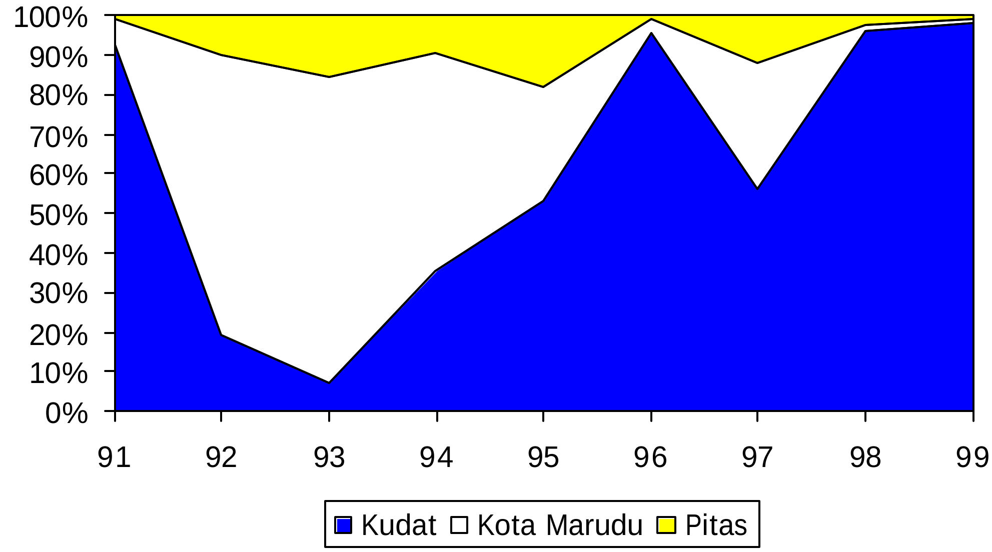


Figure 256i. Temporal distribution of regional shrimp landings in the SSME-1 area, 1991-1999

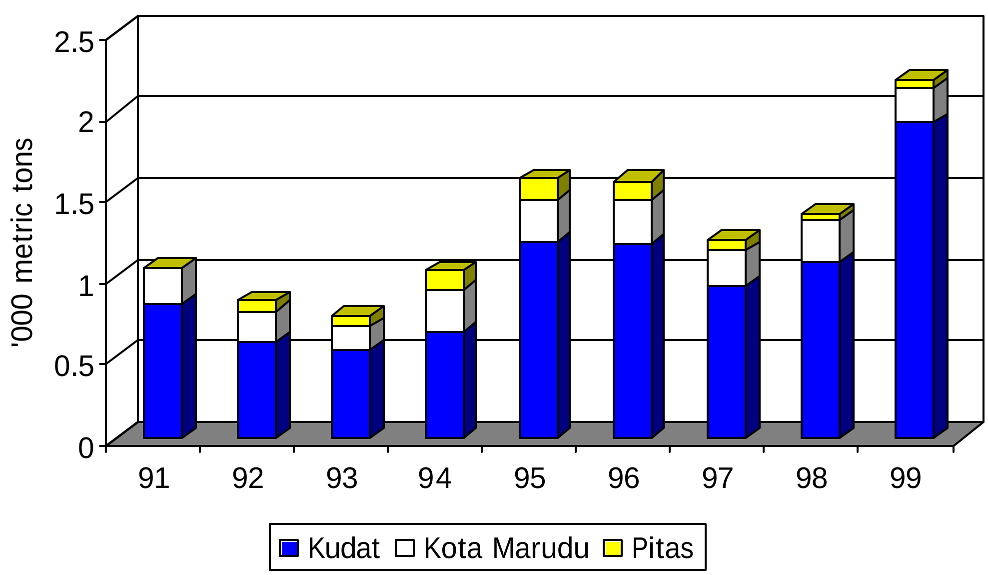


Figure 256j. Temporal distribution of regional shrimp landings in the SSME-1 area, 1991-1999

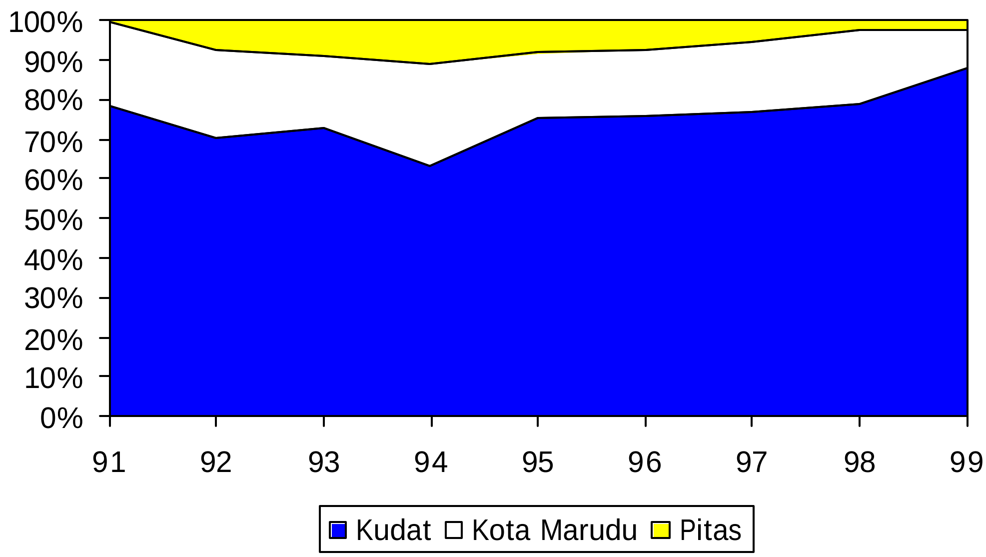


Figure 256k. Temporal distribution of regional pelagic landings in the SSME-1 area, 1991-1999

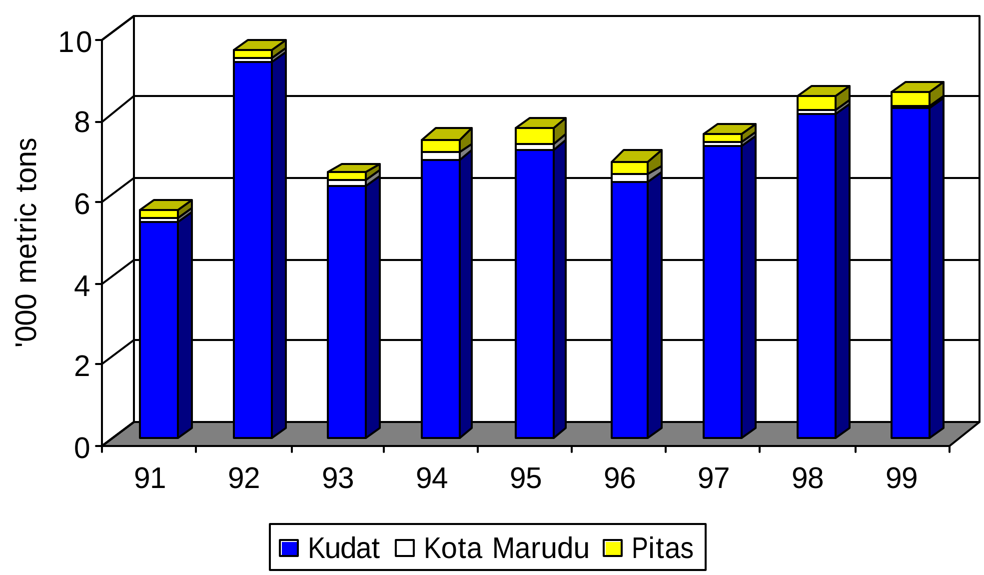


Figure 256l. Temporal distribution of regional pelagic landings in the SSME-1 area, 1991-1999

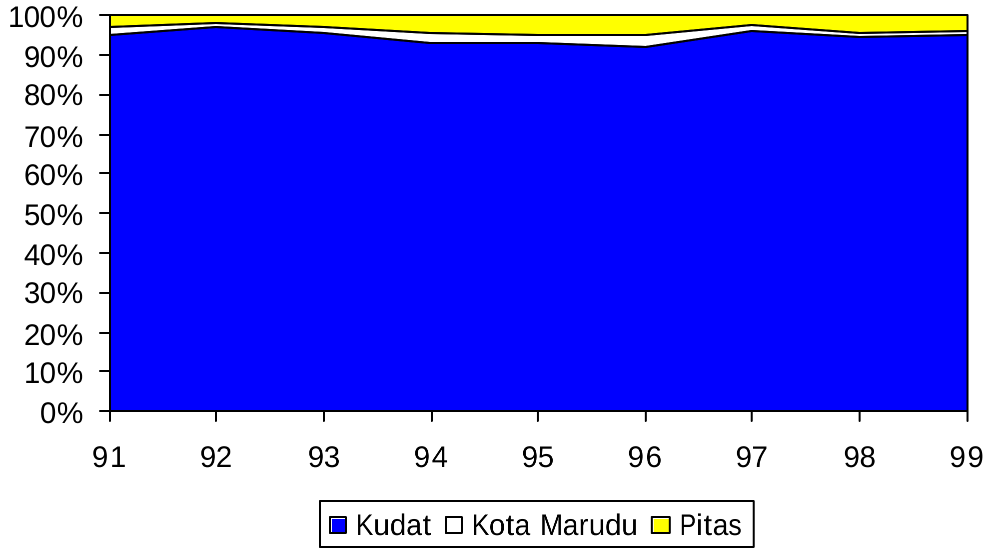


Figure 256m. Temporal distribution of fish landings by resource group in Kudat - SSME-1 area, 1991-1999

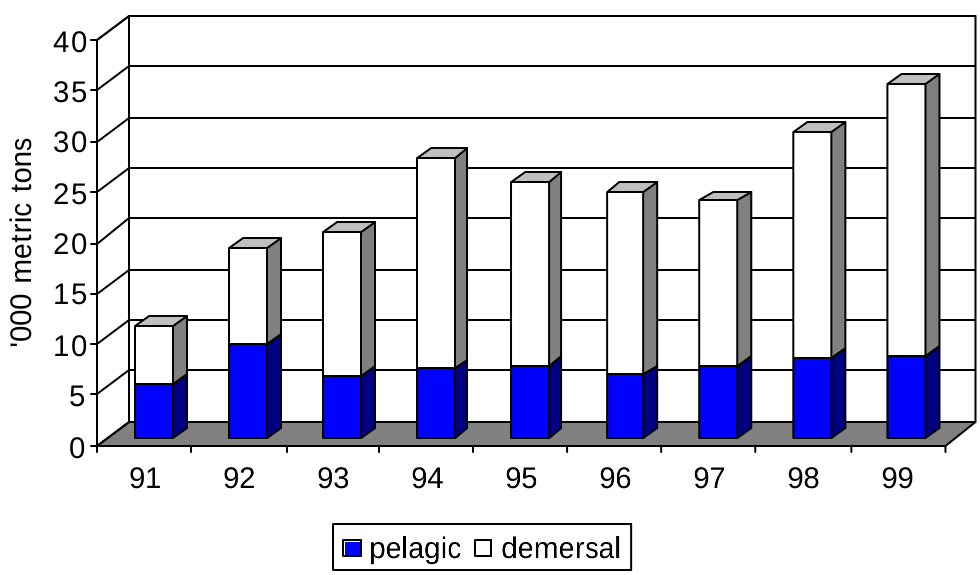


Figure 256n. Temporal distribution of fish landings by resource group in Kudat - SSME-1 area, 1991-1999

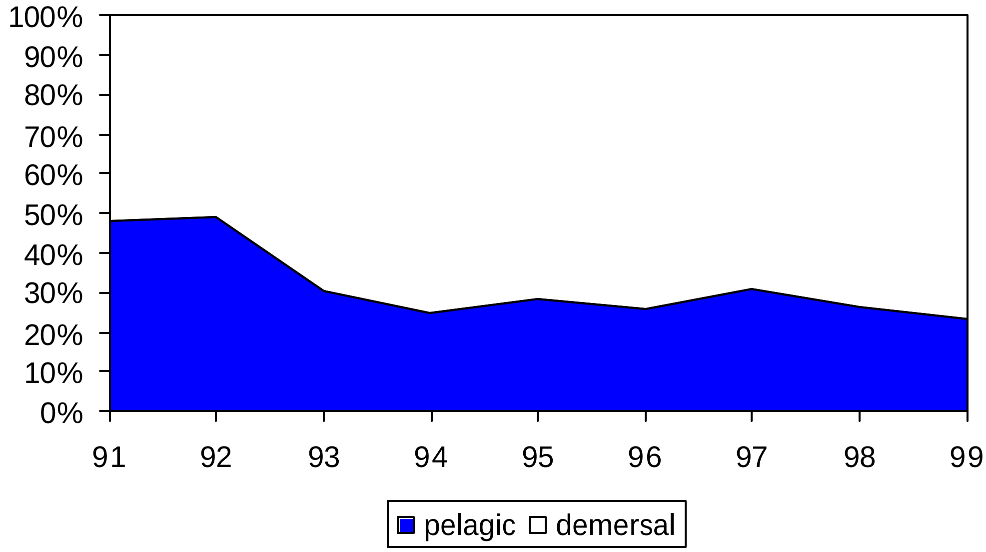


Figure 256o. Temporal distribution of fish landings by resource group in Kota Marudu - SSME-1 area, 1991-1999

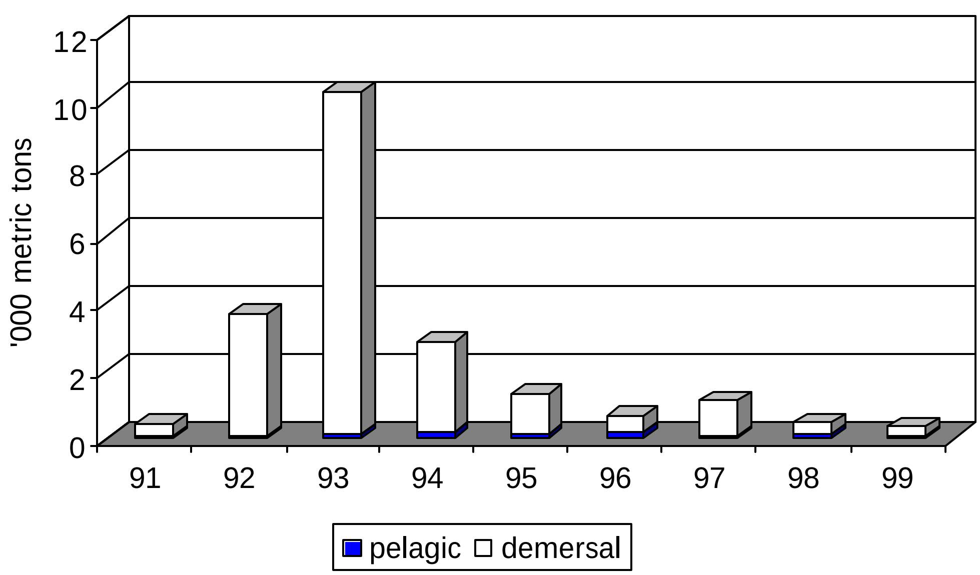


Figure 256p. Temporal distribution of fish landings by resource group in Kota Marudu - SSME-1 area, 1991-1999

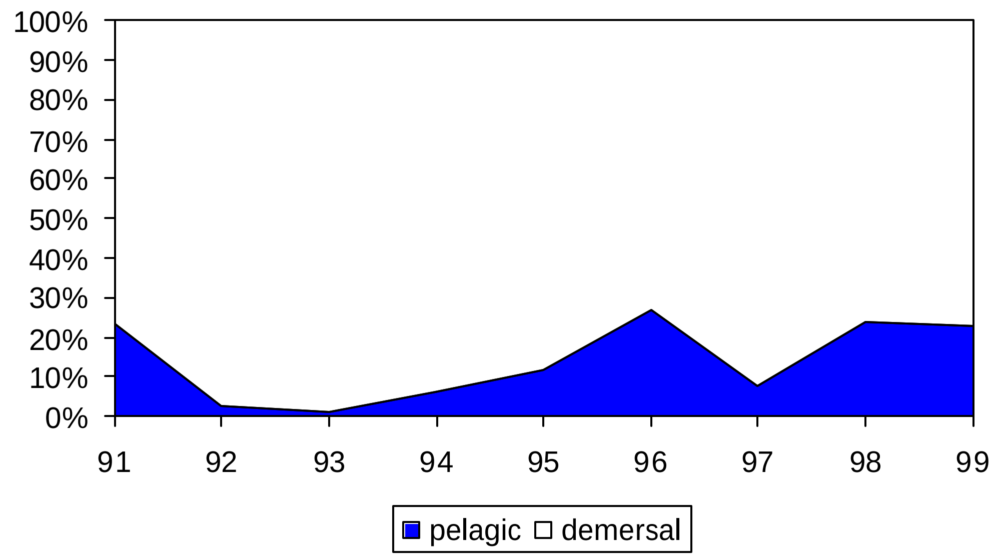


Figure 256q. Temporal distribution of fish landings by resource group in Pitas - SSME-1 area, 1991-1999

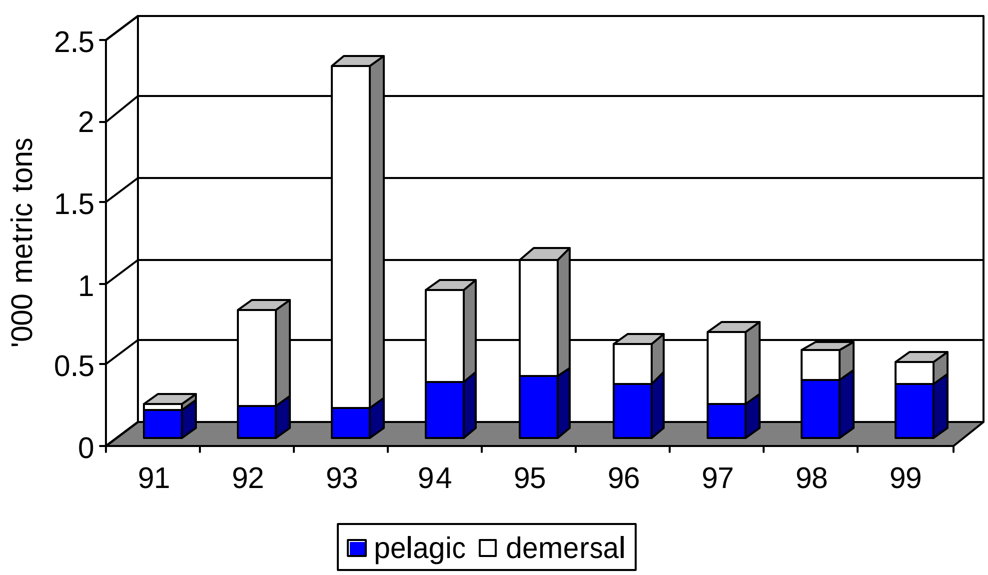


Figure 256r. Temporal distribution of fish landings by resource group in Pitas - SSME-1 area, 1991-1999

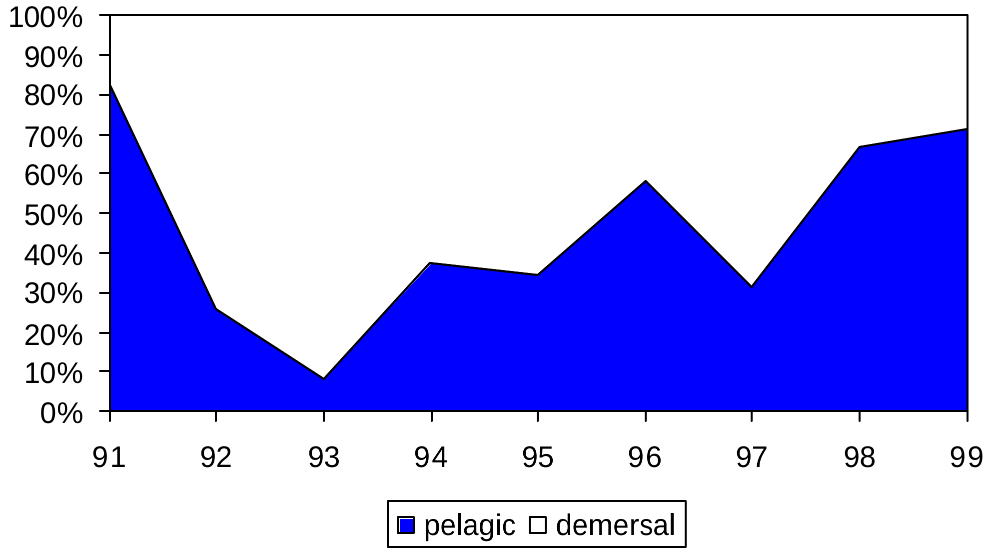


Figure 257a. Temporal distribution of demersal landings by resource type in the SSME-2 area, 1991-1999

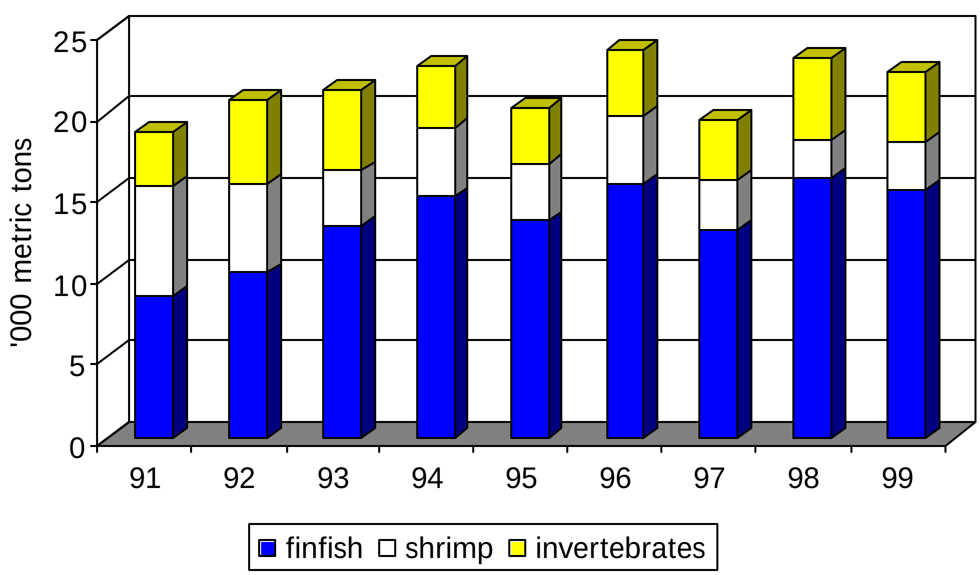


Figure 257b. Temporal distribution of demersal landings by resource type in the SSME-2 area, 1991-1999

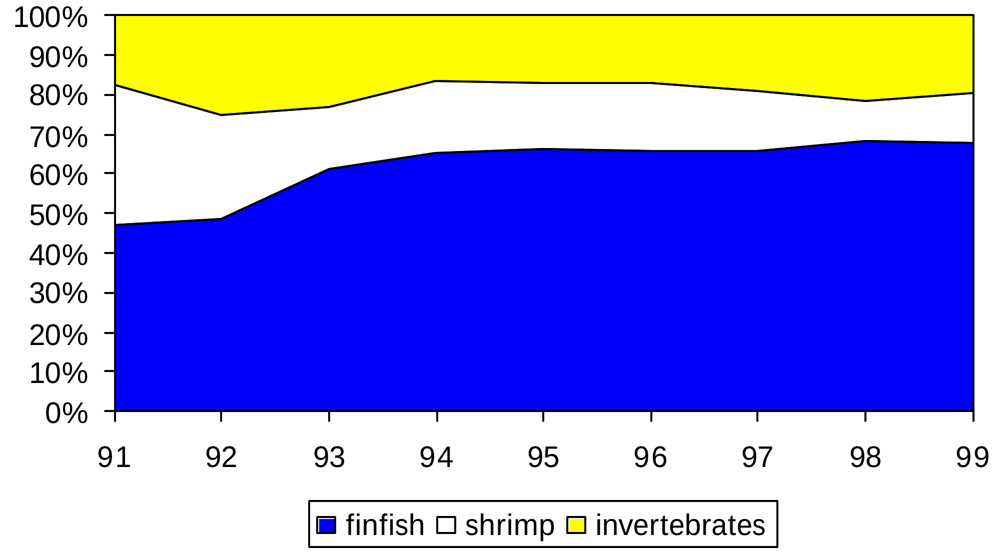


Figure 257c. Temporal distribution of regional demersal landings in the SSME-2 area, 1991-1999

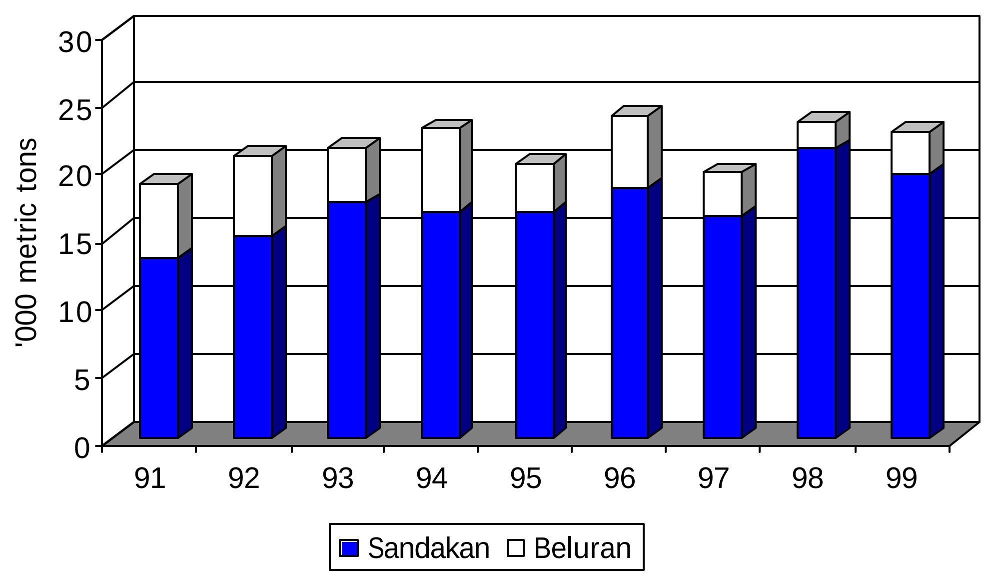


Figure 257d. Temporal distribution of regional demersal landings in the SSME area2, 1991-1999

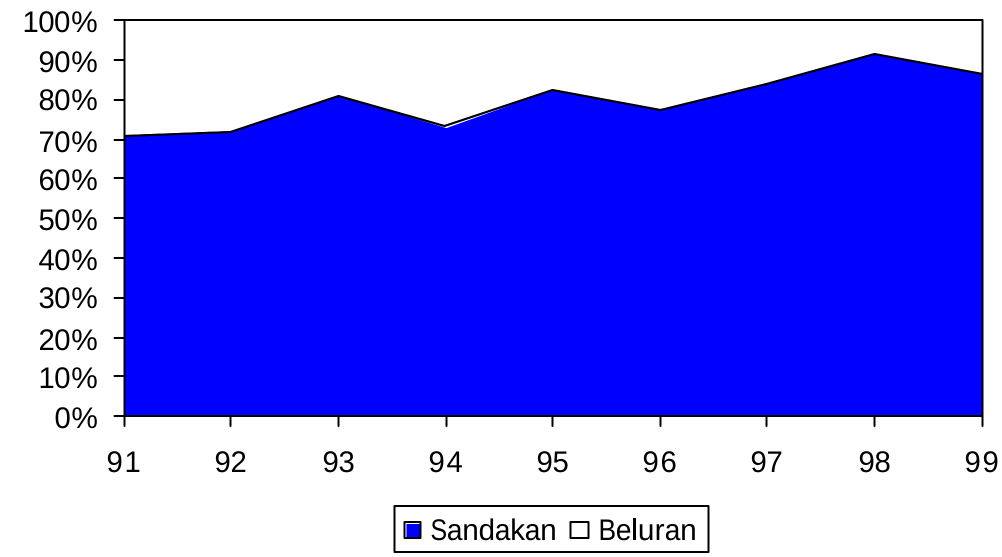


Figure 257e. Temporal distribution of regional demersal finfish landings in the SSME-2 area, 1991-1999

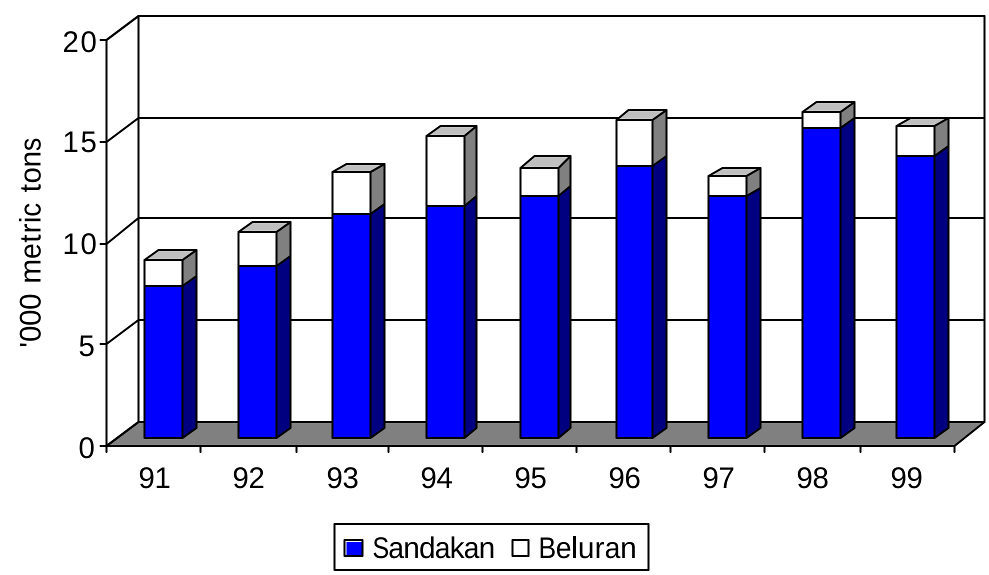


Figure 257f. Temporal distribution of regional demersal finfish landings in the SSME-2 area, 1991-1999

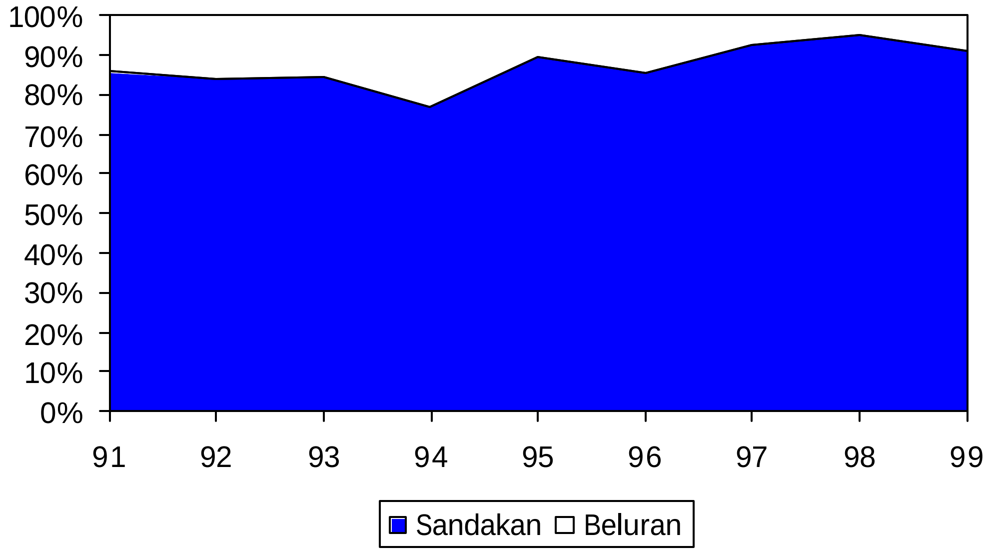


Figure 257g. Temporal distribution of regional demersal invertebrate landings in the SSME-2 area, 1991-1999

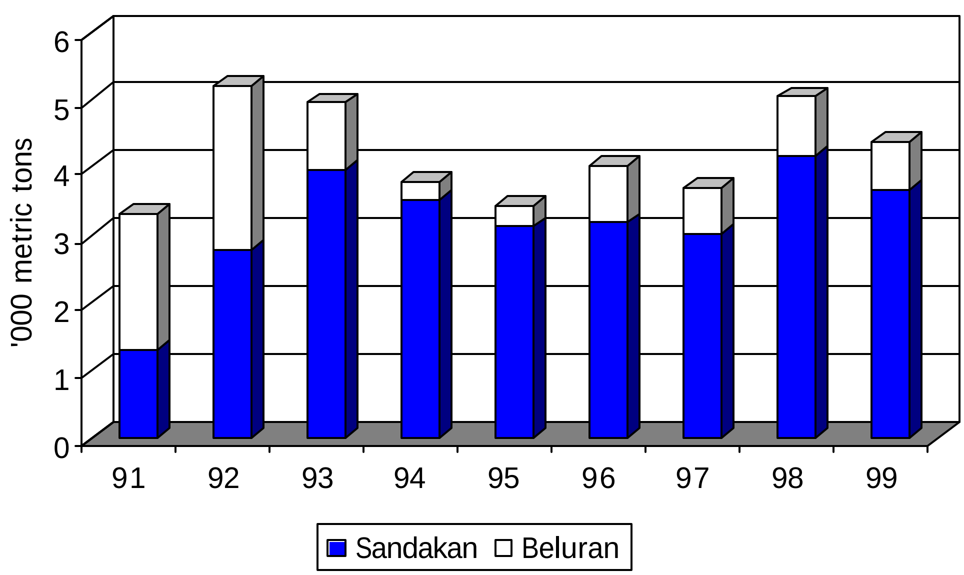


Figure 257h. Temporal distribution of regional demersal invertebrate landings in the SSME-2 area, 1991-1999

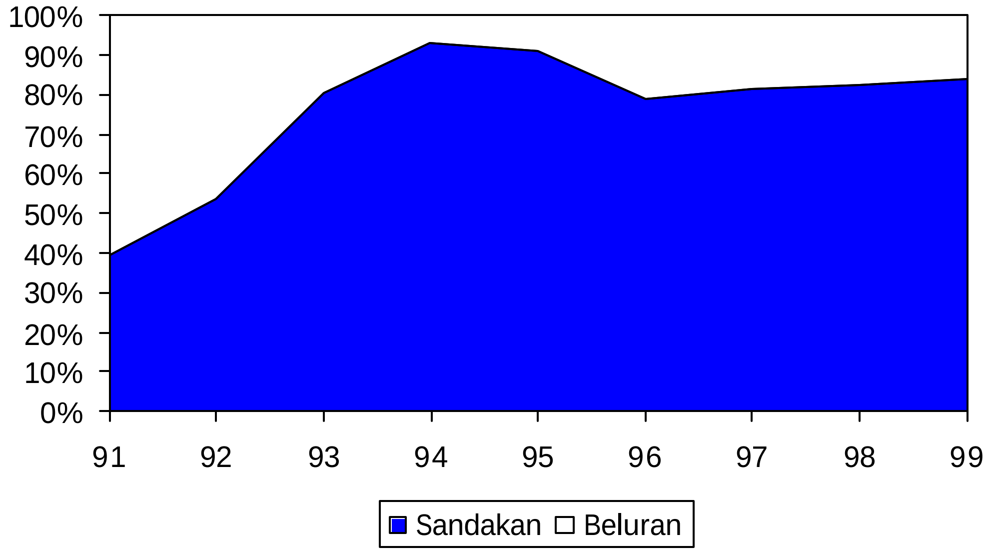


Figure 257i. Temporal distribution of regional shrimp landings in the SSME-2 area, 1991-1999

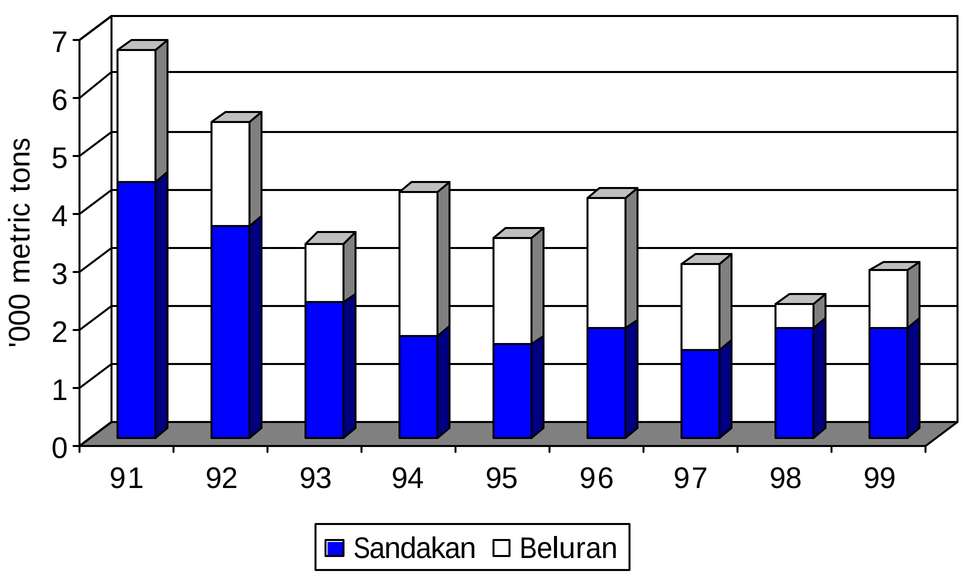


Figure 257j. Temporal distribution of regional shrimp landings in the SSME-2 area, 1991-1999

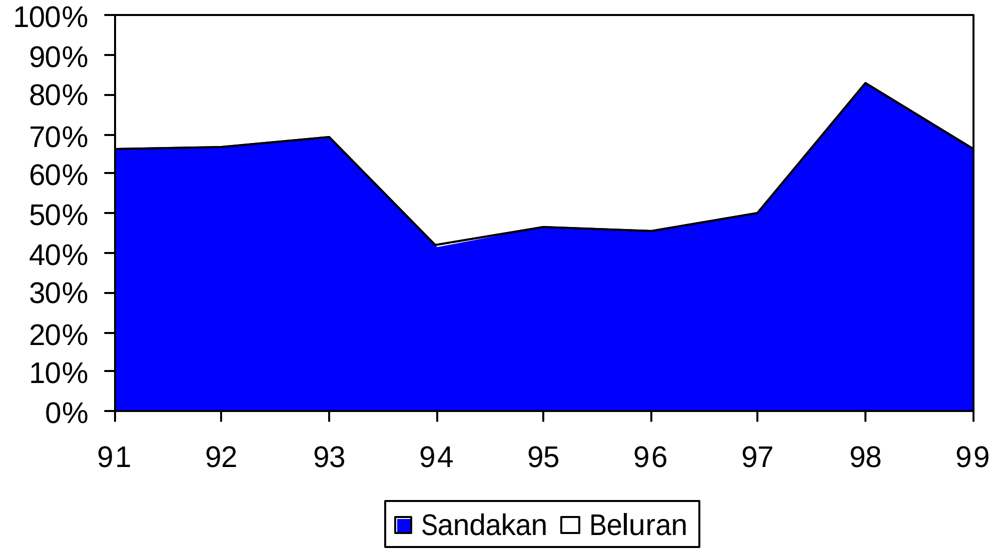


Figure 257k. Temporal distribution of regional pelagic landings in the SSME-2 area, 1991-1999

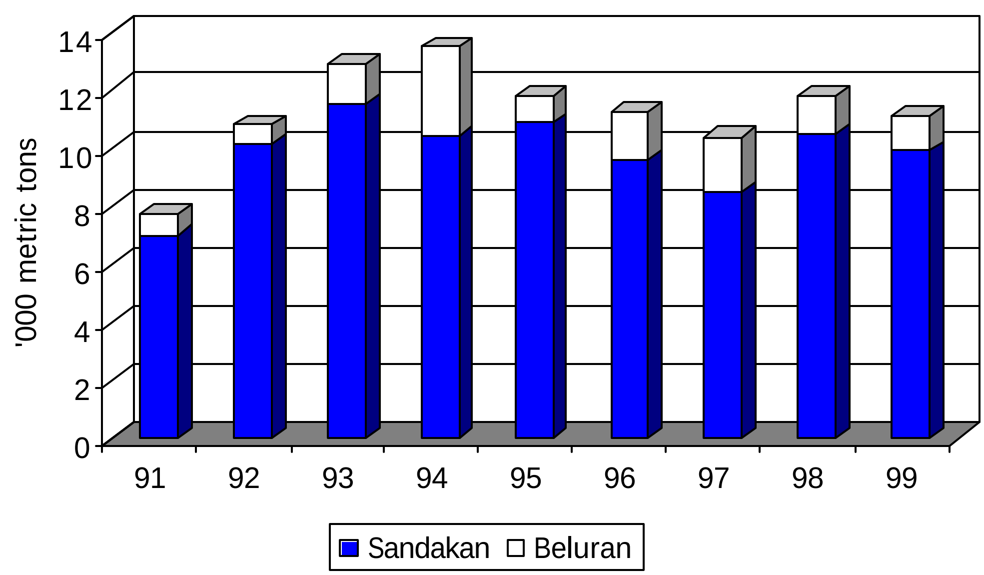


Figure 257l. Temporal distribution of regional pelagic landings in the SSME-2 area, 1991-1999

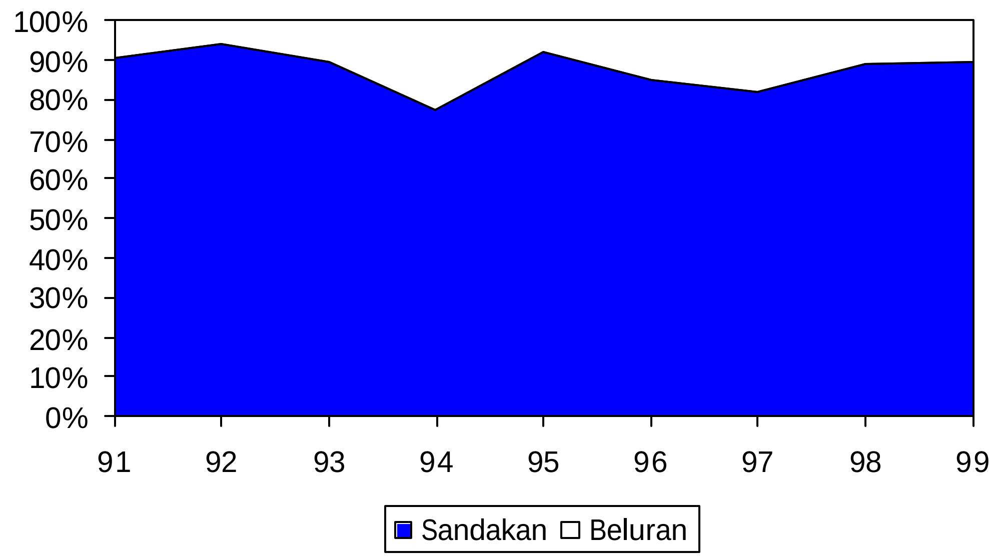


Figure 257m. Temporal distribution of fish landings by resource group in Sandakan - SSME-2 area, 1991-1999

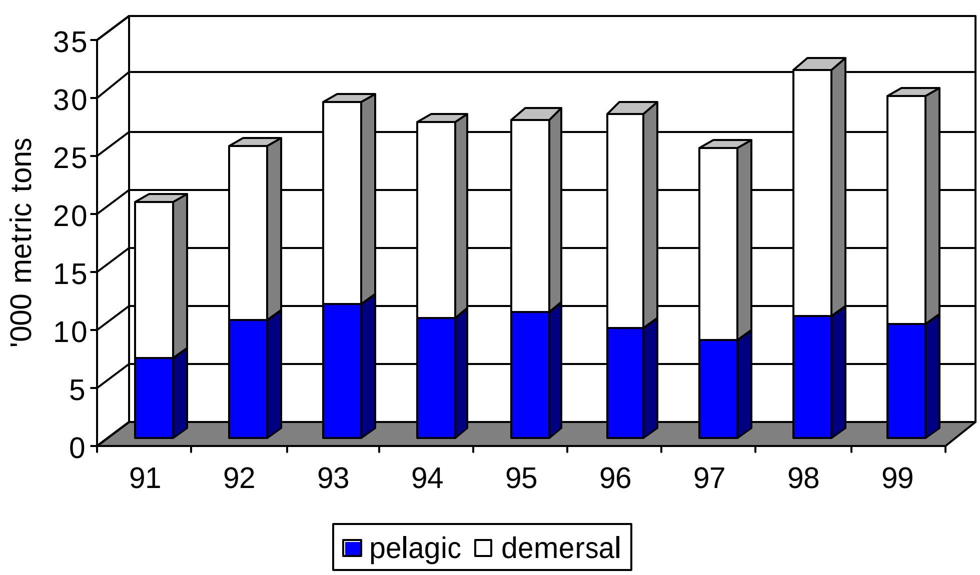


Figure 257n. Temporal distribution of fish landings by resource group in Sandakan - SSME-2 area, 1991-1999

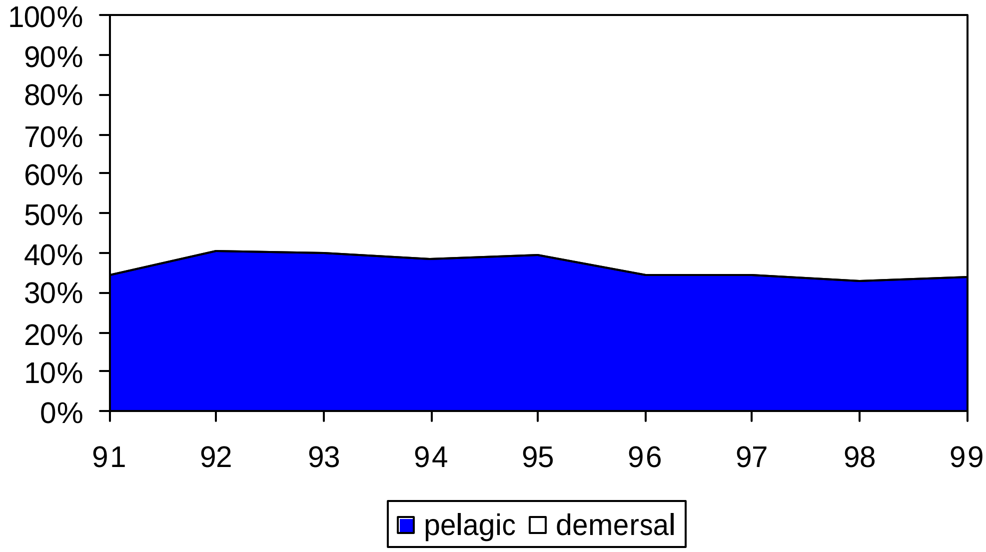


Figure 257o. Temporal distribution of fish landings by resource group in Beluran - SSME-2 area, 1991-1999

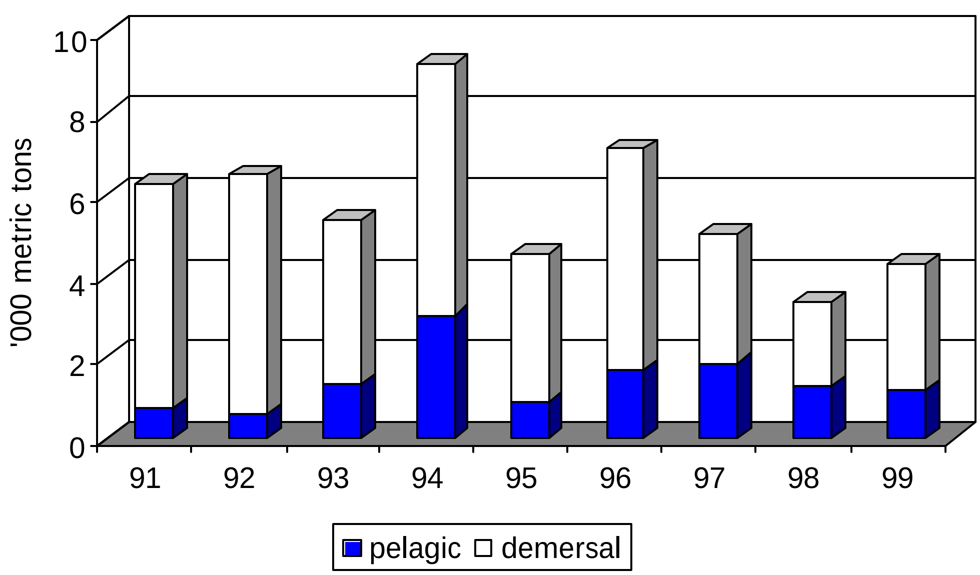


Figure 257p. Temporal distribution of fish landings by resource group in Beluran - SSME-2 area, 1991-1999

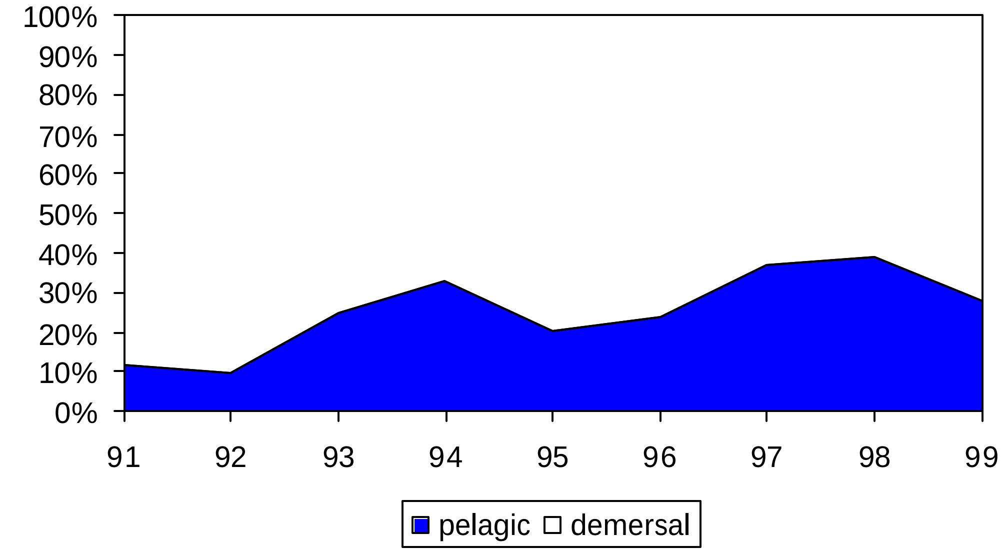


Figure 258a. Temporal distribution of demersal landings by resource type in the SSME-3 area, 1991-1999

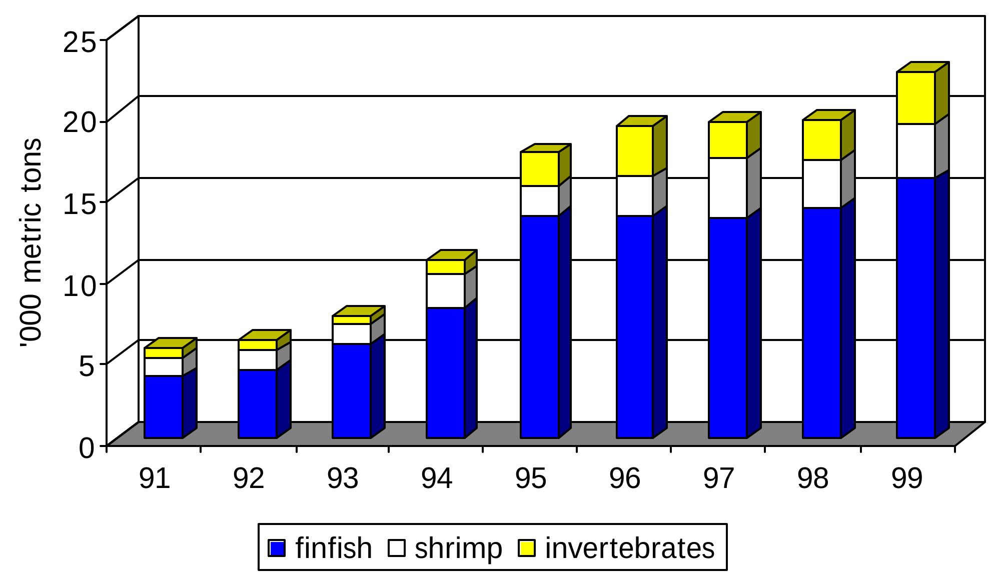


Figure 258b. Temporal distribution of demersal landings by resource type in the SSME-3 area, 1991-1999

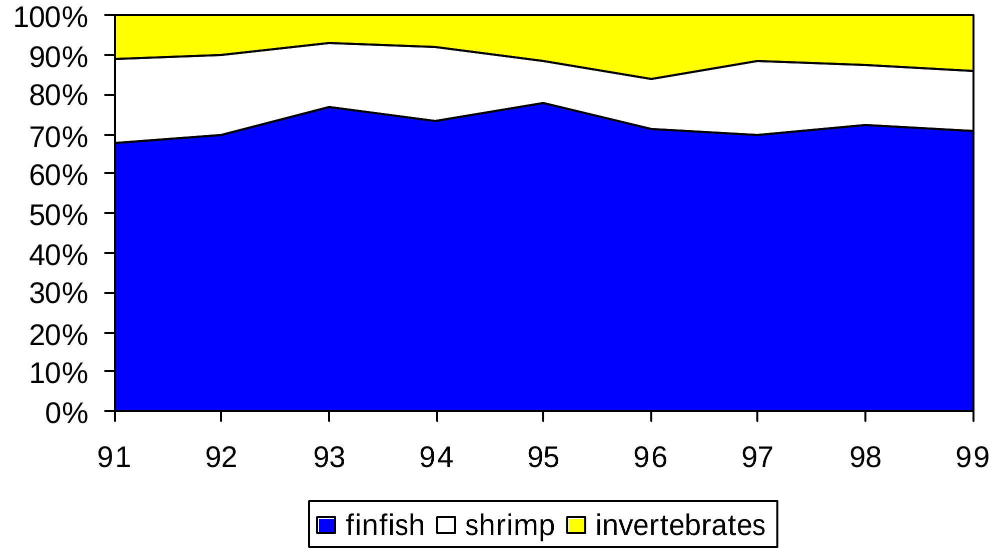


Figure 258c. Temporal distribution of regional demersal landings in the SSME-3 area, 1991-1999

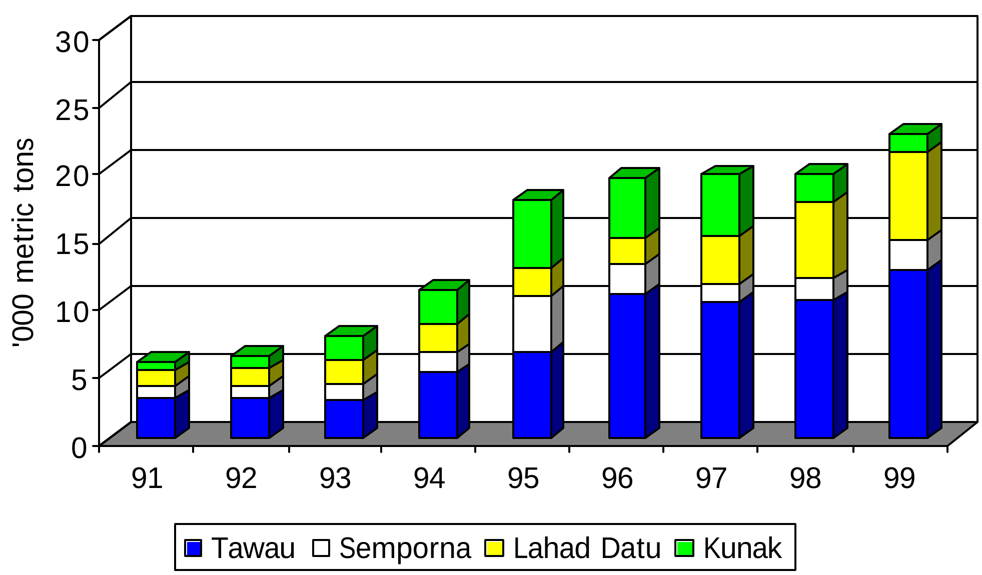


Figure 258d. Temporal distribution of regional demersal landings in the SSME-3 area, 1991-1999

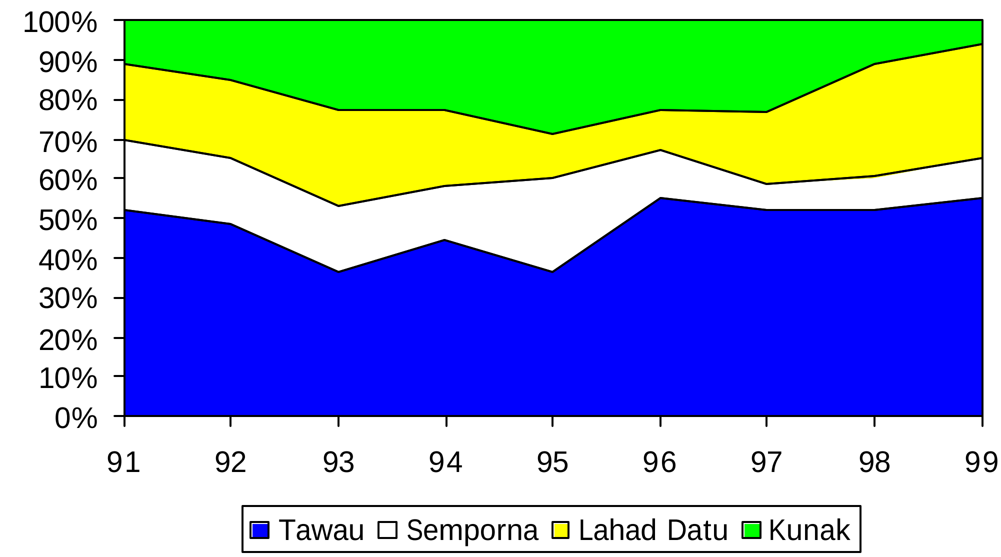


Figure 258e. Temporal distribution of regional demersal finfish landings in the SSME-3 area, 1991-1999

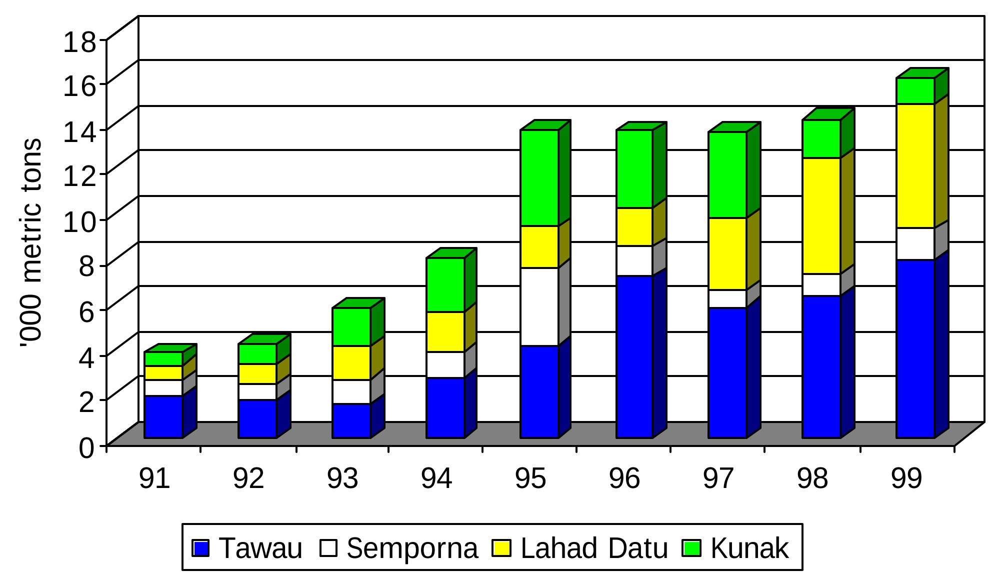


Figure 258f. Temporal distribution of regional demersal finfish landings in the SSME-3 area, 1991-1999

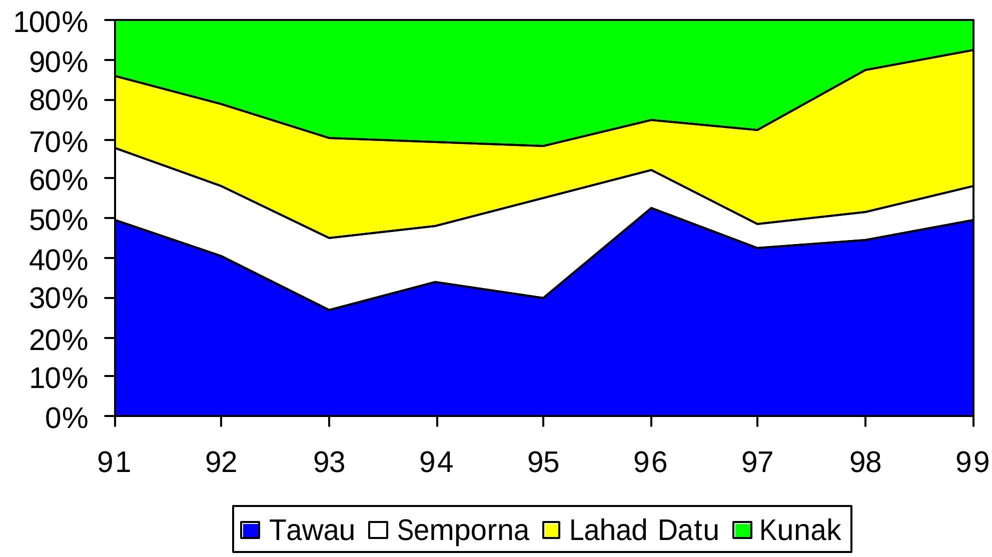


Figure 258g. Temporal distribution of regional demersal invertebrate landings in the SSME-3 area, 1991-1999

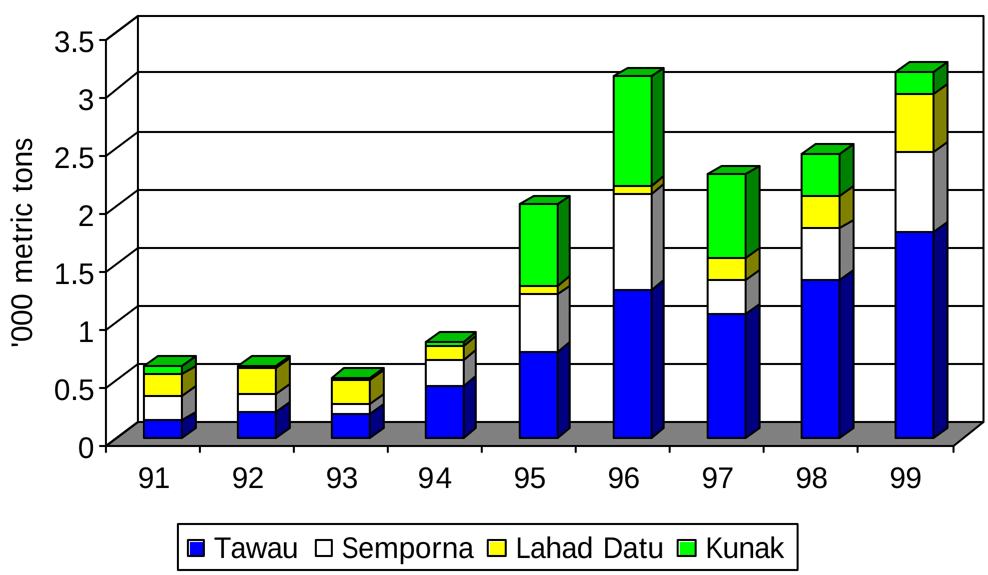


Figure 258h. Temporal distribution of regional demersal invertebrate landings in the SSME-3 area, 1991-1999

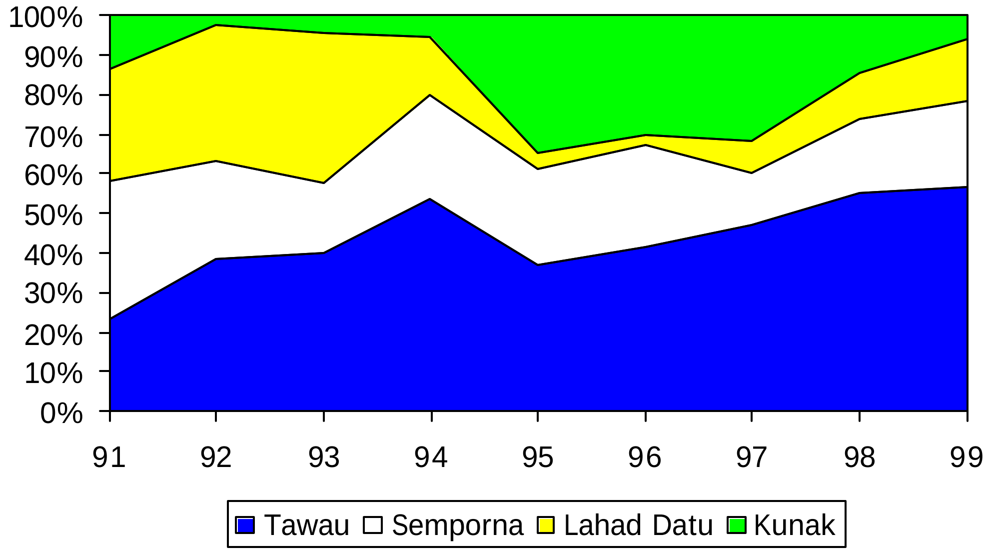


Figure 258i. Temporal distribution of regional shrimp landings in the SSME-3 area, 1991-1999

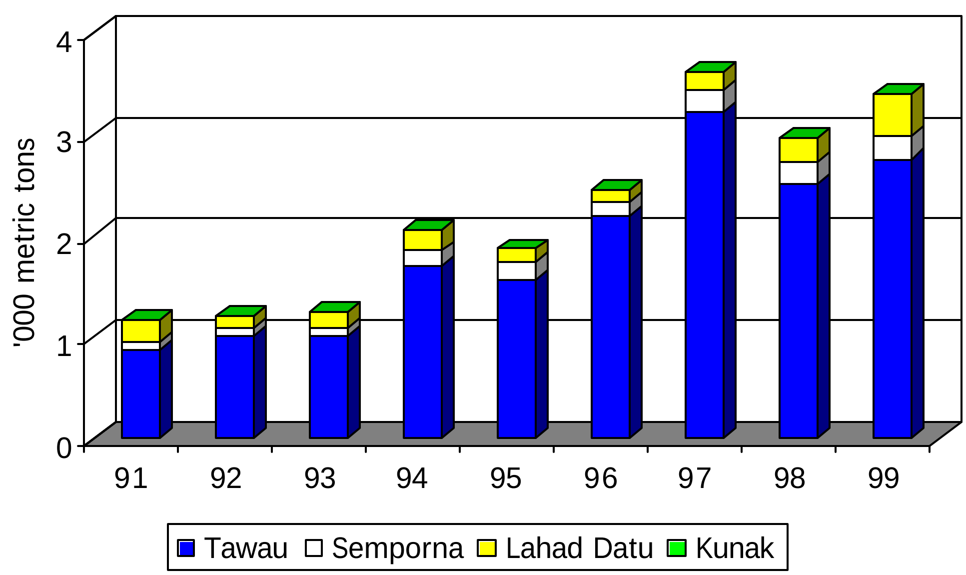


Figure 258j. Temporal distribution of regional shrimp landings in the SSME-3 area, 1991-1999

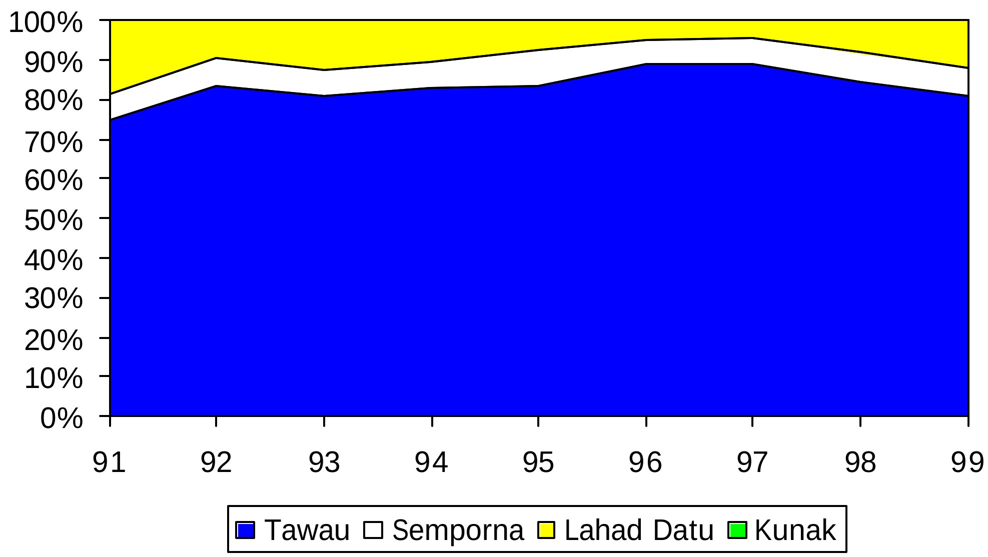


Figure 258k. Temporal distribution of regional pelagic landings in the SSME-3 area, 1991-1999

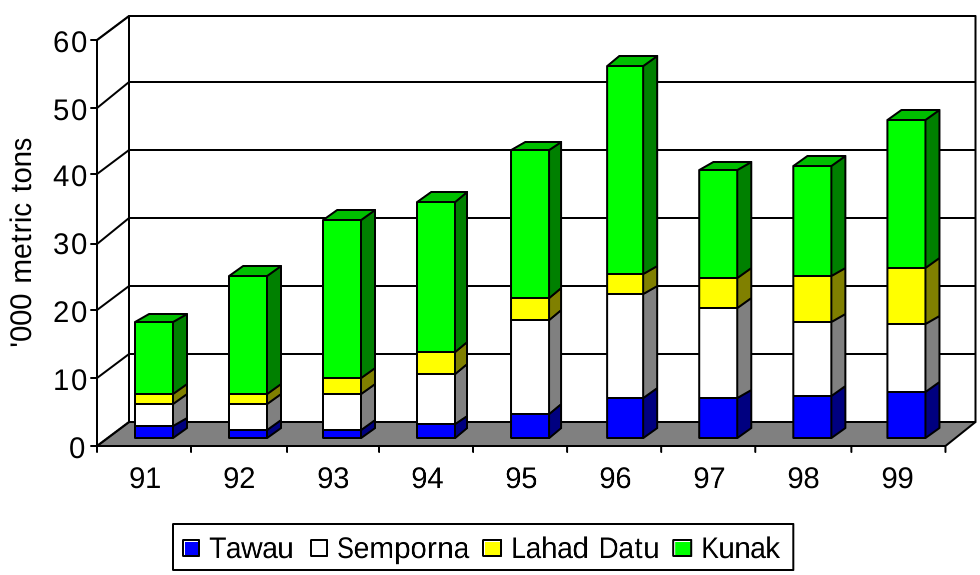


Figure 258l. Temporal distribution of regional pelagic landings in the SSME-3 area, 1991-1999

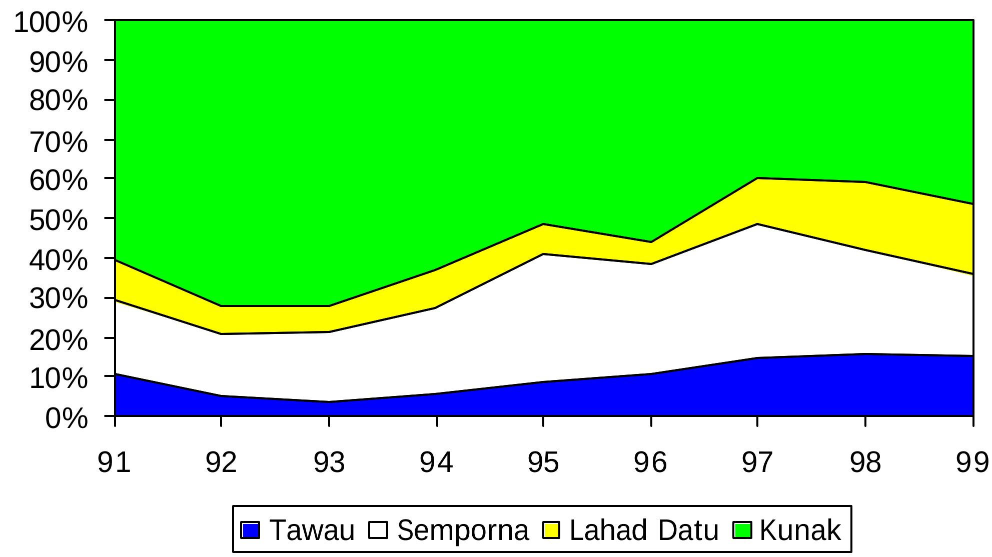


Figure 258m. Temporal distribution of fish landings by resource group in Tawau - SSME-3 area, 1991-1999

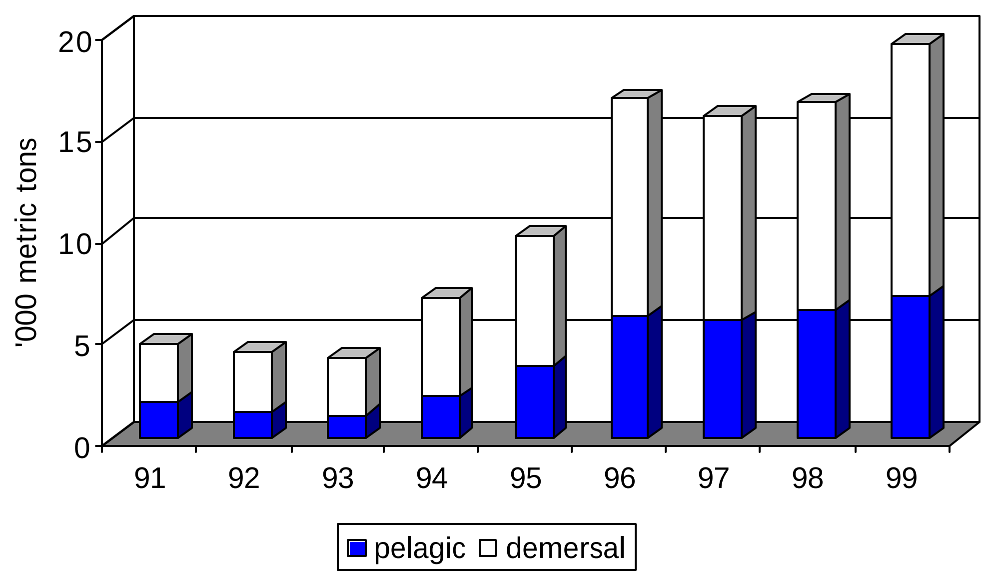


Figure 258n. Temporal distribution of fish landings by resource group in Tawau - SSME-3 area, 1991-1999

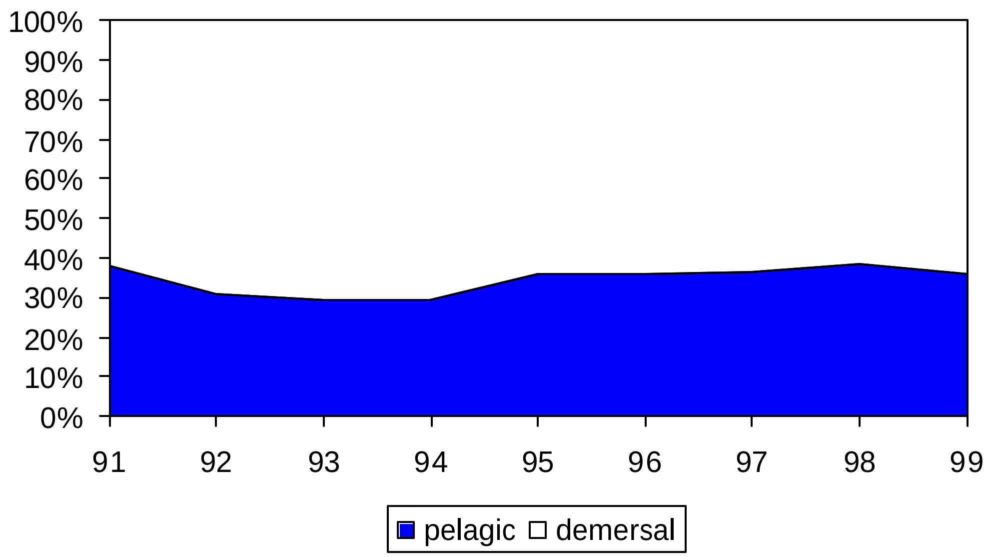


Figure 258o. Temporal distribution of fish landings by resource group in Semporna - SSME-3 area, 1991-1999

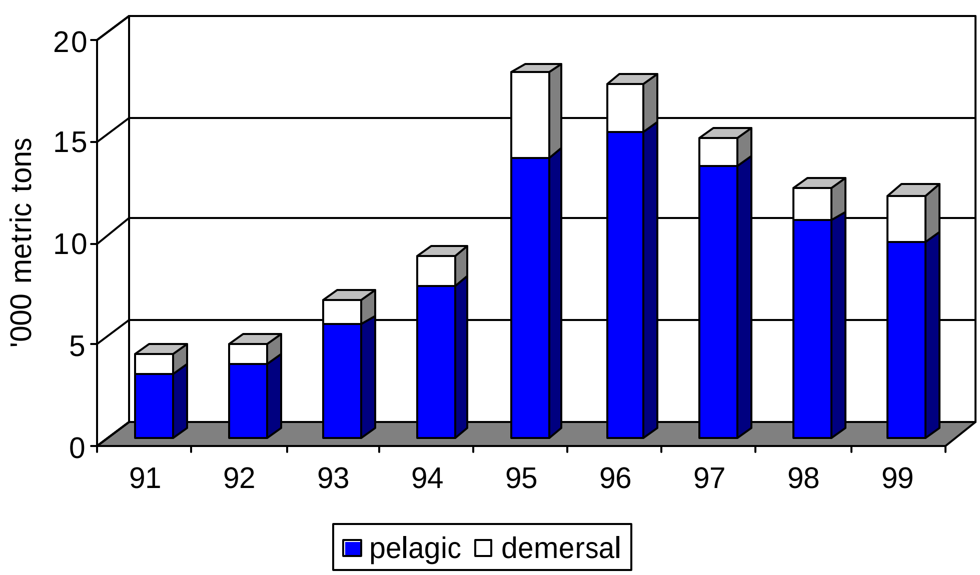


Figure 258p. Temporal distribution of fish landings by resource group in Semporna - SSME-3 area, 1991-1999

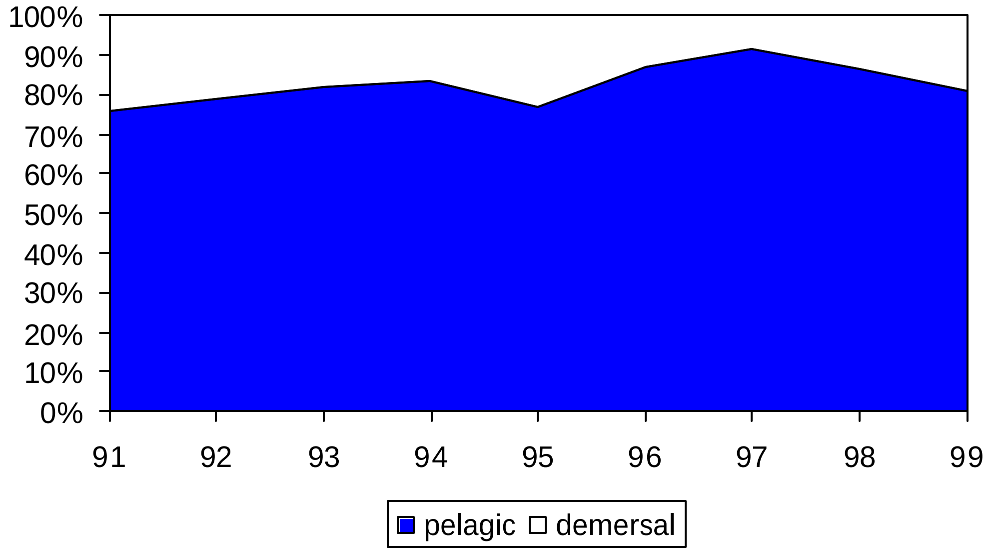


Figure 258q. Temporal distribution of fish landings by resource group in Lahad Datu - SSME-3 area, 1991-1999

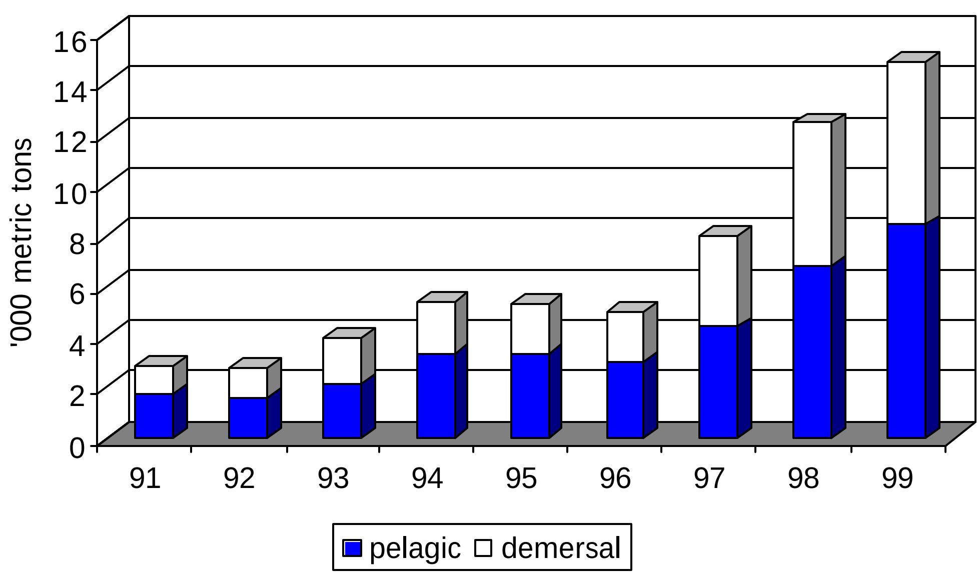


Figure 258r. Temporal distribution of fish landings by resource group in Lahad Datu - SSME-3 area, 1991-1999

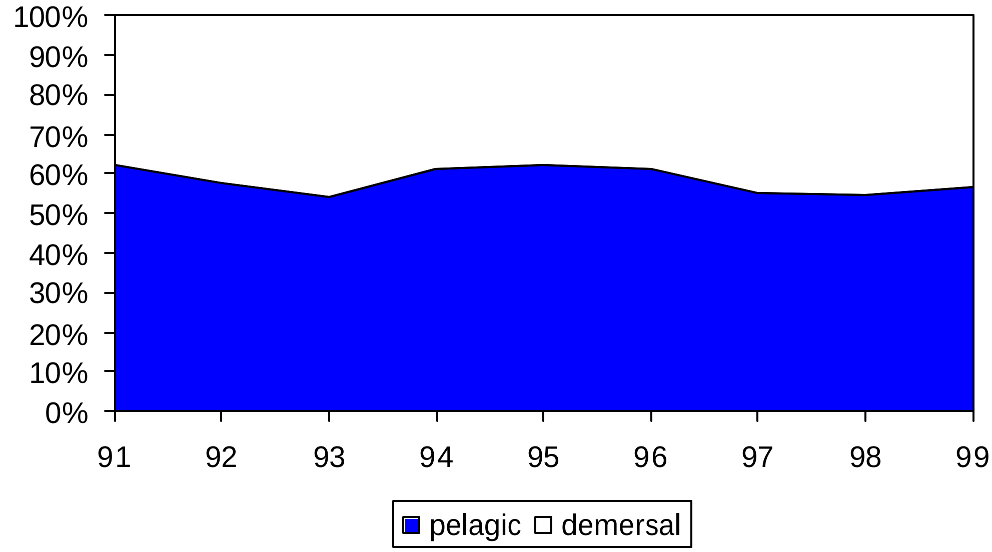


Figure 258s. Temporal distribution of fish landings by resource group in Kunak - SSME-3 area, 1991-1999

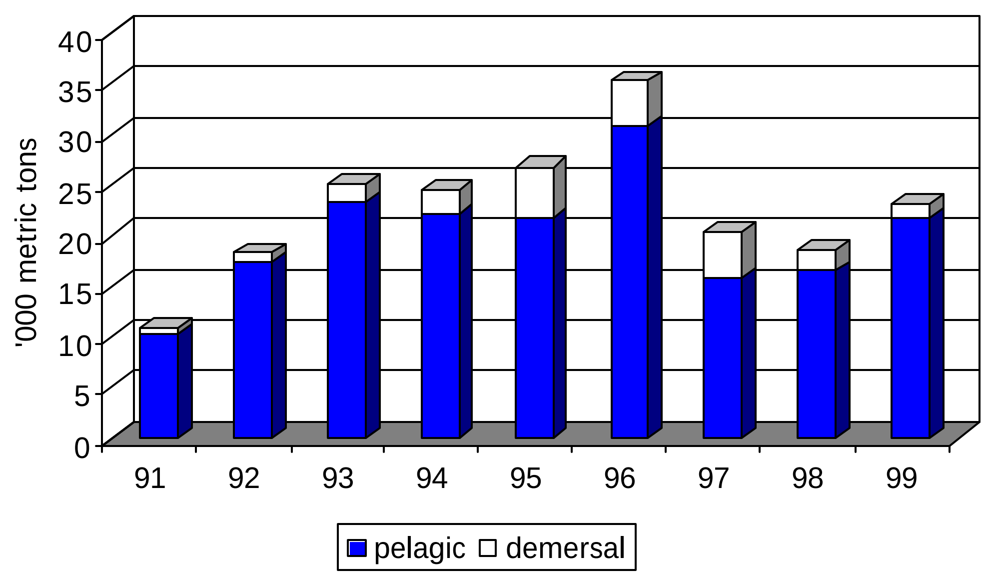


Figure 258t. Temporal distribution of fish landings by resource group in Kunak - SSME-3 area, 1991-1999

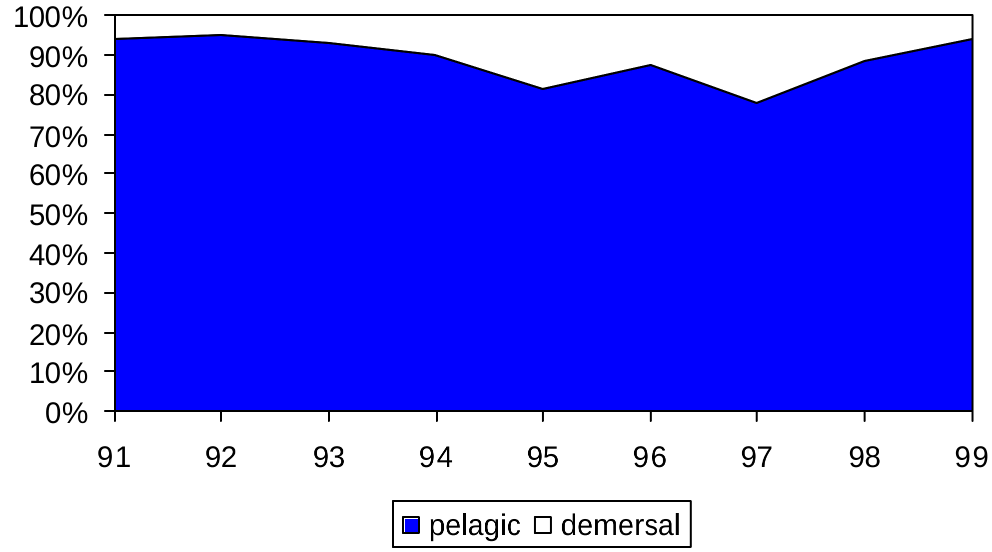


Figure 259a. Temporal distribution of pelagic landings by resource type in Sabah, 1991-1999

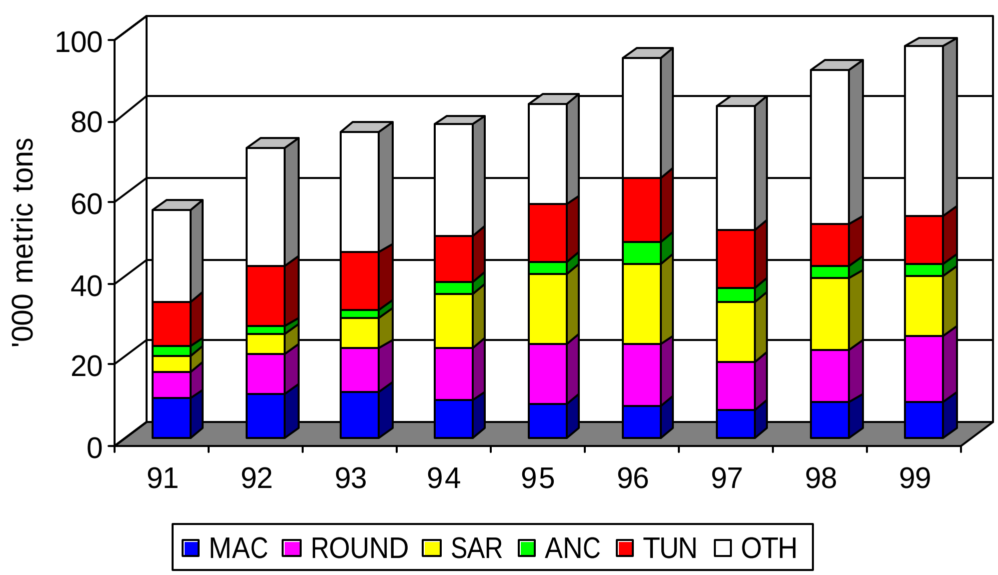


Figure 259b. Temporal distribution of pelagic landings by resource type in Sabah, 1991-1999

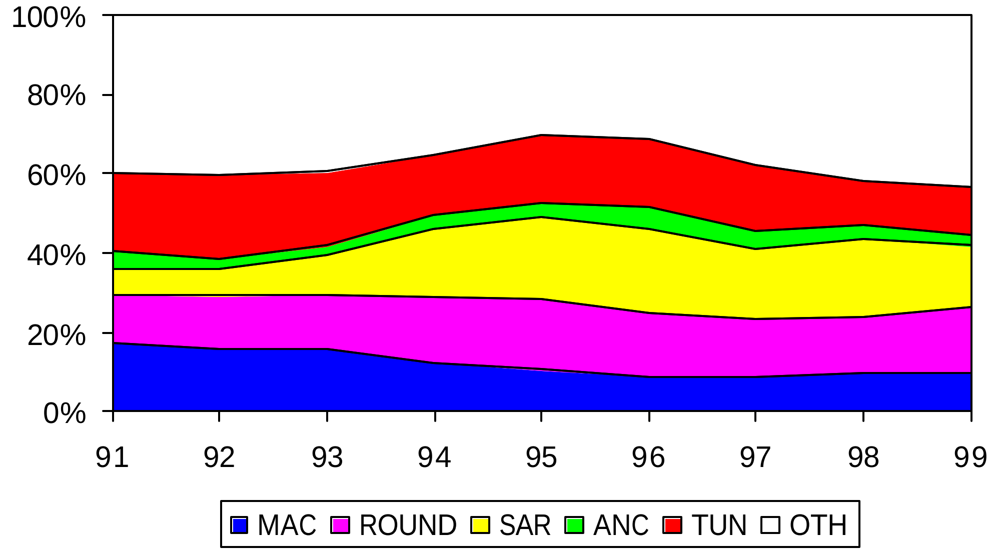


Figure 259c. Temporal distribution of pelagic landings by resource type in the non-SSME area, 1991-1999

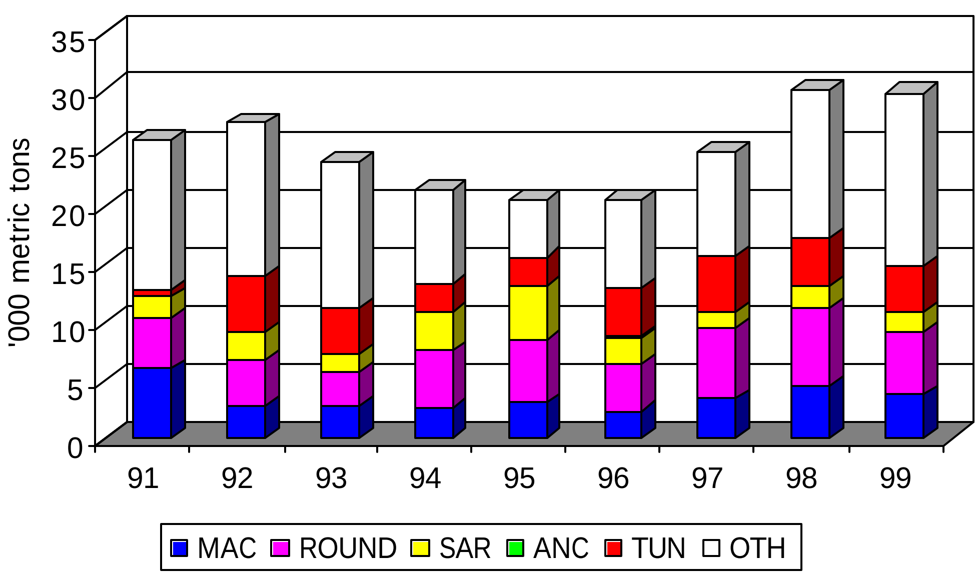


Figure 259d. Temporal distribution of pelagic landings by resource type in the non-SSME area, 1991-1999

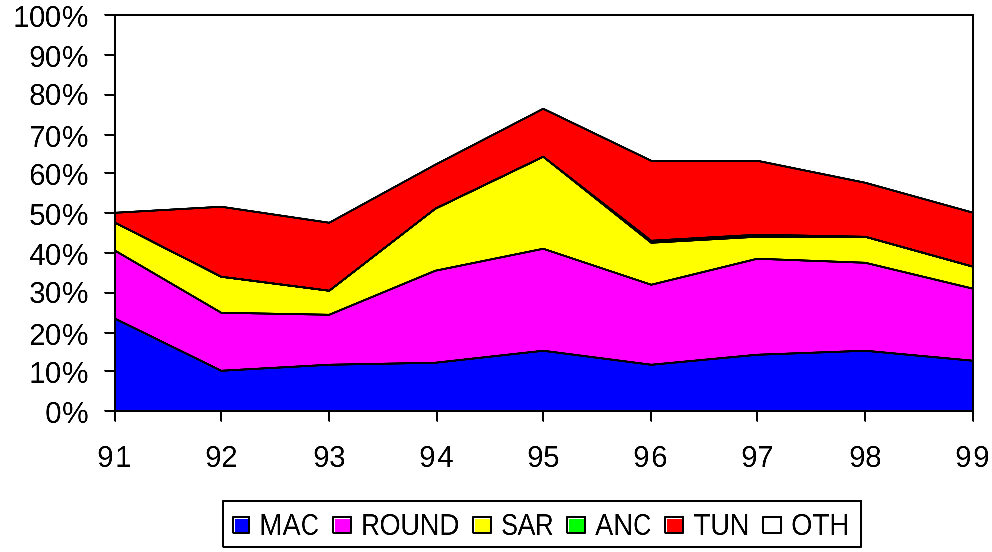


Figure 259e. Temporal distribution of pelagic landings by resource type in the SSME area, 1991-1999

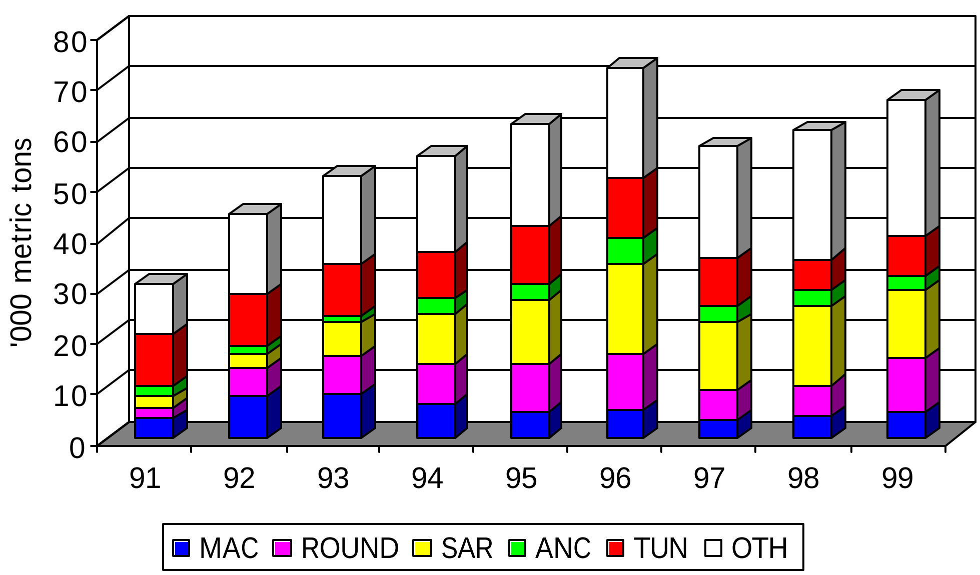


Figure 259f. Temporal distribution of pelagic landings by resource type in the SSME area, 1991-1999

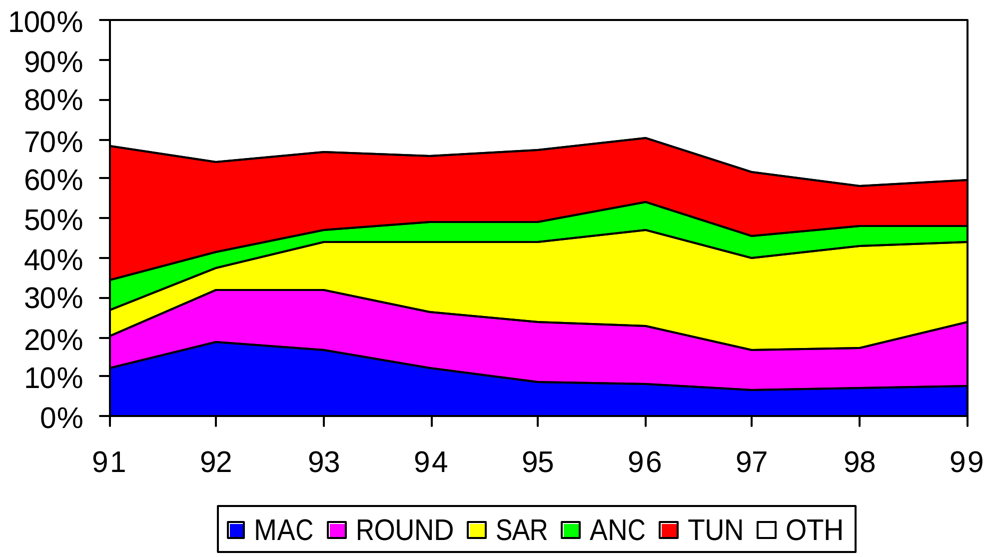


Figure 259g. Temporal distribution of pelagic landings by resource type in the SSME-1 area, 1991-1999

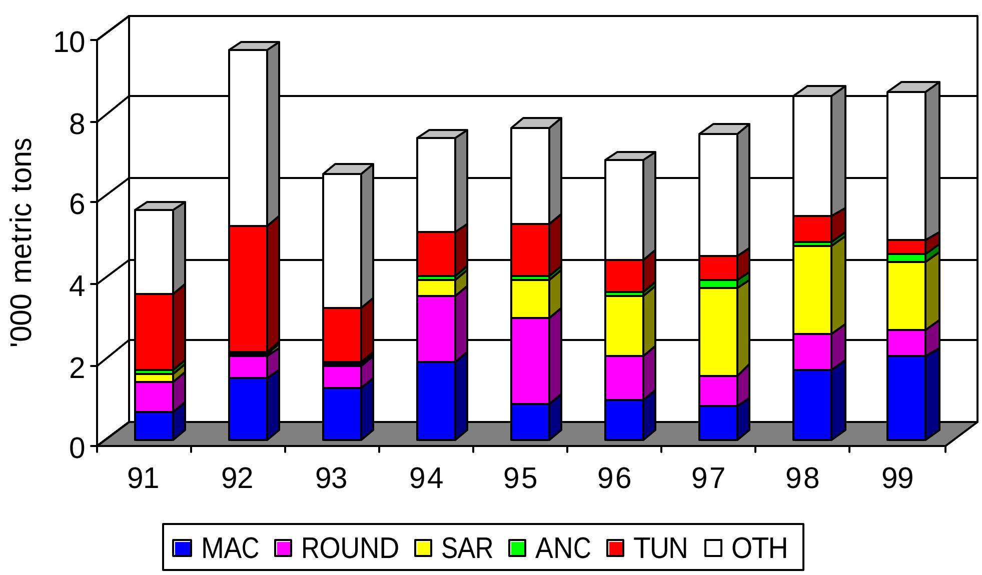


Figure 259h. Temporal distribution of pelagic landings by resource type in the SSME-1 area, 1991-1999

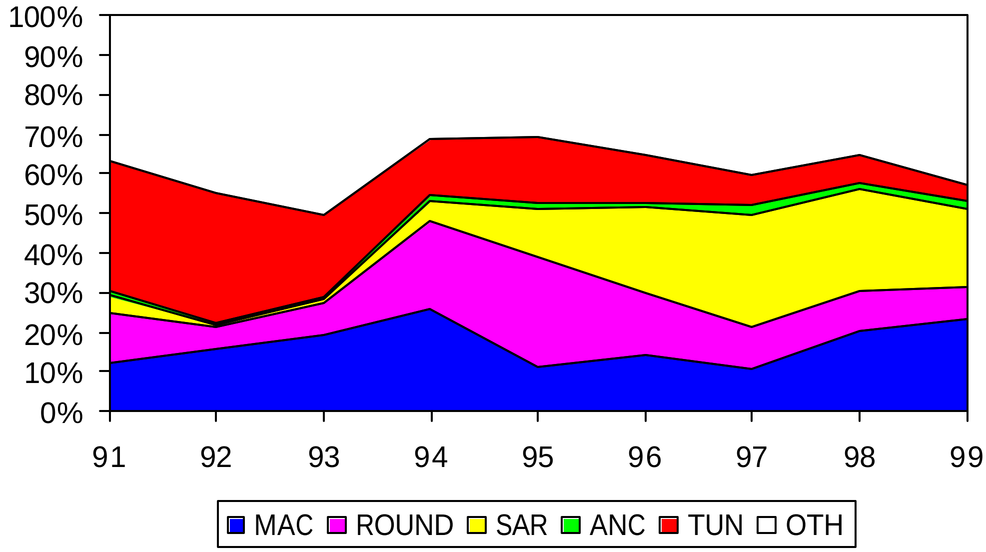


Figure 259i. Temporal distribution of pelagic landings by resource type in the SSME-2 area, 1991-1999

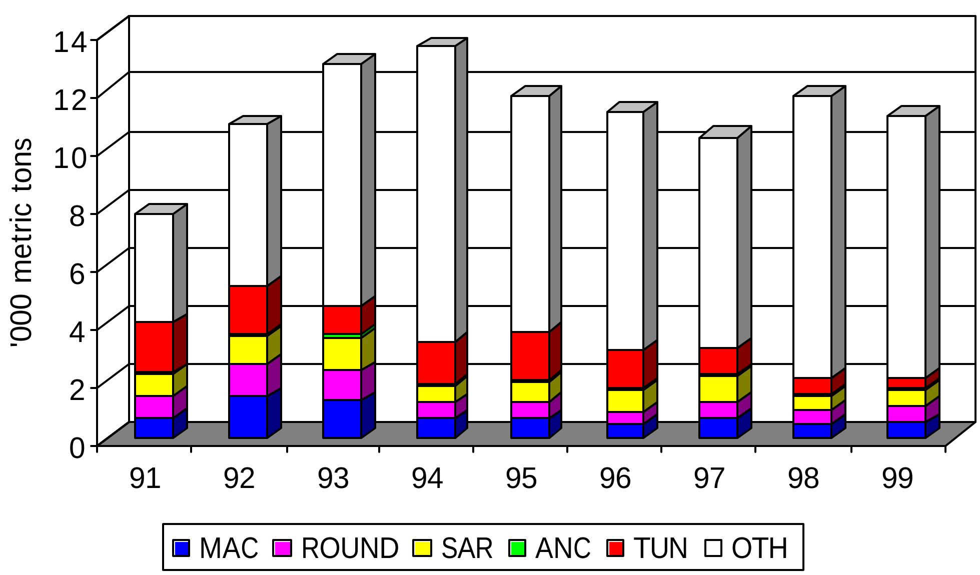


Figure 259j. Temporal distribution of pelagic landings by resource type in the SSME-2 area, 1991-1999

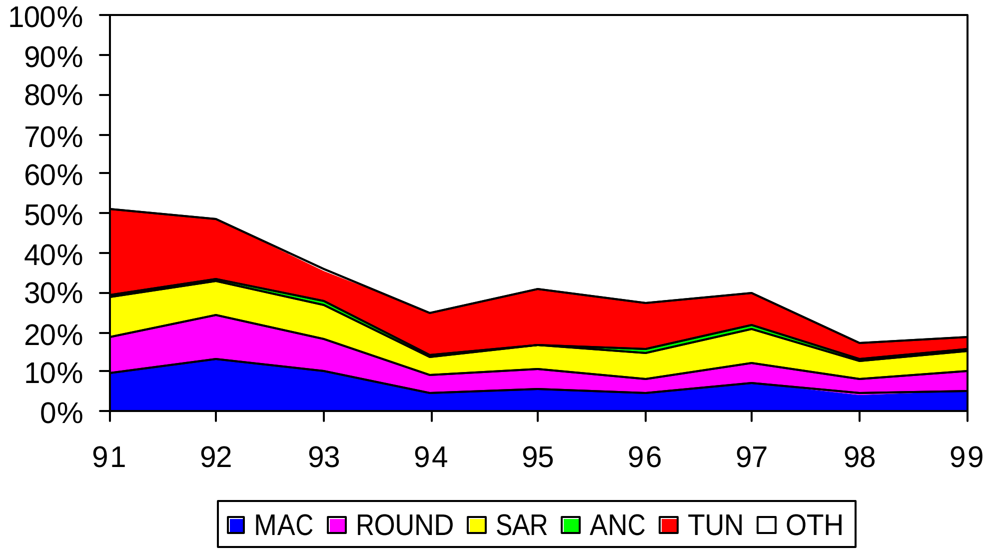


Figure 259k. Temporal distribution of pelagic landings by resource type in the SSME-3 area, 1991-1999

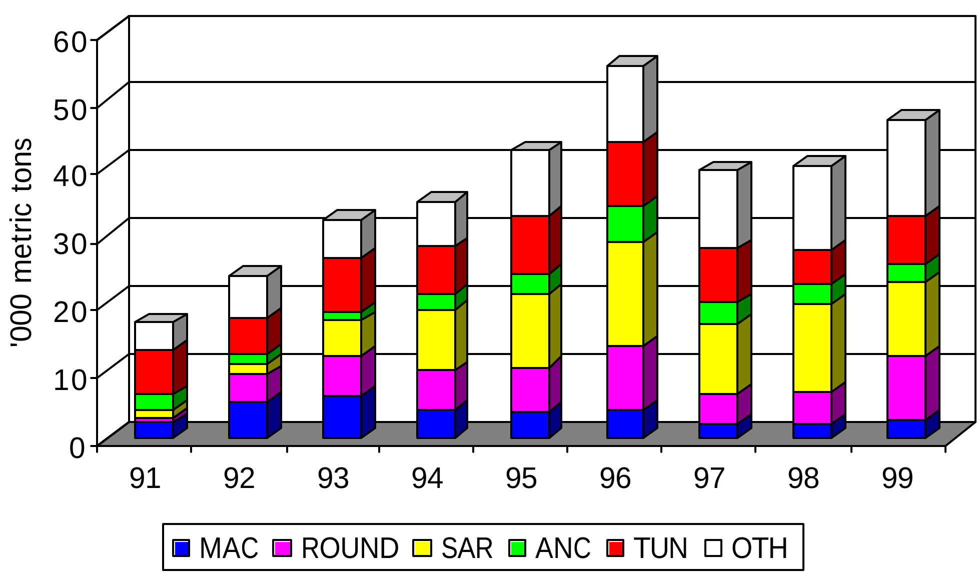


Figure 259l. Temporal distribution of pelagic landings by resource type in the SSME-3 area, 1991-1999

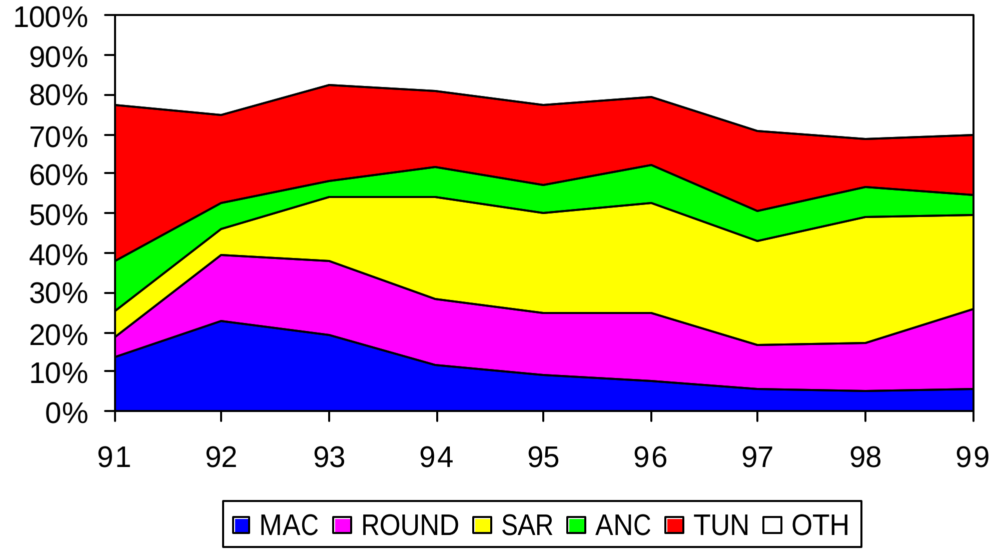


Figure 259m. Temporal distribution of mackerel landings by fishing region in Sabah, 1991-1999

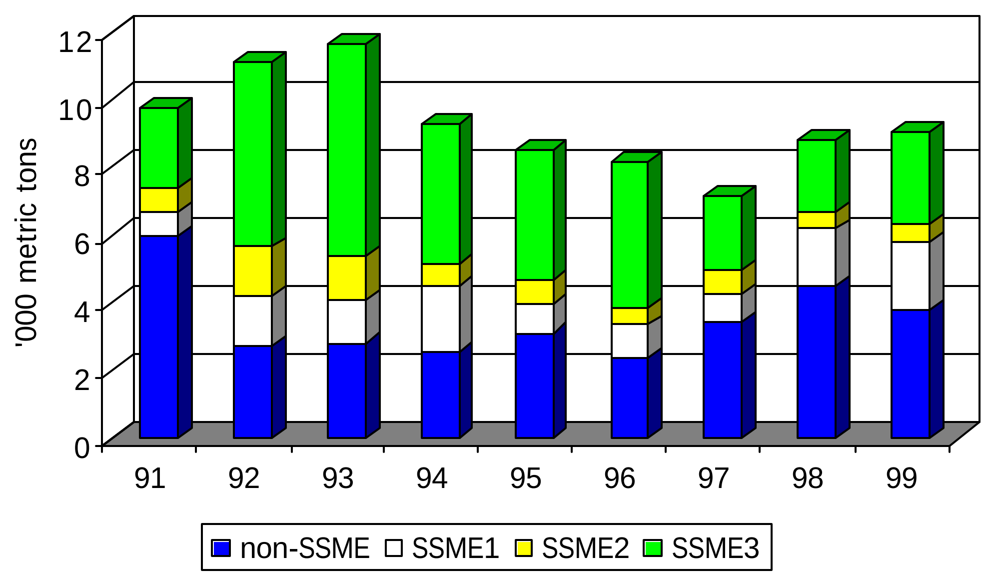


Figure 259n. Temporal distribution of mackerel landings by fishing region in Sabah, 1991-1999

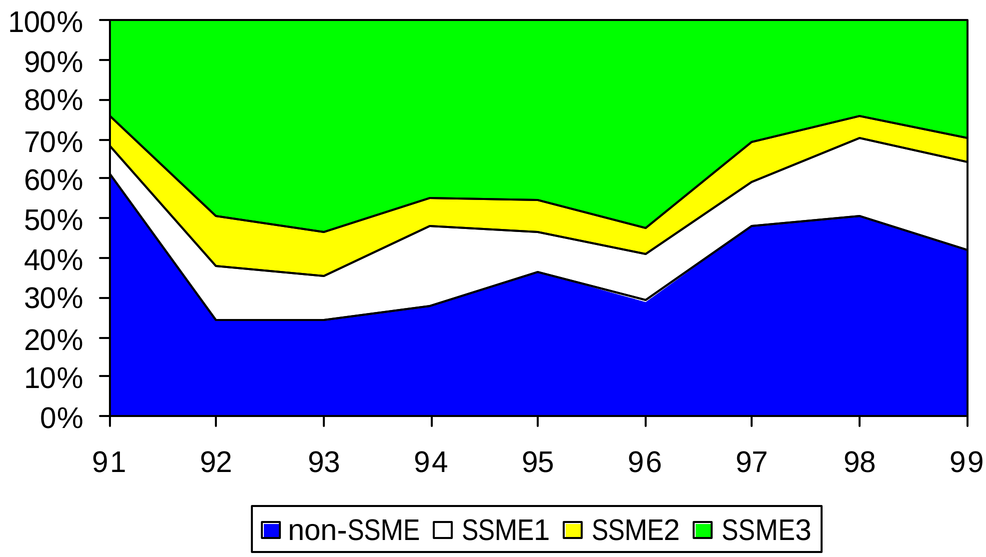


Figure 259o. Temporal distribution of round scad landings by fishing region in Sabah, 1991-1999

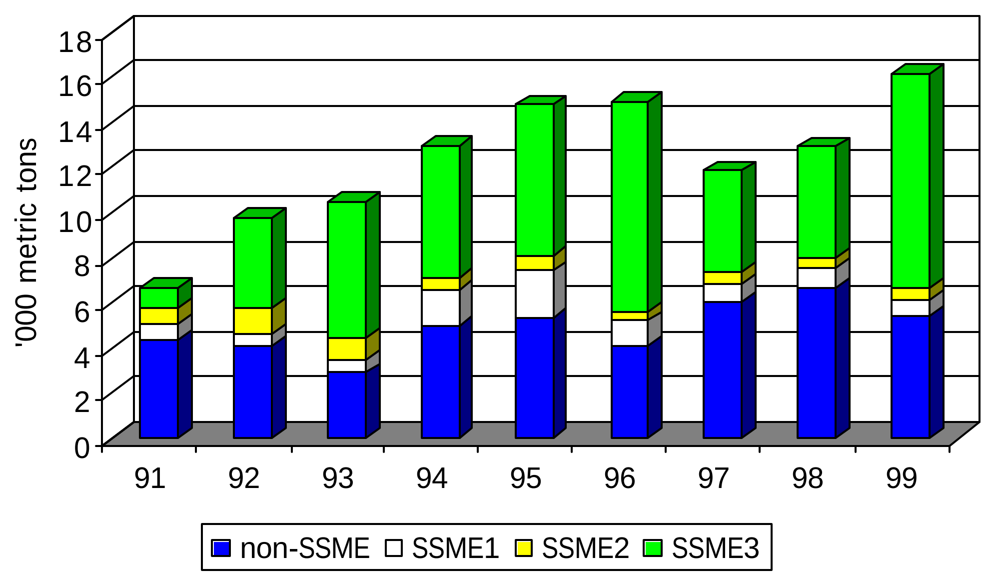


Figure 259p. Temporal distribution of round scad landings by fishing region in Sabah, 1991-1999

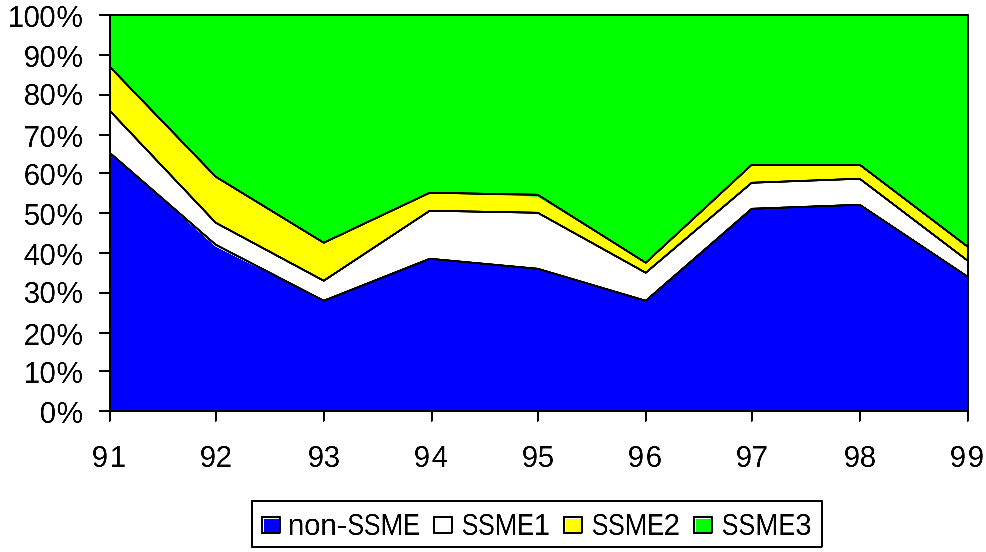


Figure 259q. Temporal distribution of sardine landings by fishing region in Sabah, 1991-1999

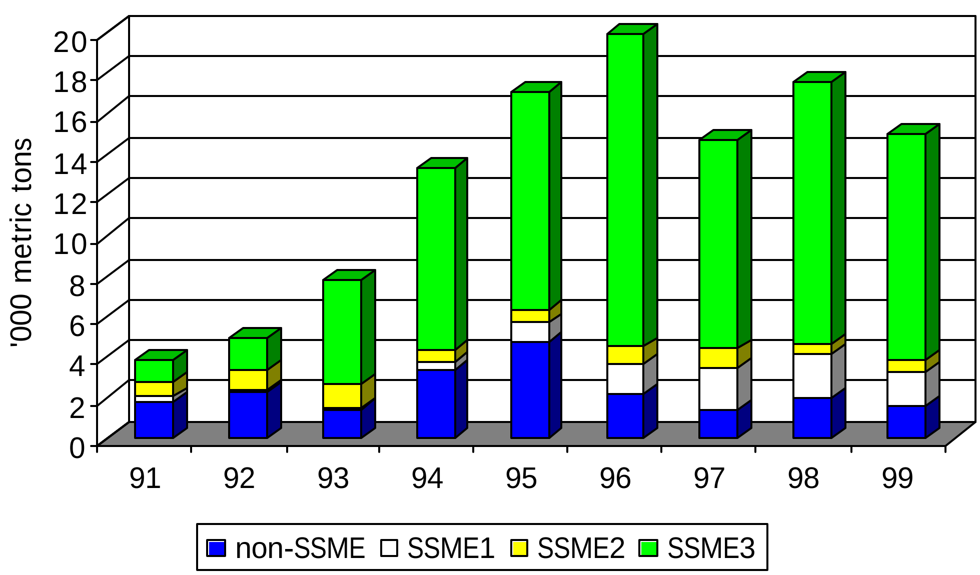


Figure 259r. Temporal distribution of sardine landings by fishing region in Sabah, 1991-1999

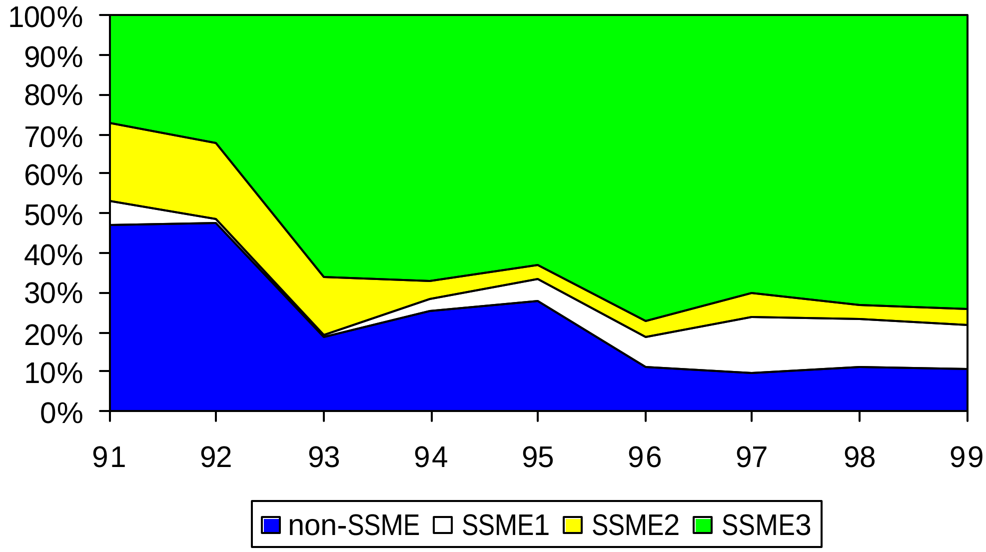


Figure 259s. Temporal distribution of anchovy landings by fishing region in Sabah, 1991-1999

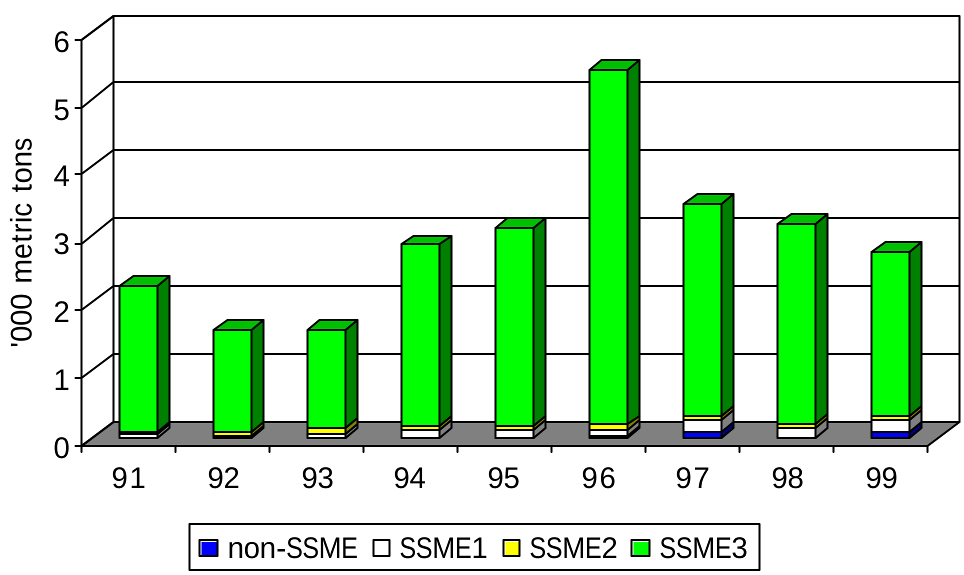


Figure 259t. Temporal distribution of anchovy landings by fishing region in Sabah, 1991-1999

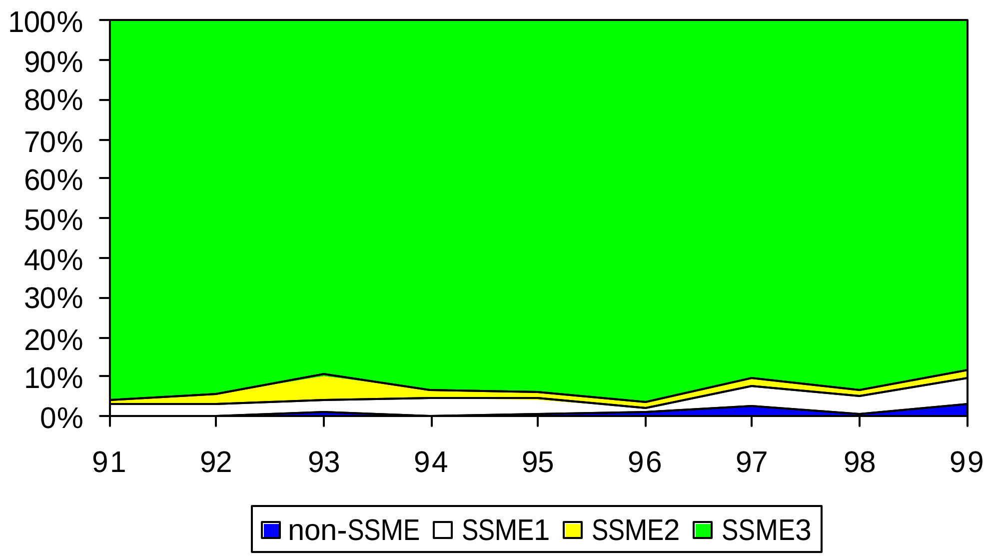


Figure 259u. Temporal distribution of tuna landings by fishing region in Sabah, 1991-1999

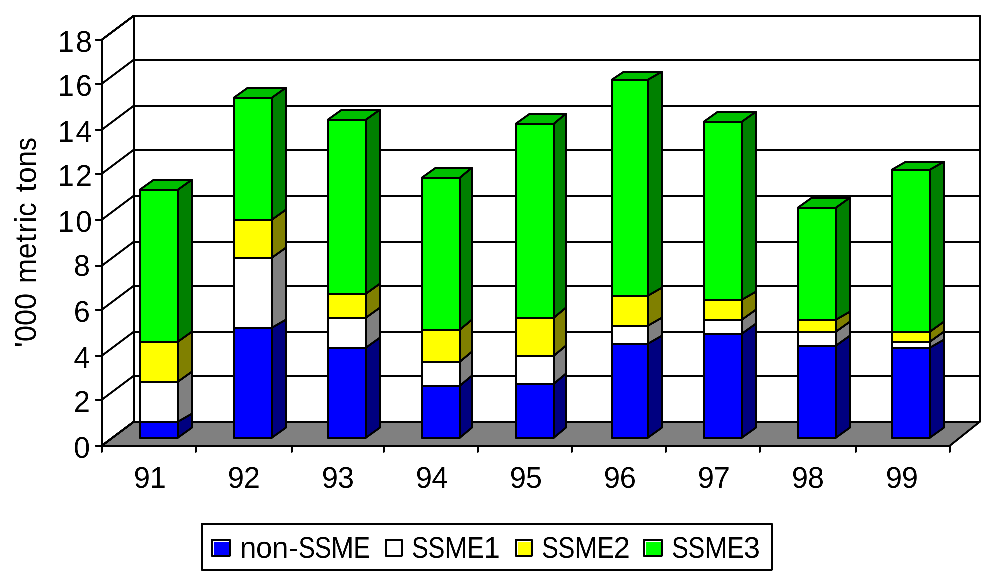


Figure 259v. Temporal distribution of tuna landings by fishing region in Sabah, 1991-1999

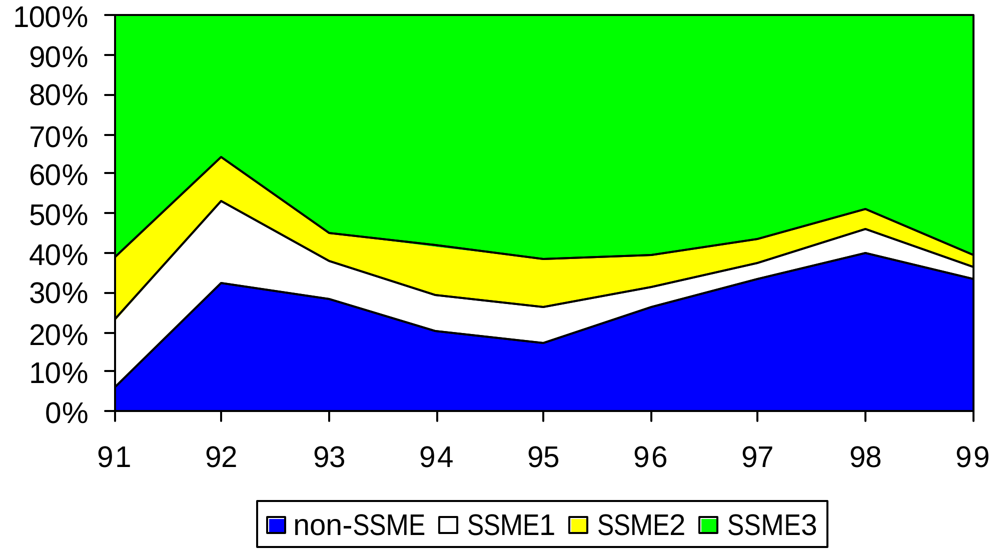
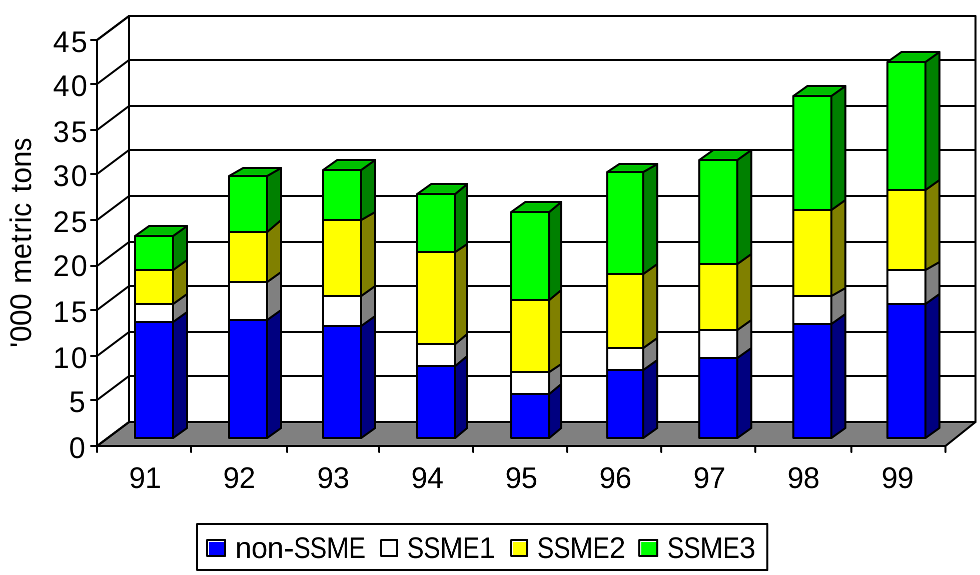


Figure 259w. Temporal distribution of misc. pelagic landings by fishing region in Sabah, 1991-1999



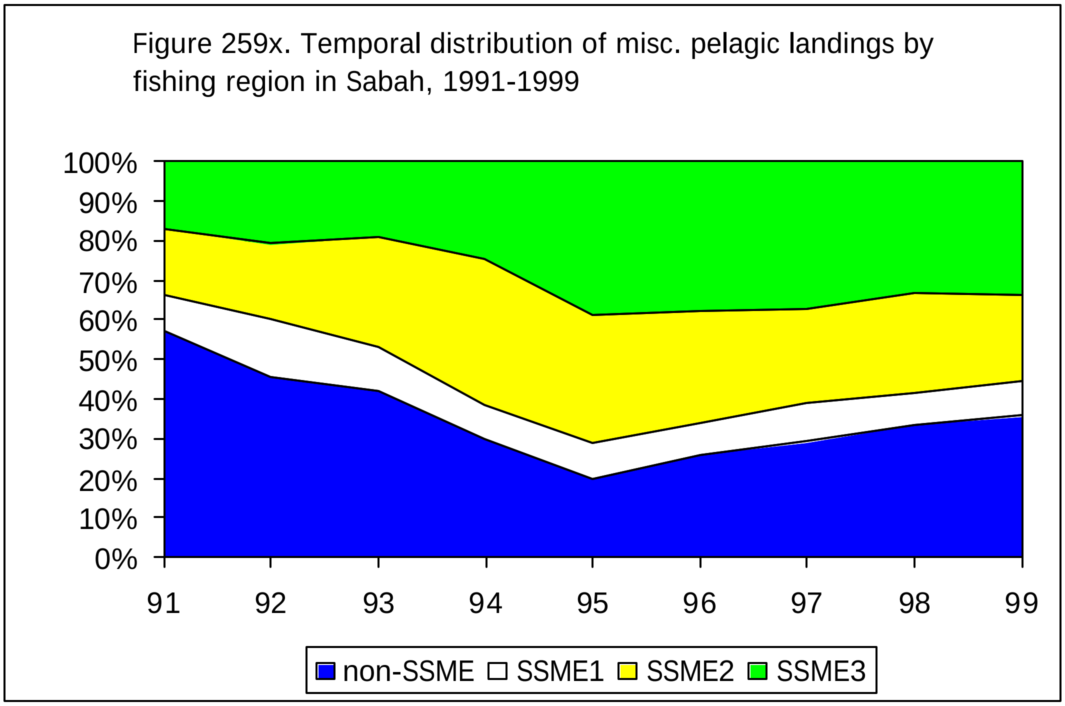


Figure 259x. Temporal distribution of misc. pelagic landings by fishing region in Sabah, 1991-1999
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
91
92
93
94
95
96
97
98
99
non-SSME
SSME1
SSME2
SSME3

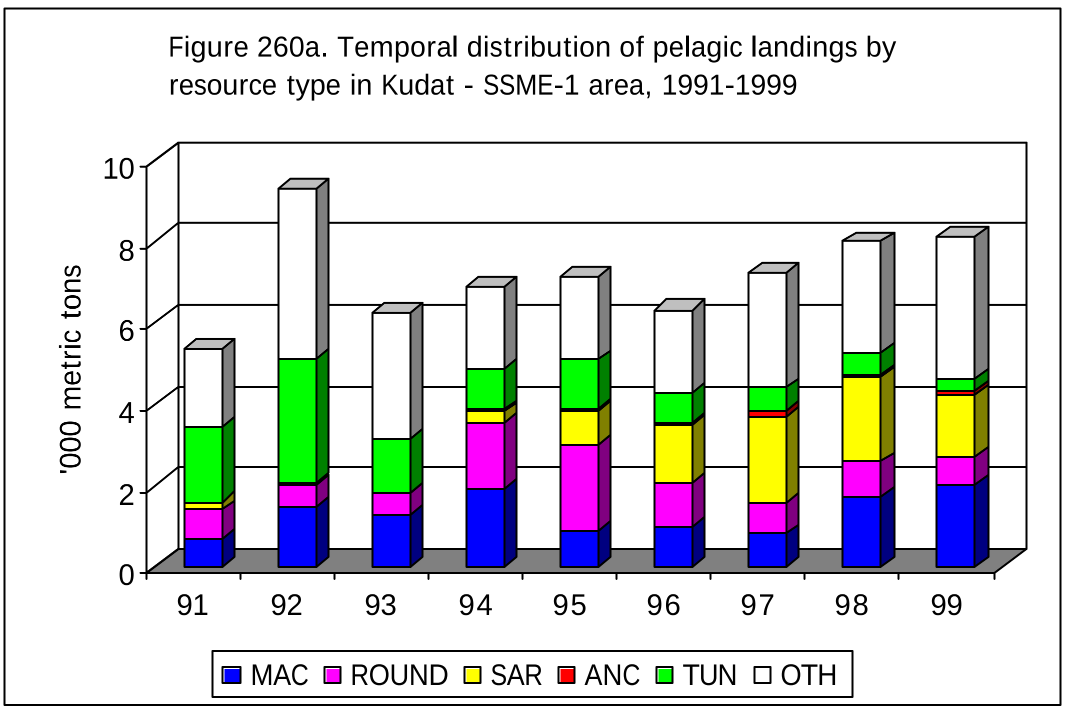


Figure 260a. Temporal distribution of pelagic landings by resource type in Kudat - SSME-1 area, 1991-1999
'000 metric tons
10
8
6
4
2
0
91
92
93
94
95
96
97
98
99
MAC
ROUND
SAR
ANC
TUN
OTH

Figure 260b. Temporal distribution of pelagic landings by resource type in Kudat - SSME-1 area, 1991-1999

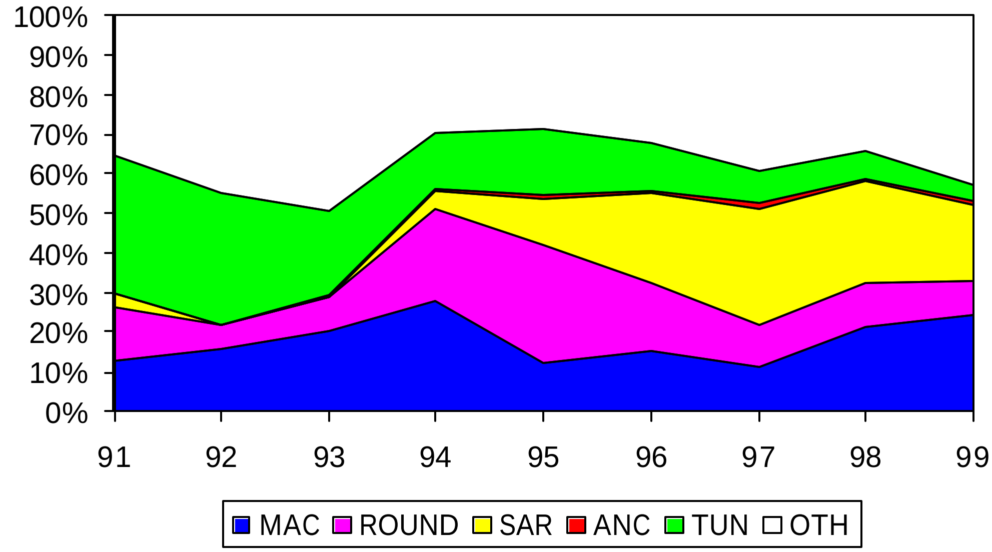


Figure 260c. Temporal distribution of pelagic landings by resource type in Kota Marudu - SSME-1 area, 1991-1999

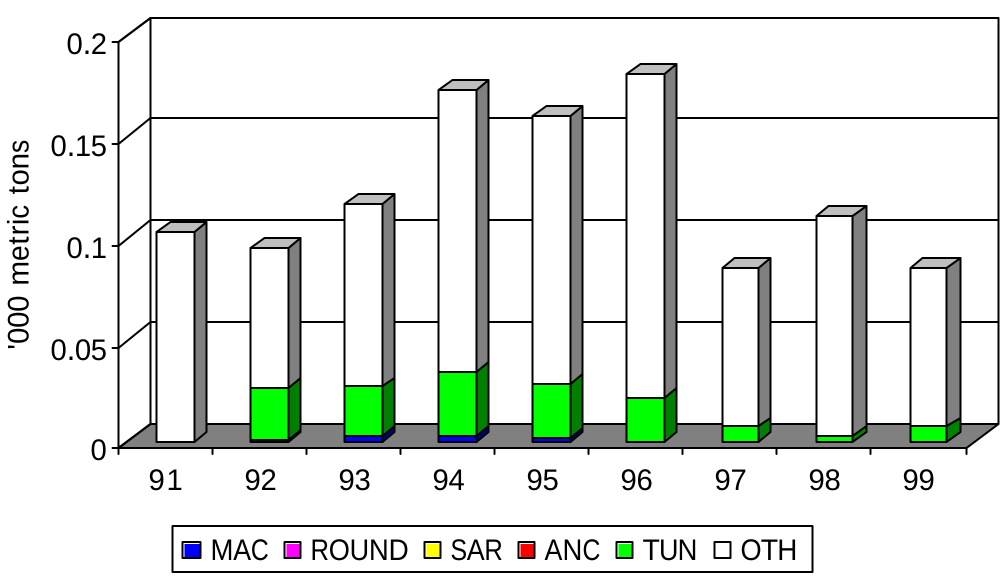


Figure 260d. Temporal distribution of pelagic landings by resource type in Kota Marudu - SSME-1 area, 1991-1999

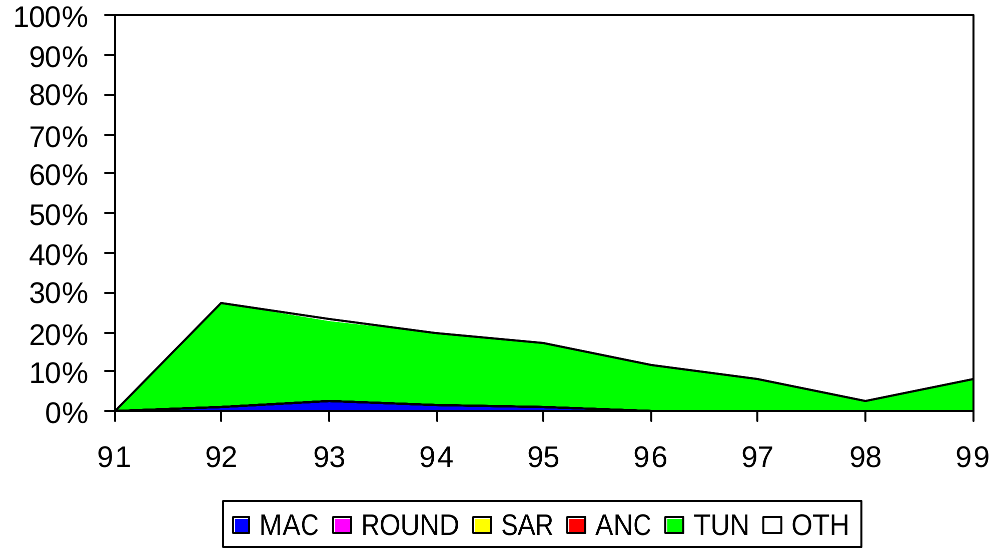


Figure 260e. Temporal distribution of pelagic landings by resource type in Pitas - SSME-1 area, 1991-1999

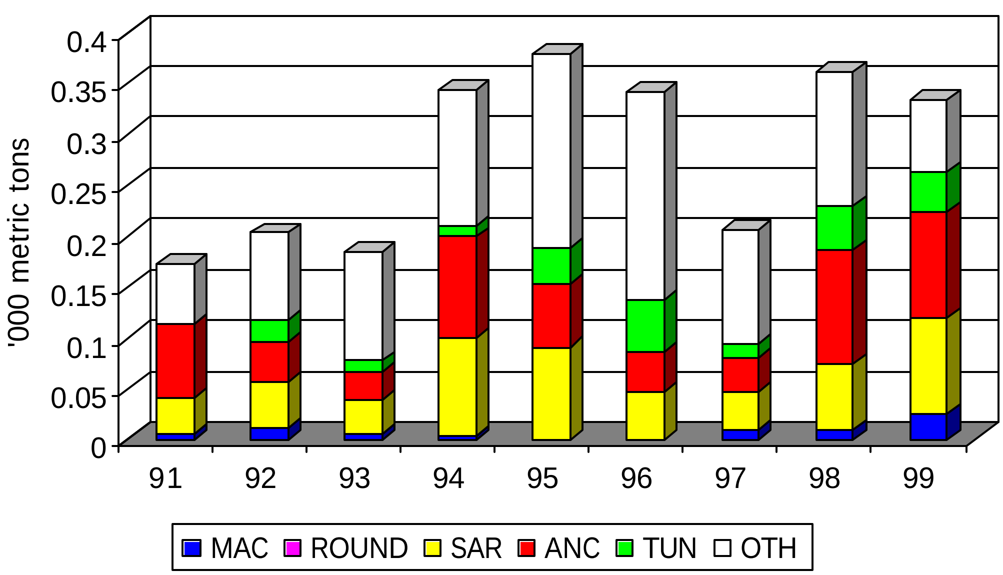


Figure 260f. Temporal distribution of pelagic landings by resource type in Pitas - SSME-1 area, 1991-1999

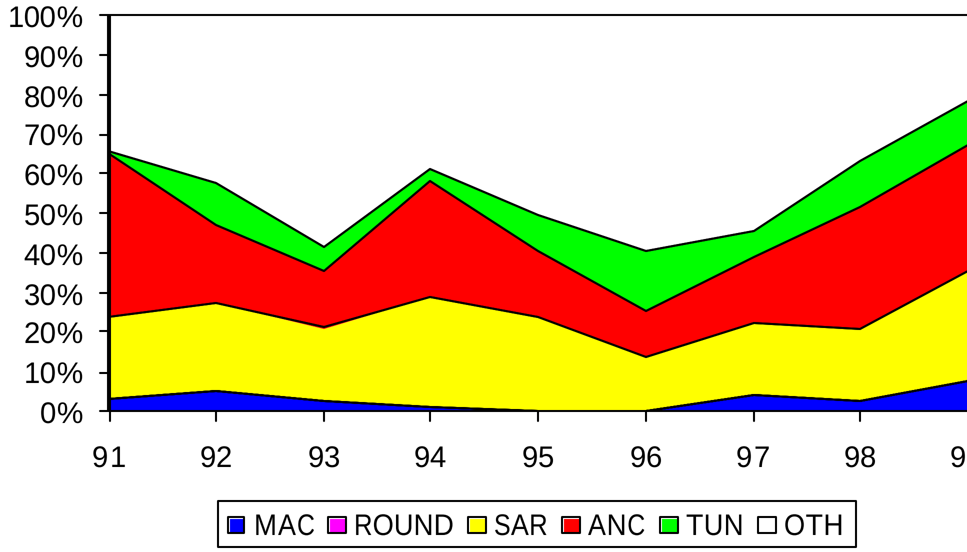


Figure 260g. Temporal distribution of pelagic landings by resource type in Sandakan - SSME-2 area, 1991-1999

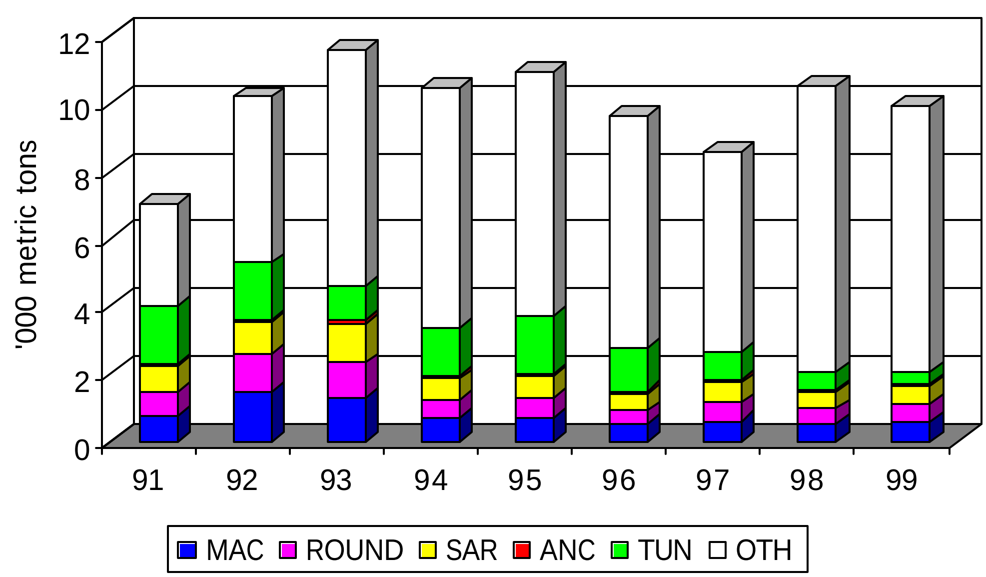


Figure 260h. Temporal distribution of pelagic landings by resource type in Sandakan - SSME-2 area, 1991-1999

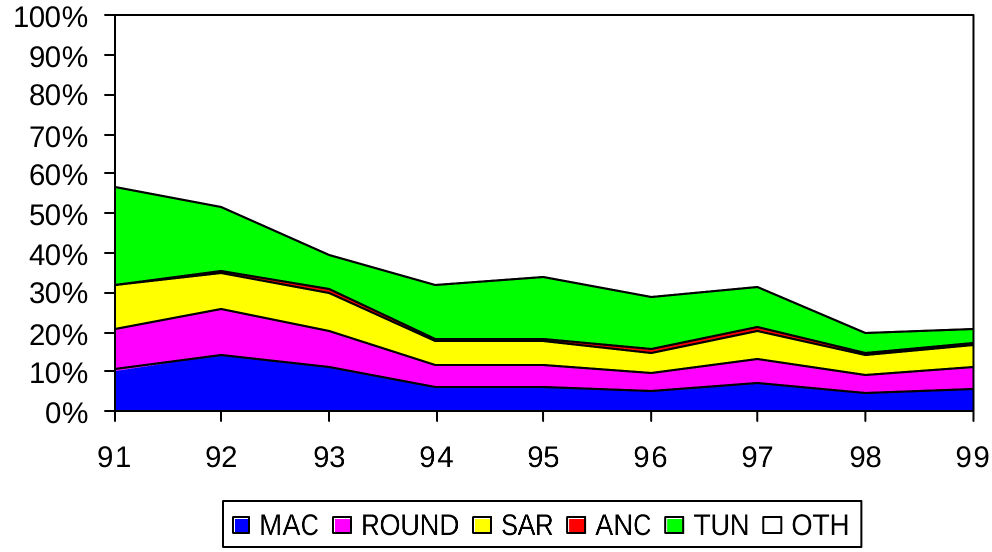


Figure 260i. Temporal distribution of pelagic landings by resource type in Beluran - SSME-2 area, 1991-1999

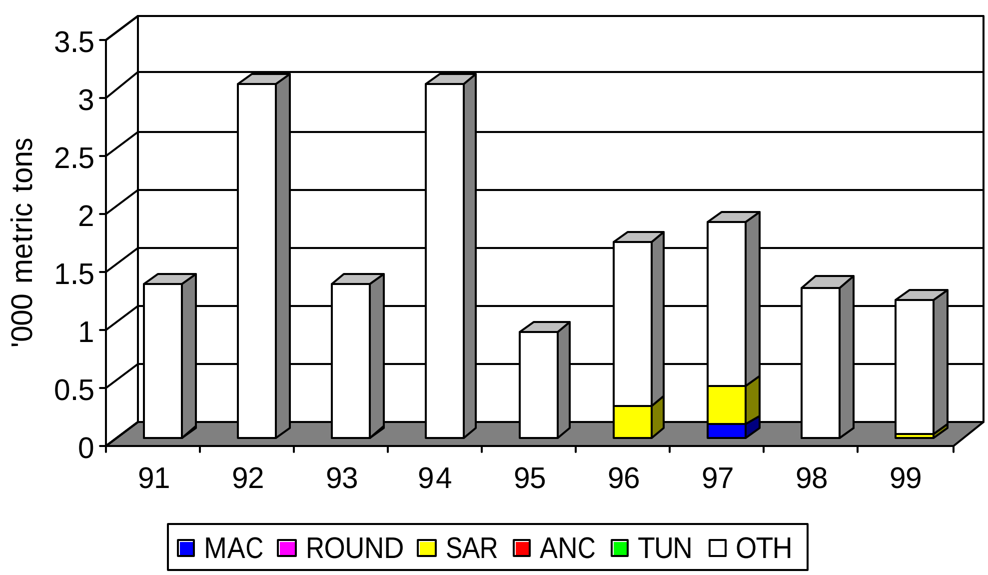


Figure 260j. Temporal distribution of pelagic landings by resource type in Beluran - SSME-2 area, 1991-1999

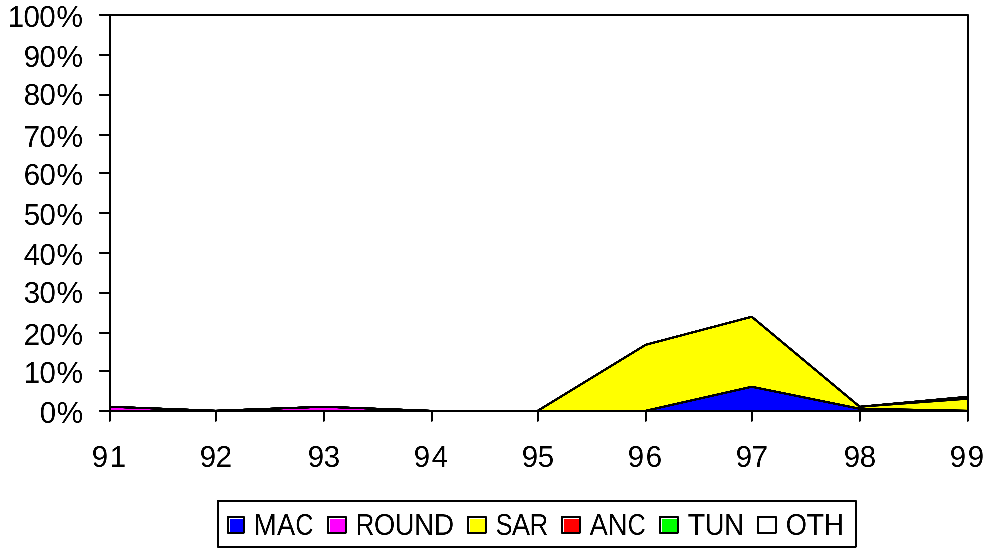


Figure 260k. Temporal distribution of pelagic landings by resource type in Tawau - SSME-3 area, 1991-1999

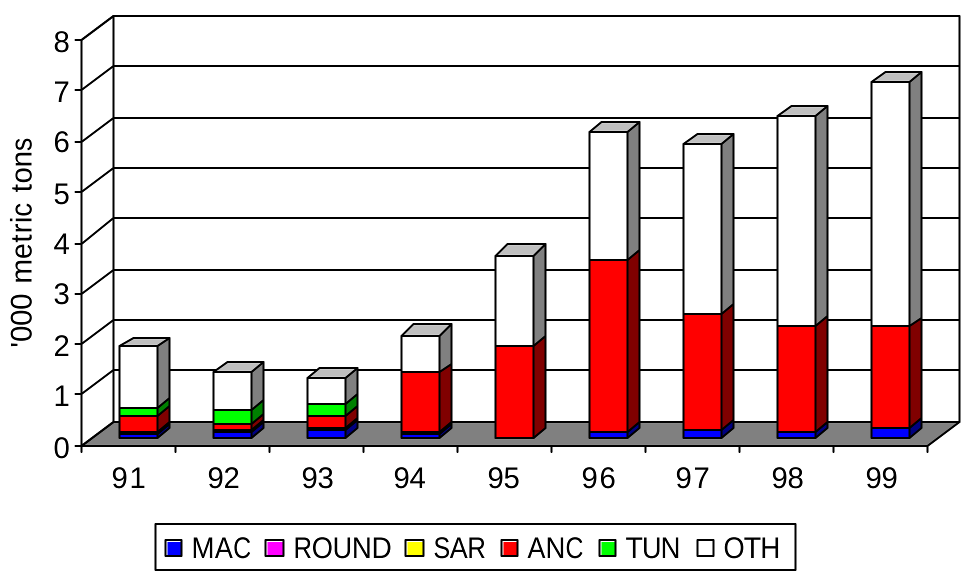


Figure 260l. Temporal distribution of pelagic landings by resource type in Tawau - SSME-3 area, 1991-1999

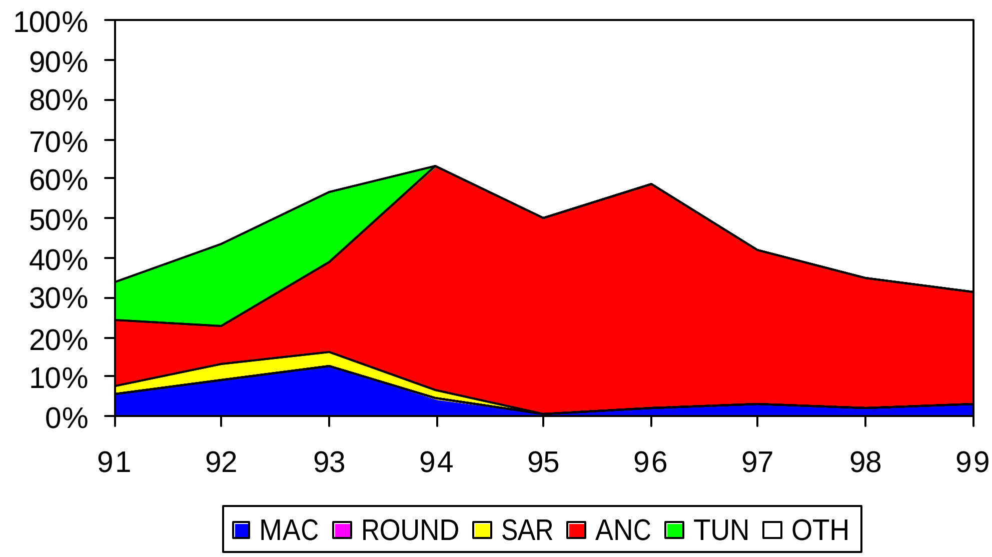


Figure 260m. Temporal distribution of pelagic landings by resource type in Semporna - SSME-3 area, 1991-1999

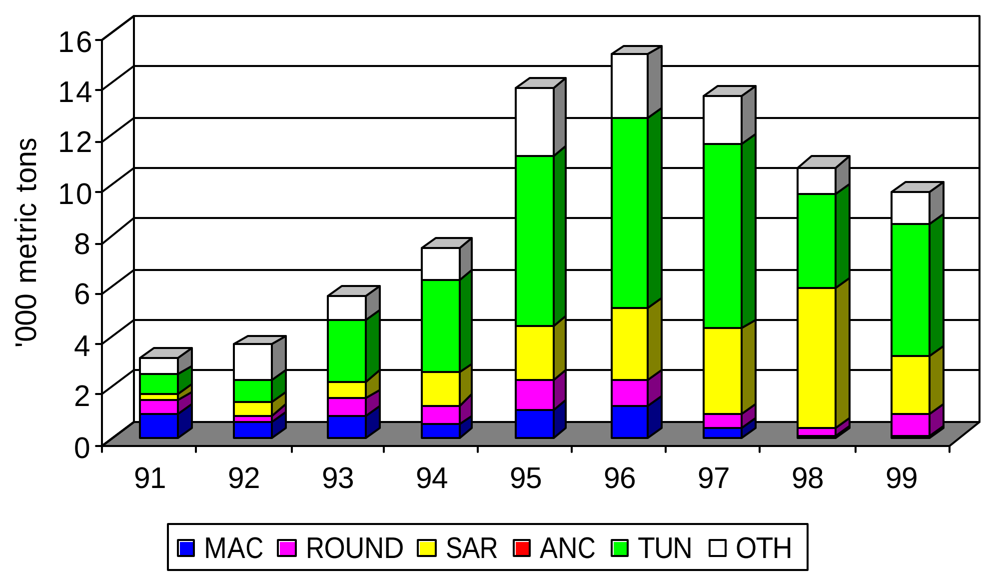


Figure 260n. Temporal distribution of pelagic landings by resource type in Semporna - SSME-3 area, 1991-1999

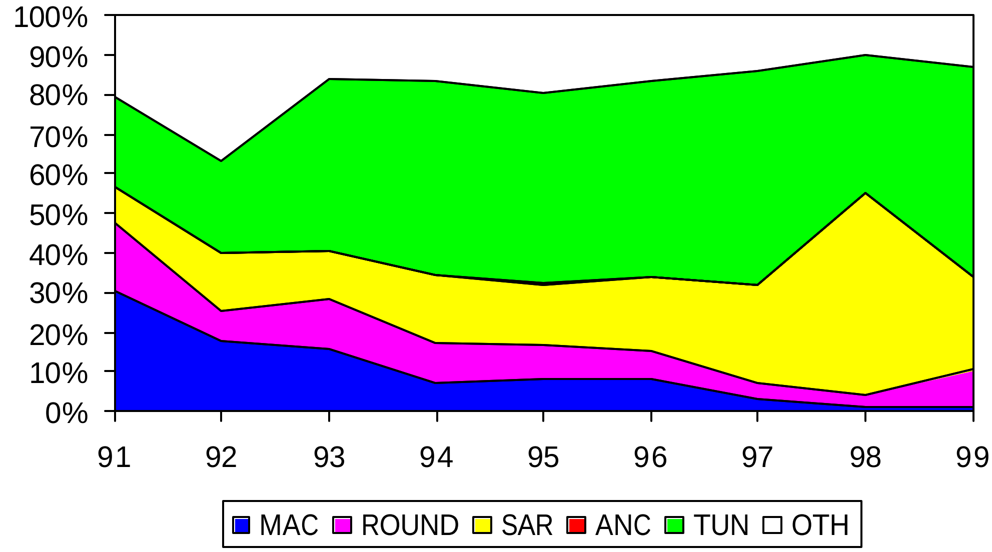


Figure 260o. Temporal distribution of pelagic landings by resource type in Kunak - SSME-3 area, 1991-1999

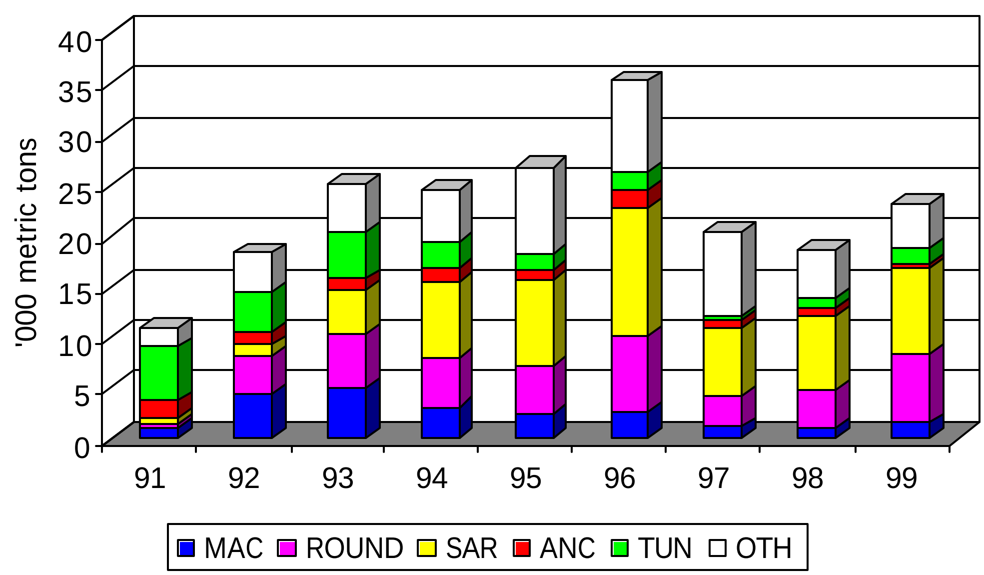


Figure 260p. Temporal distribution of pelagic landings by resource type in Kunak - SSME-3 area, 1991-1999

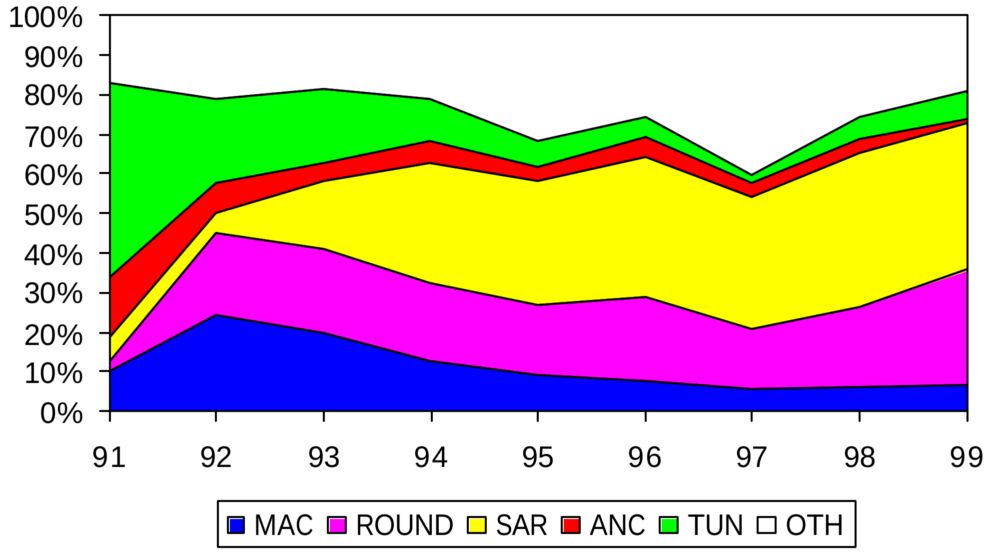


Figure 260q. Temporal distribution of pelagic landings by resource type in Lahad Datu - SSME-3 area, 1991-1999

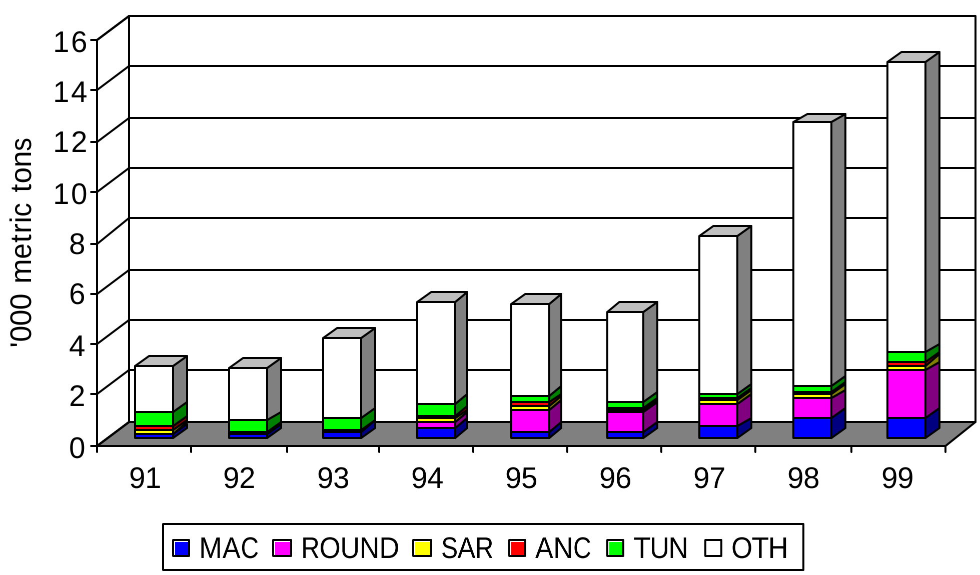


Figure 260r. Temporal distribution of pelagic landings by resource type in Lahad Datu - SSME-3 area, 1991-1999

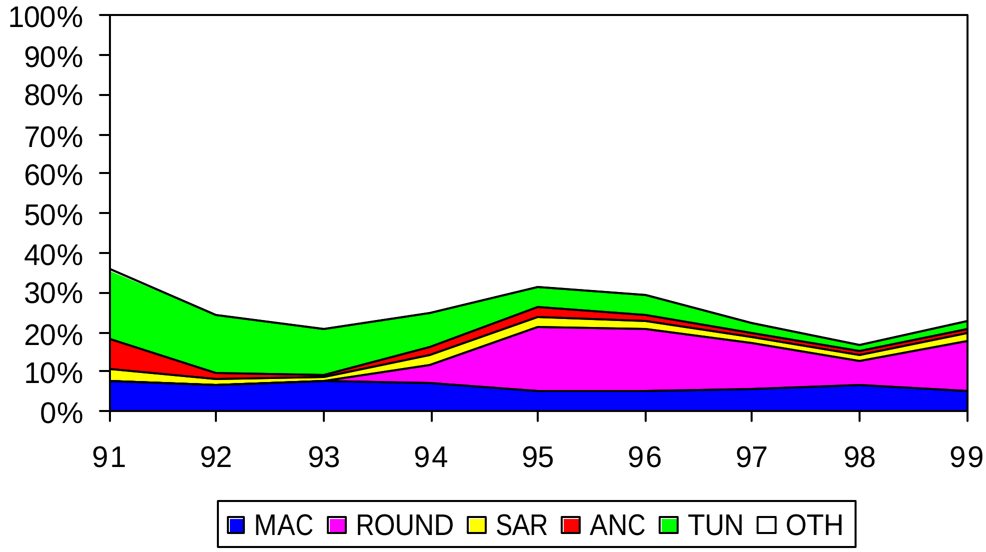


Figure 261a. Pelagic fish landing breakdown by resource type in Sabah (% annual average 1991-1999)

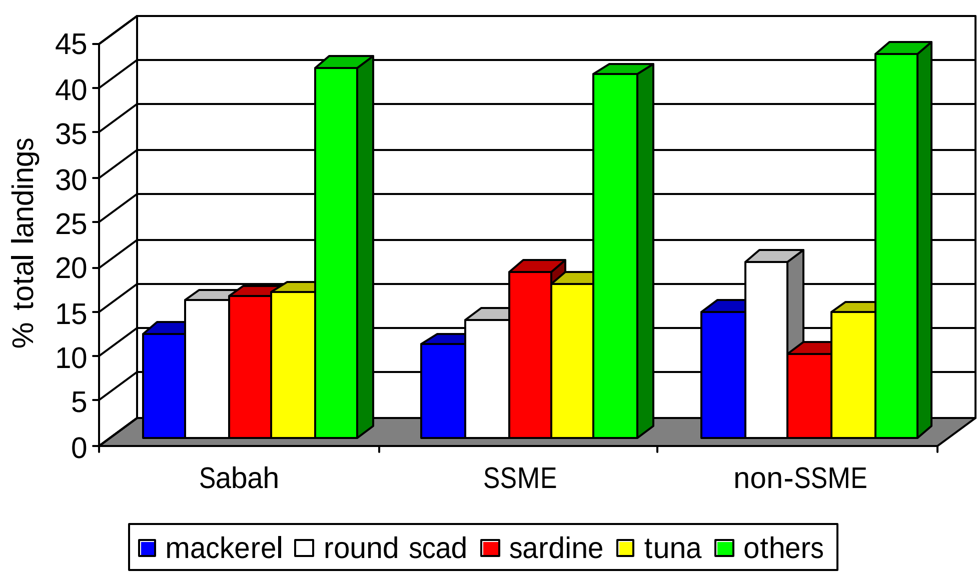


Figure 261b. Pelagic fish landing breakdown by resource type in the SSME area (% annual average 1991-1999)

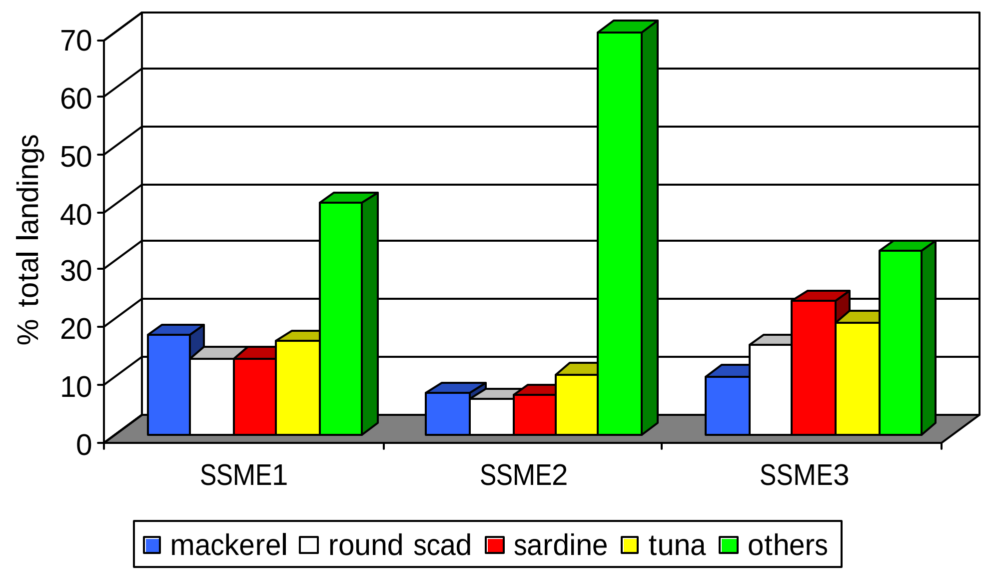


Figure 262a. Annual marine fish landing breakdown by gear type, Sabah 1997-1999 (SSME-1)

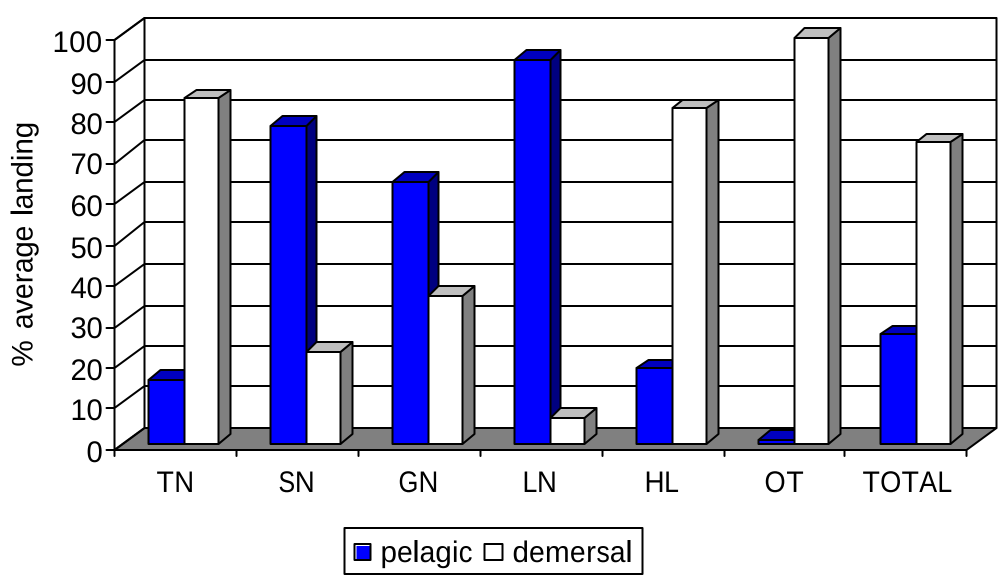


Figure 262b. Average marine fish landing breakdown by gear type, Sabah 1997-1999 (SSME-2)

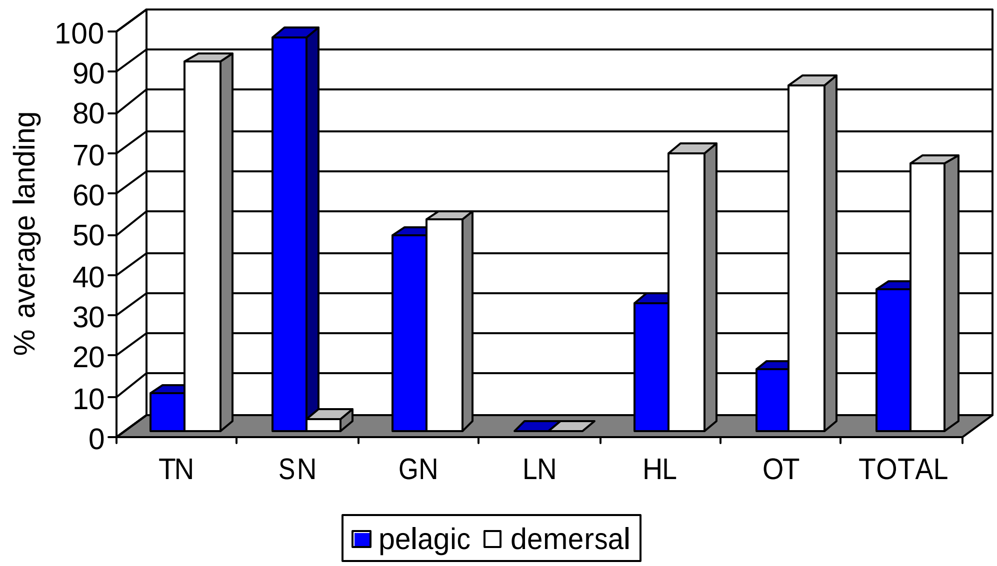


Figure 262c. Average marine fish landing breakdown by gear type, Sabah 1997-1999 (SSME-3)

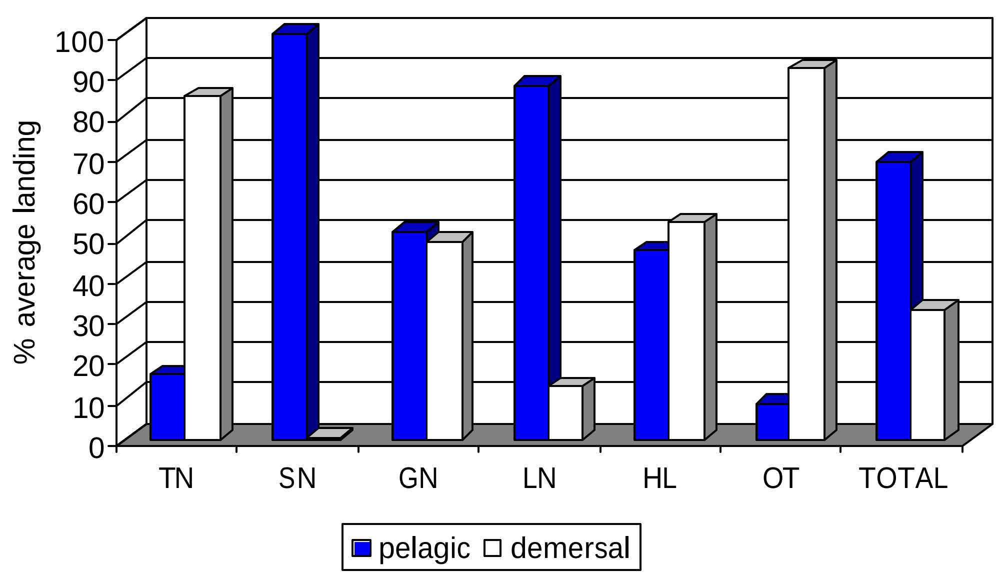


Figure 262d. Average marine fish landing breakdown by gear type, Sabah 1997-1999 (SSME area)

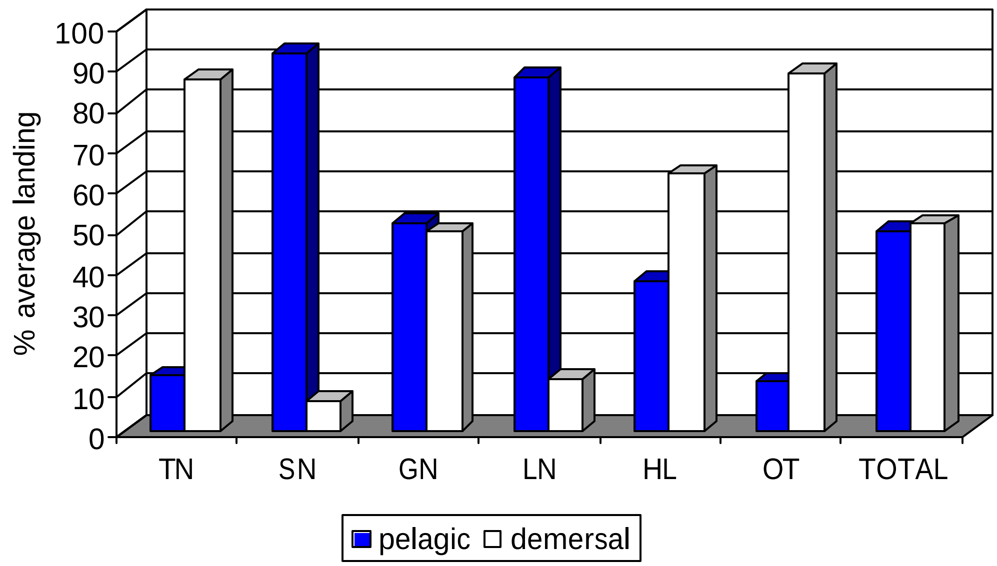


Figure 262e. Average marine fish landing breakdown by gear type, Sabah 1997-1999 (non-SSME area)

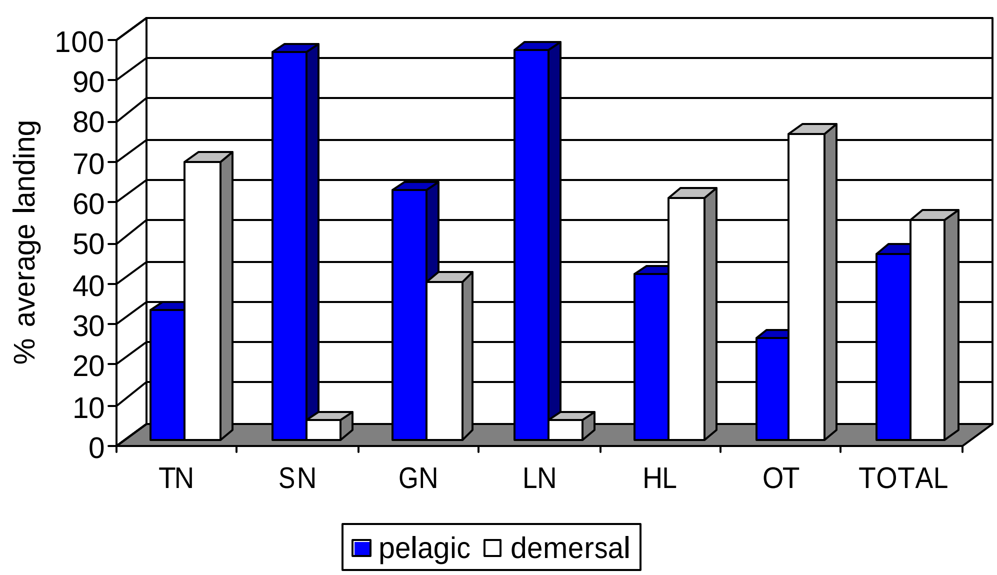


Figure 262f. Average marine fish landing breakdown by gear type, Sabah 1997-1999 (total)

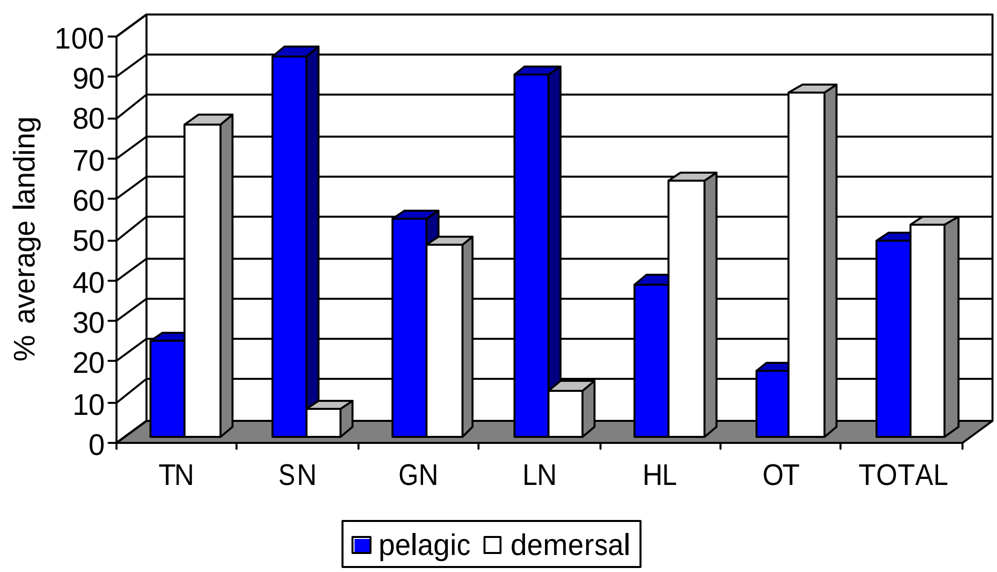


Figure 263a. Annual demersal landing breakdown by gear type, Sabah, 1997-1999

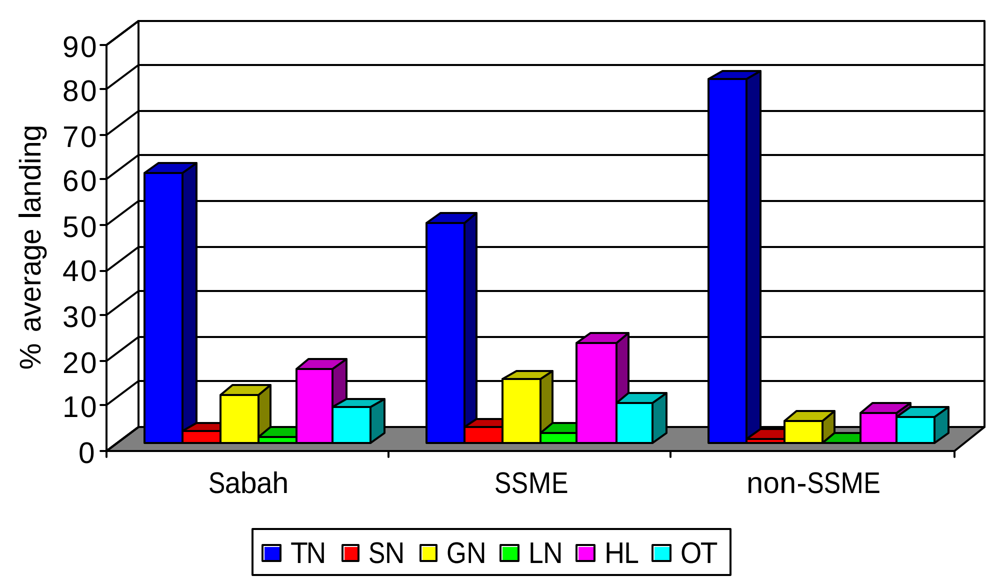


Figure 263b. Annual demersal landing breakdown by gear type in the SSME area, 1997-1999

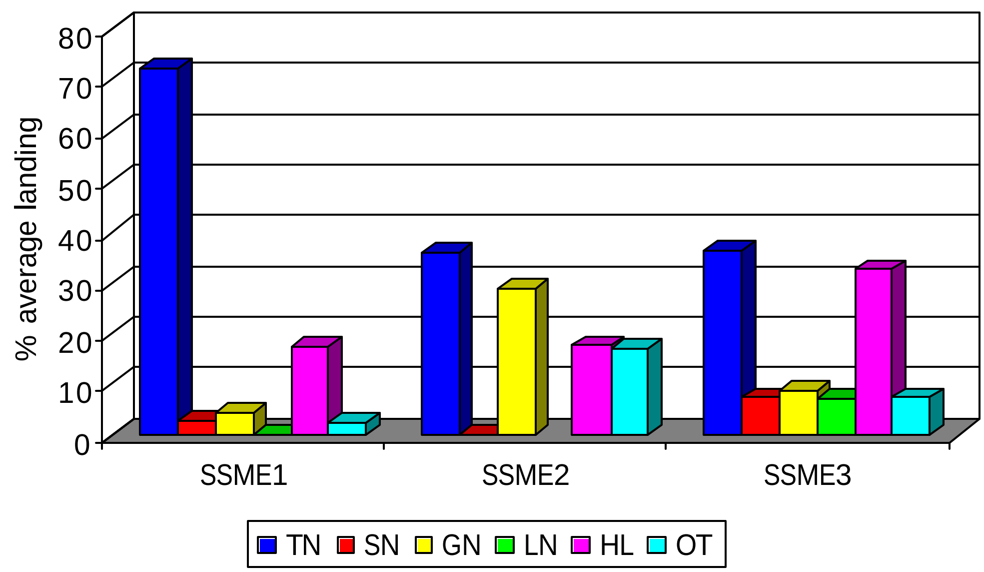


Figure 263c. Annual demersal landing breakdown by gear type in the non-SSME area, 1997-1999

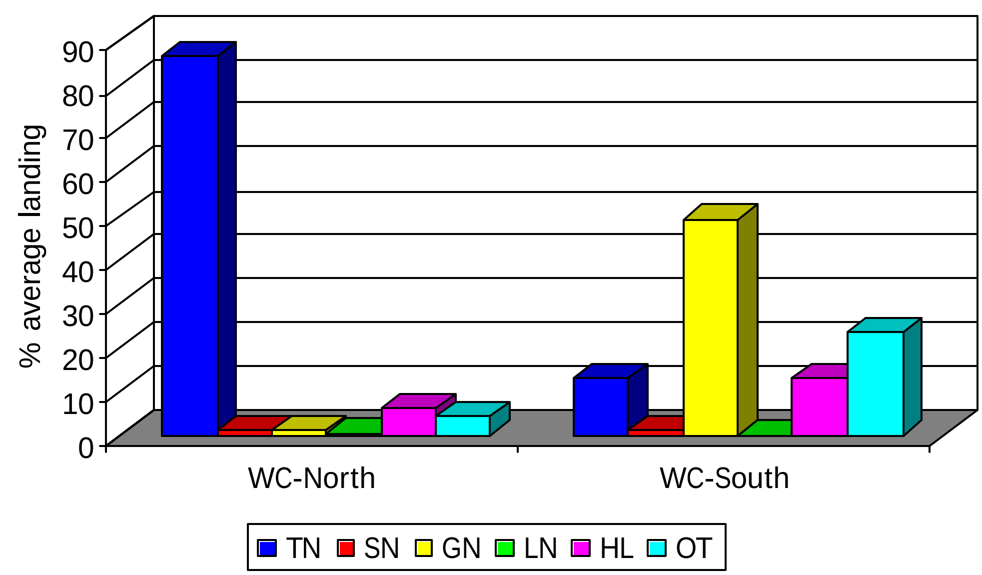


Figure 263d. Annual demersal landing breakdown by gear type in the WC-North (non-SSME area), 1997-1999

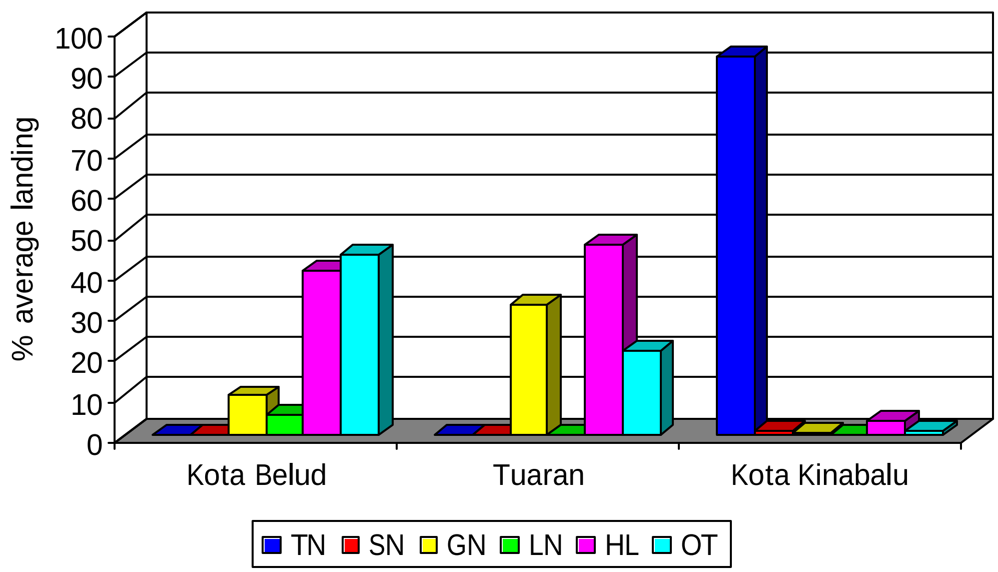


Figure 263e. Annual demersal landing breakdown by gear type in the WC-South (non-SSME area), 1997-1999

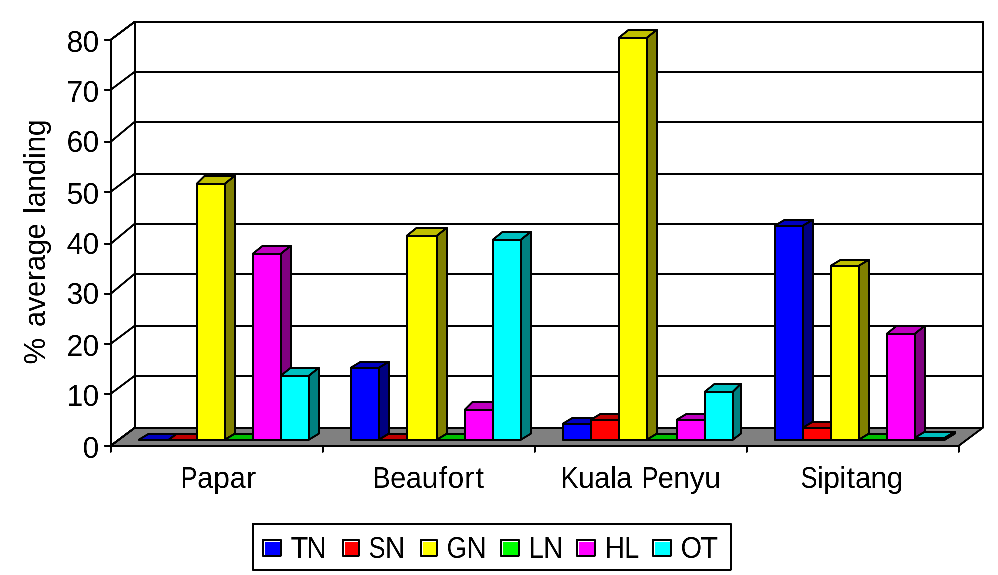


Figure 263f. Annual demersal landing breakdown by gear type and district in the SSME-1 area, 1997-1999

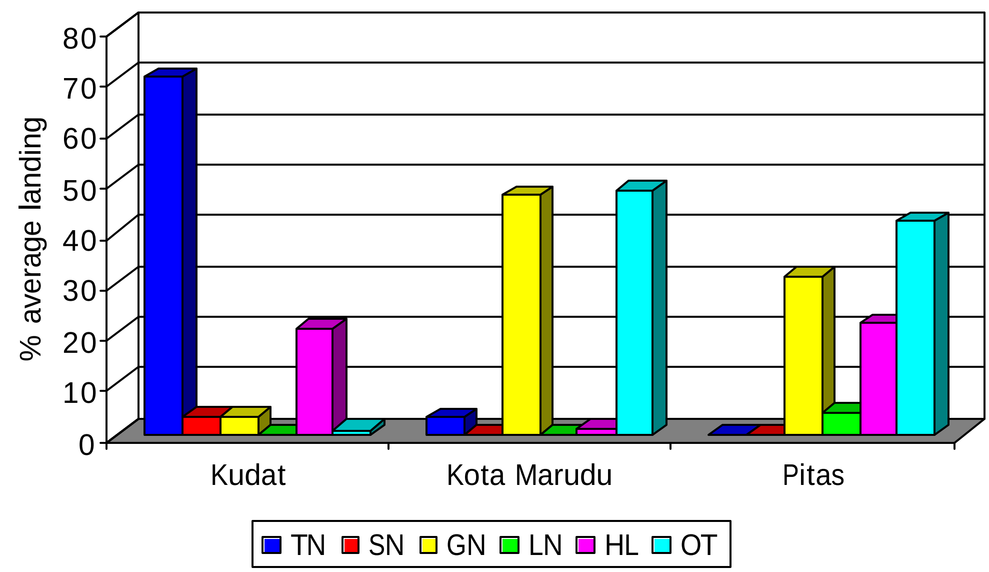


Figure 263g. Annual demersal landing breakdown by gear type and district in the SSME-2 area, 1997-1999

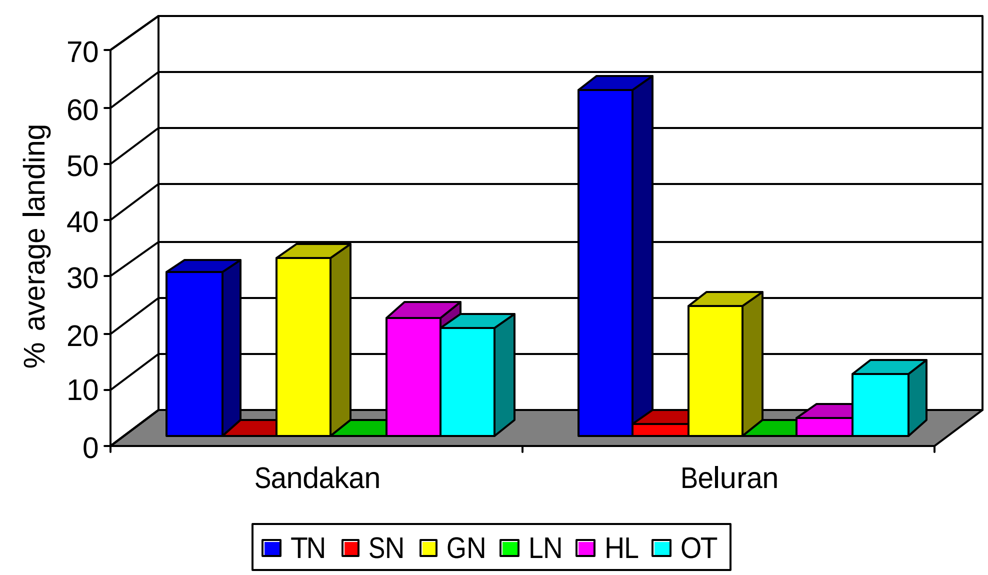


Figure 263h. Annual demersal landing breakdown by gear type and district in the SSME-3 area, 1997-1999

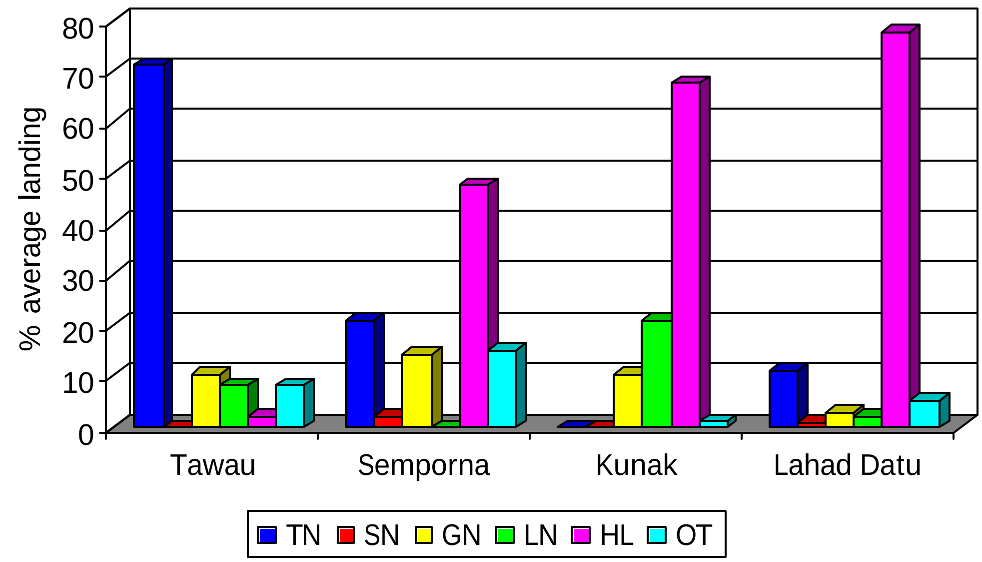


Figure 264a. Annual demersal landing breakdown by gear type, Sabah 1997-1999 (finfish)

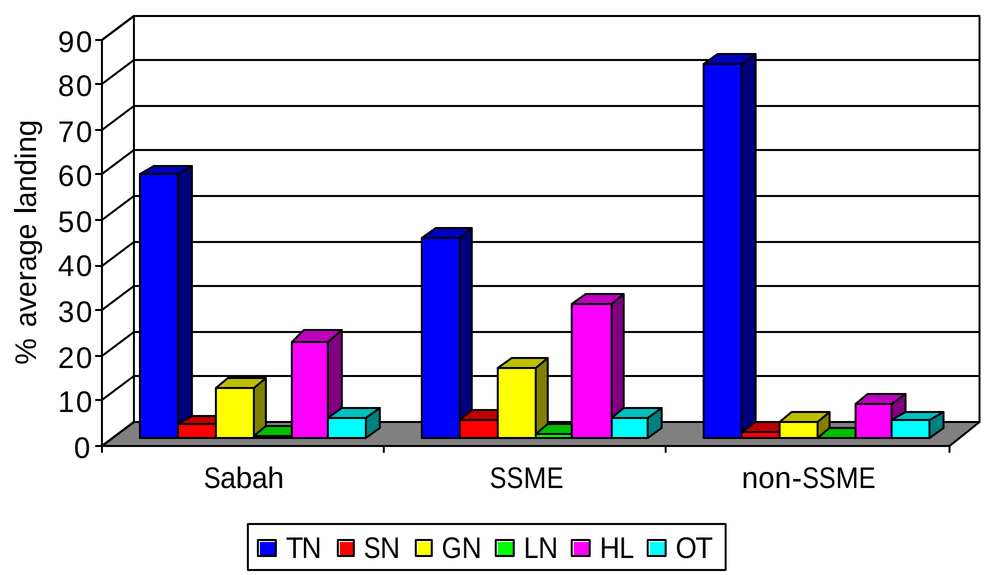


Figure 264b. Annual demersal landing breakdown by gear type in the SSME area, 1997-1999 (finfish)

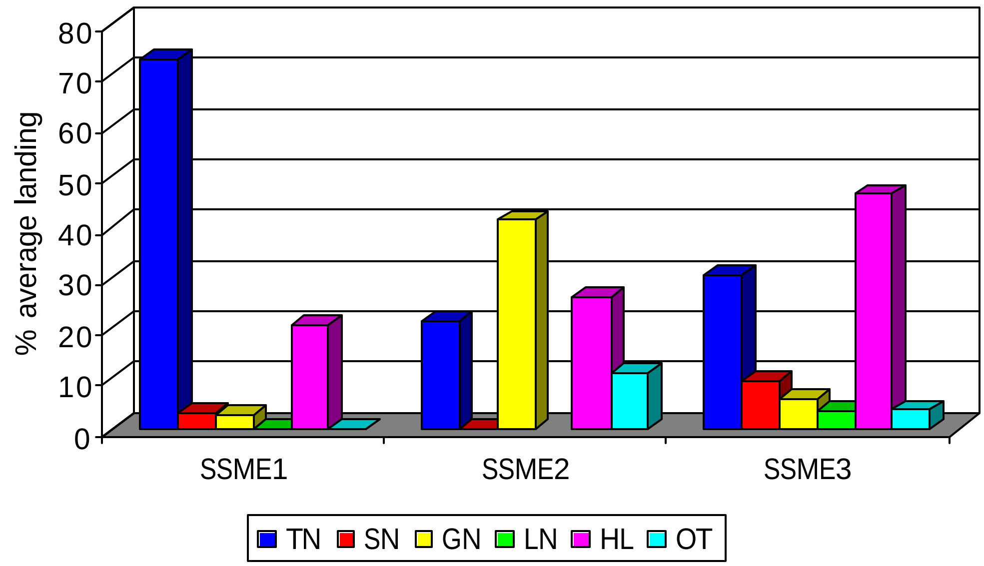


Figure 264c. Annual demersal landing breakdown by gear type in the non-SSME area, 1997-1999 (finfish)

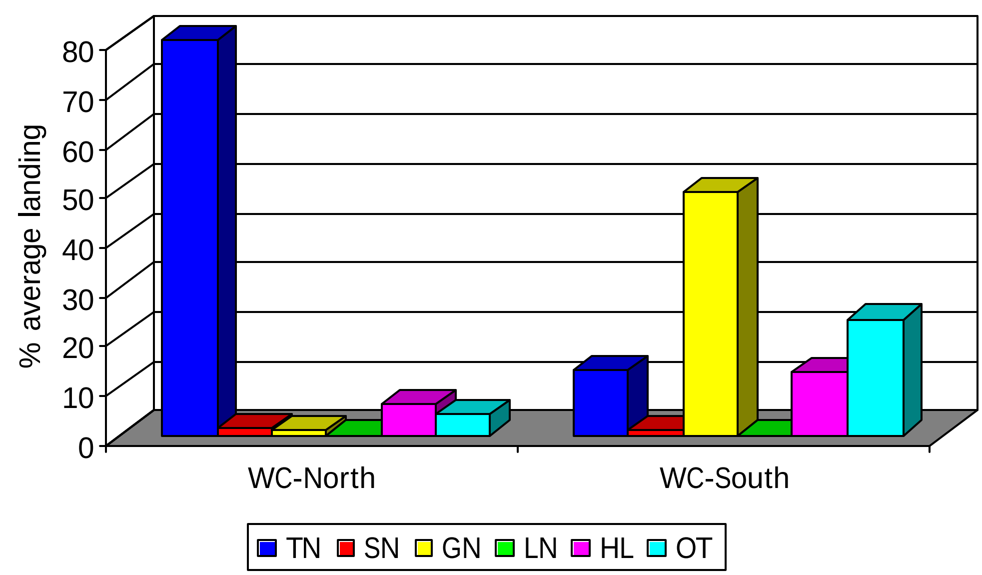


Figure 264d. Annual demersal landing breakdown by gear type in the WC-North (non-SSME area), 1997-1999 (finfish)

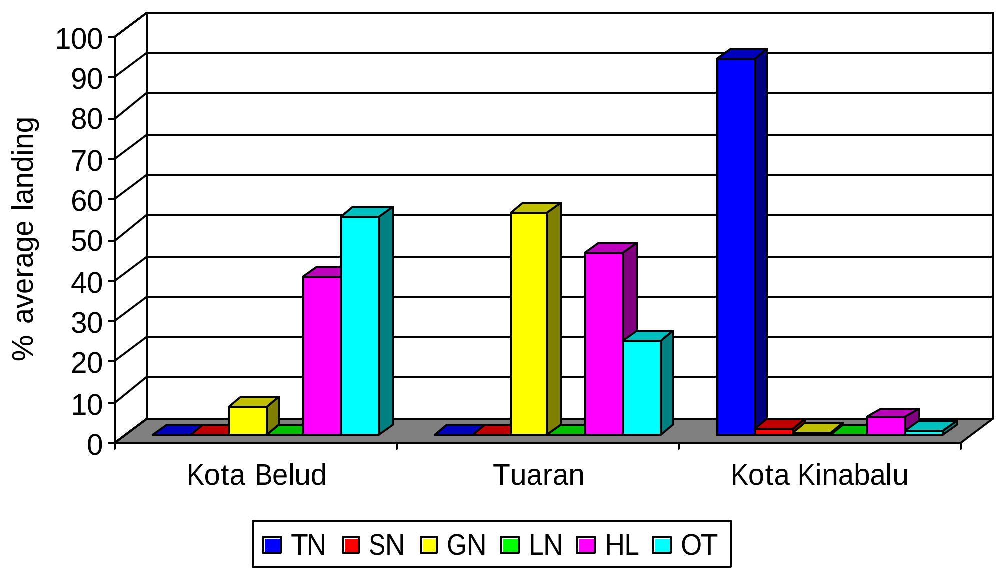


Figure 264e. Annual demersal landing breakdown by gear type in the WC-South (non-SSME area), 1997-1999 (finfish)

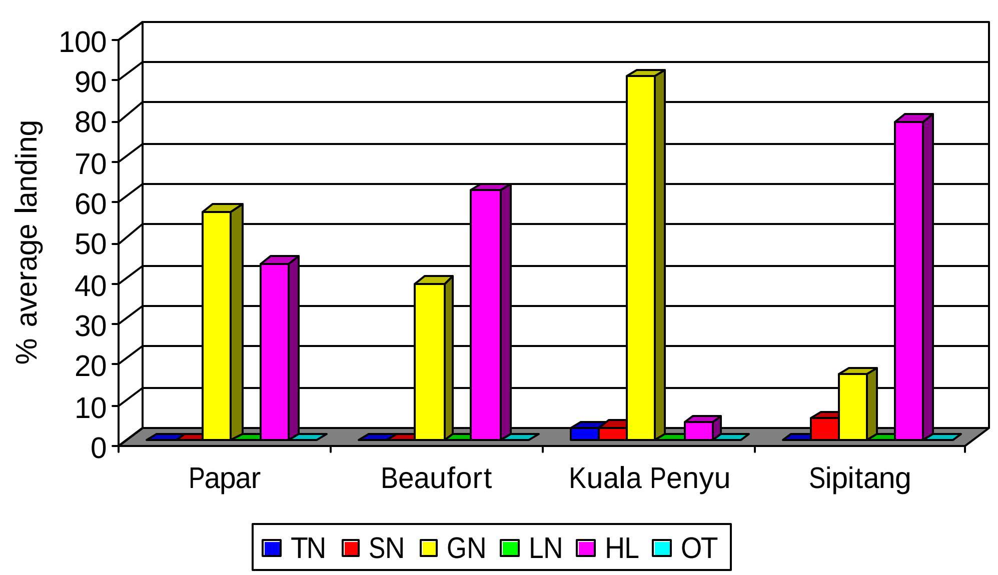


Figure 264f. Annual demersal landing breakdown by gear type and district in the SSME-1 area, 1997-1999 (finfish)

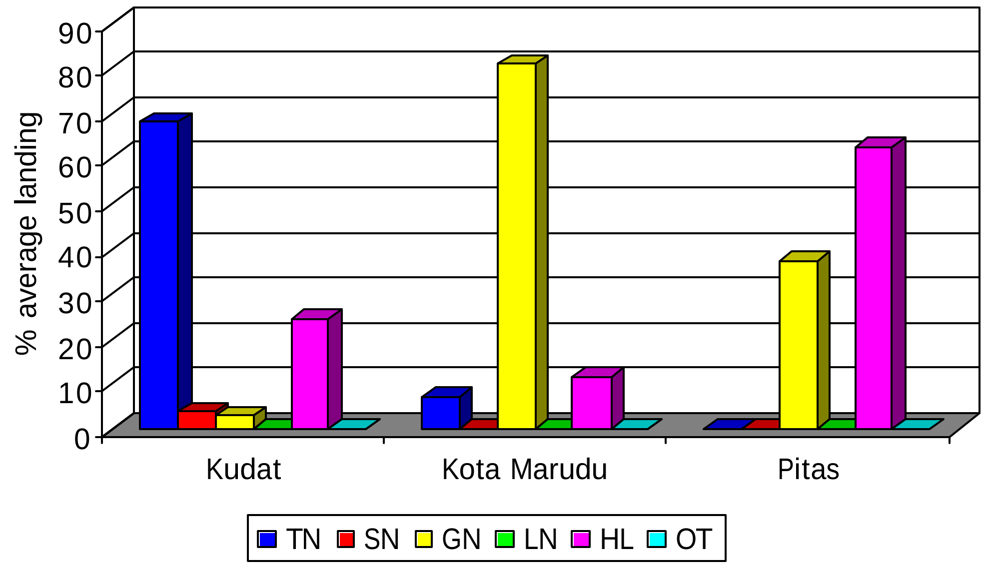


Figure 264g. Annual demersal landing breakdown by gear type and district in the SSME-2 area, 1997-1999 (finfish)

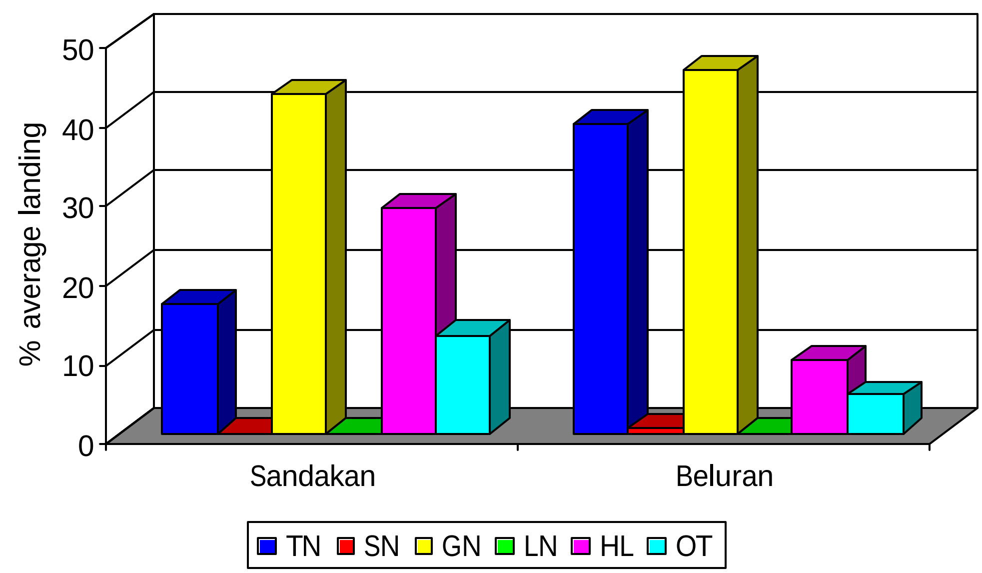


Figure 264h. Annual demersal landing breakdown by gear type and district in the SSME-3 area, 1997-1999 (finfish)

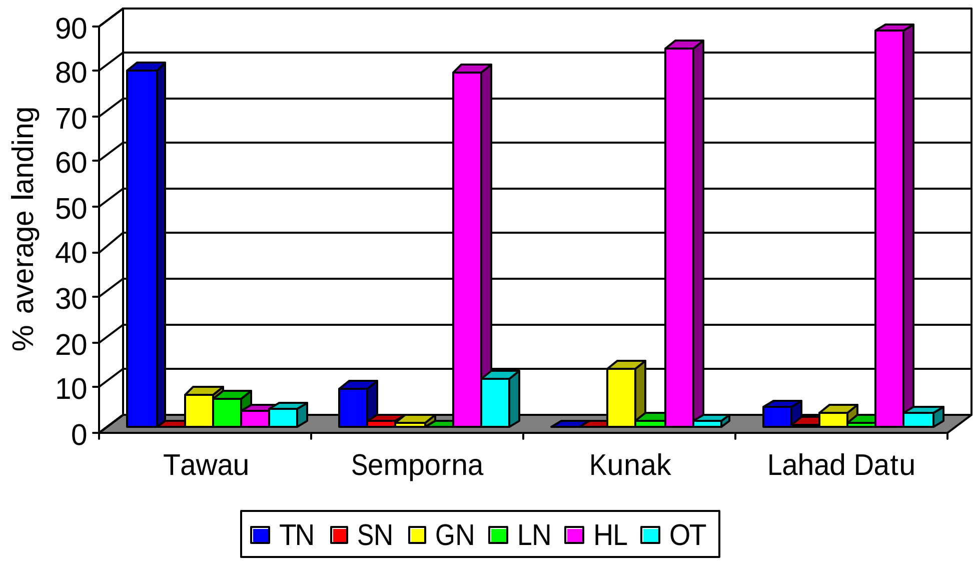


Figure 265a. Annual demersal landing breakdown by gear type, Sabah 1997-1999 (shrimp)

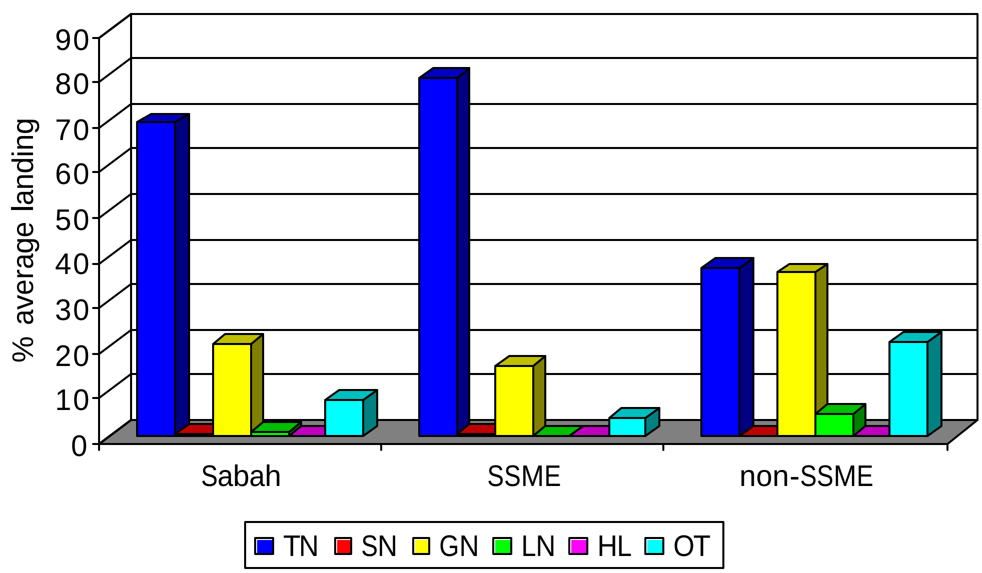


Figure 265b. Annual demersal landing breakdown by gear type in the SSME area, 1997-1999 (shrimp)

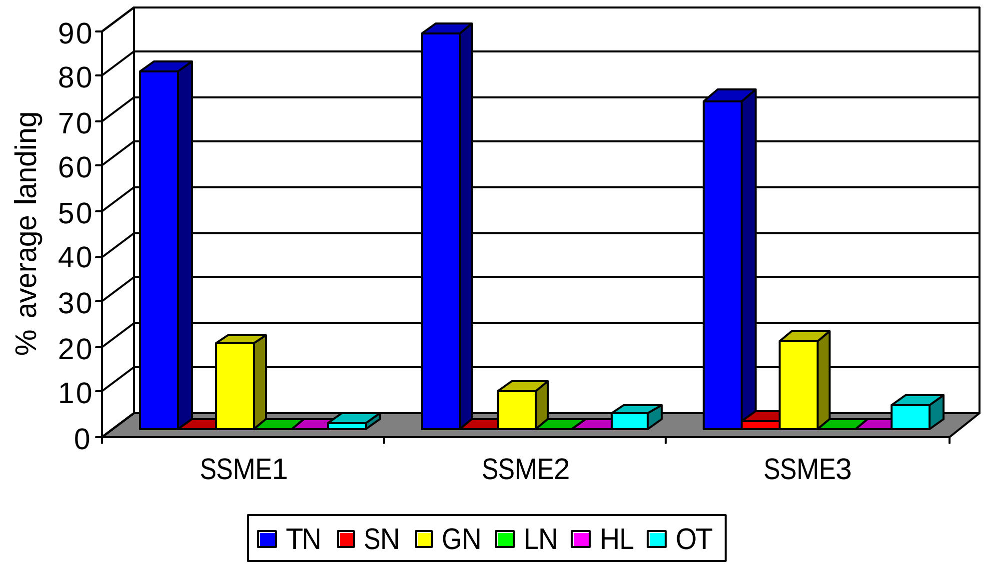


Figure 265c. Annual demersal landing breakdown by gear type in the non-SSME area, 1997-1999 (shrimp)

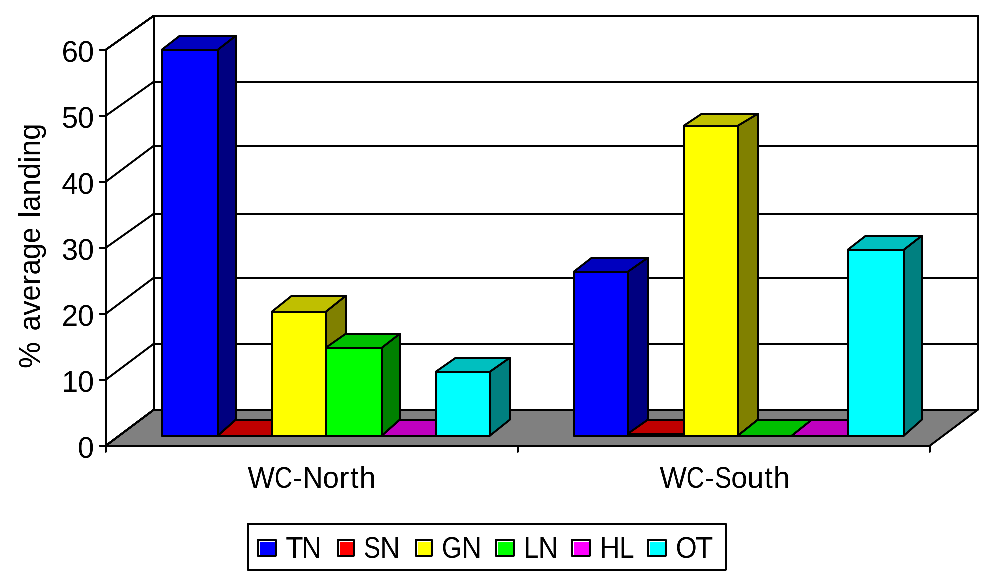


Figure 265d. Annual demersal landing breakdown by gear type in the WC-North (non-SSME area), 1997-1999 (shrimp)

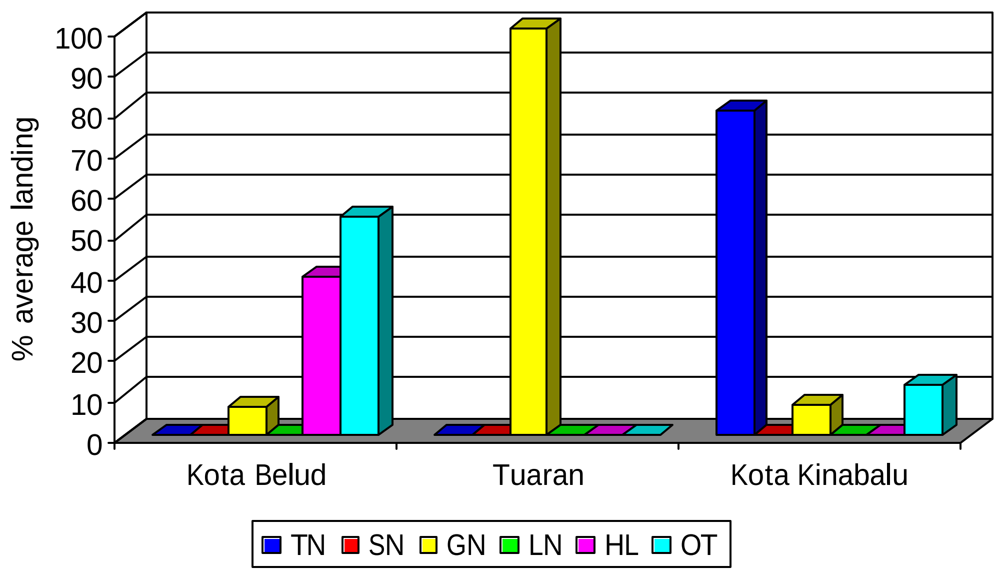


Figure 265e. Annual demersal landing breakdown by gear type in the WC-South (non-SSME area), 1997-1999 (shrimp)

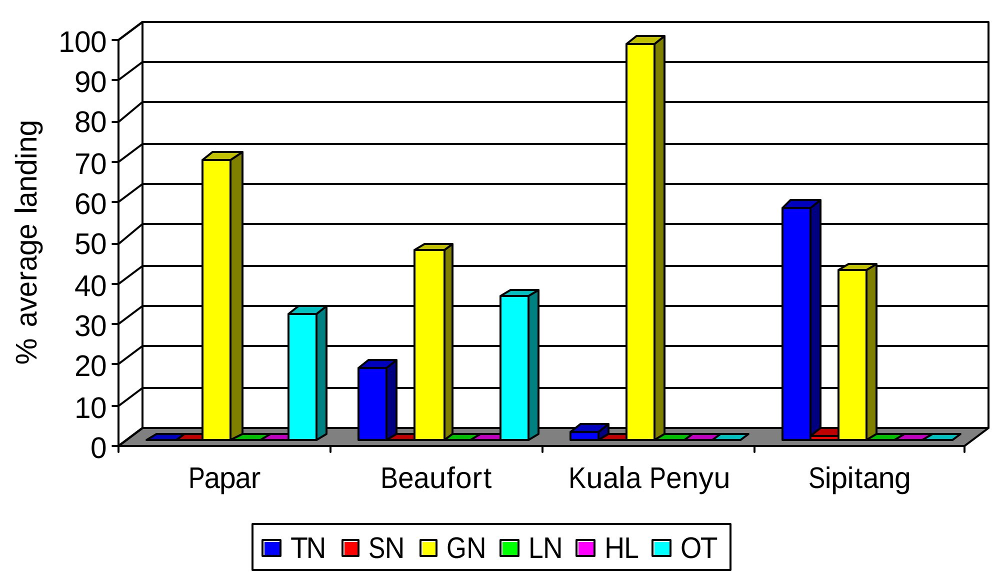


Figure 265f. Annual demersal landing breakdown by gear type and district in the SSME-1 area, 1997-1999 (shrimp)

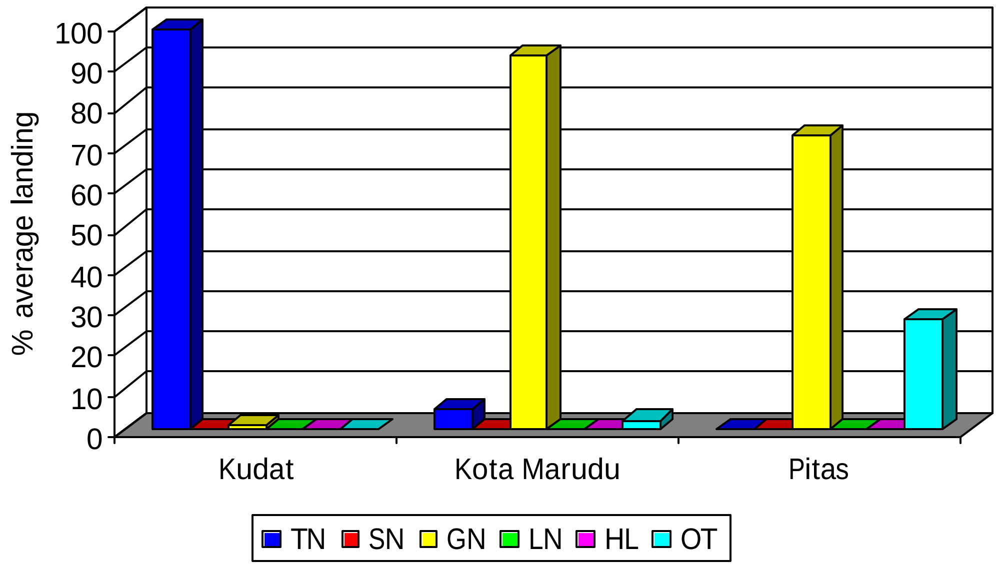


Figure 265g. Annual demersal landing breakdown by gear type and district in the SSME-2 area, 1997-1999 (shrimp)

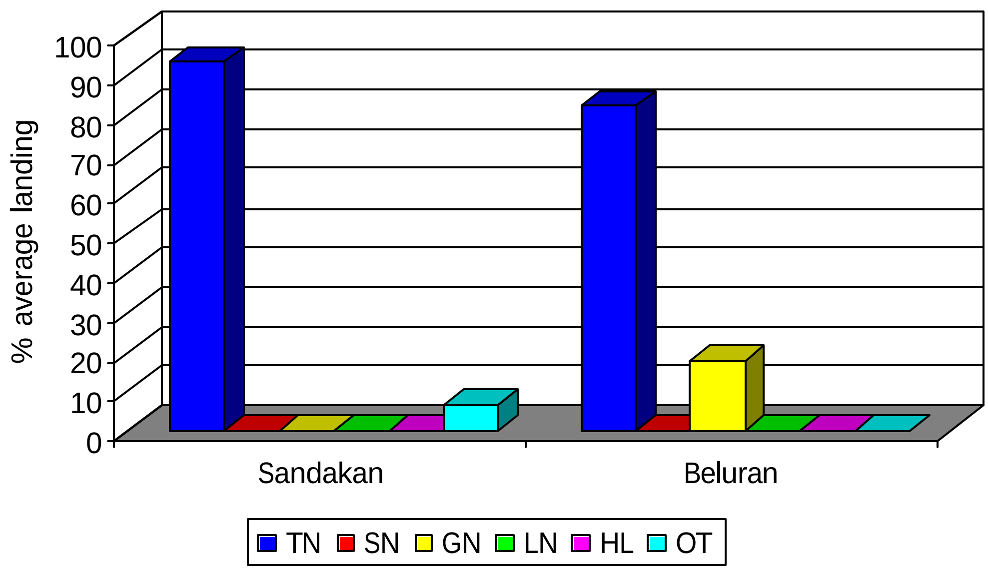


Figure 265h. Annual demersal landing breakdown by gear type and district in the SSME-3 area, 1997-1999 (shrimp)

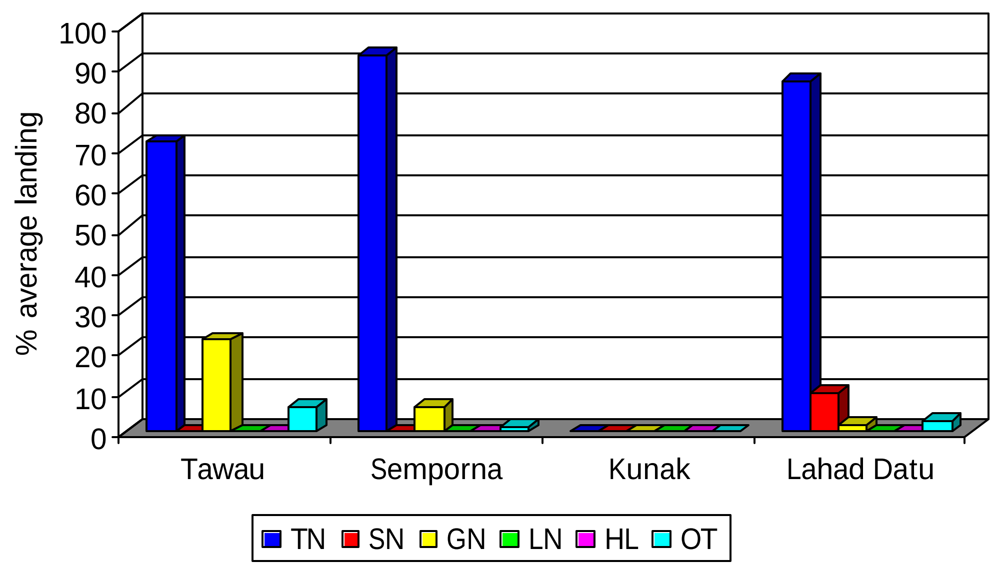


Figure 266a. Annual demersal landing breakdown by gear type, Sabah 1997-1999 (invertebrates)

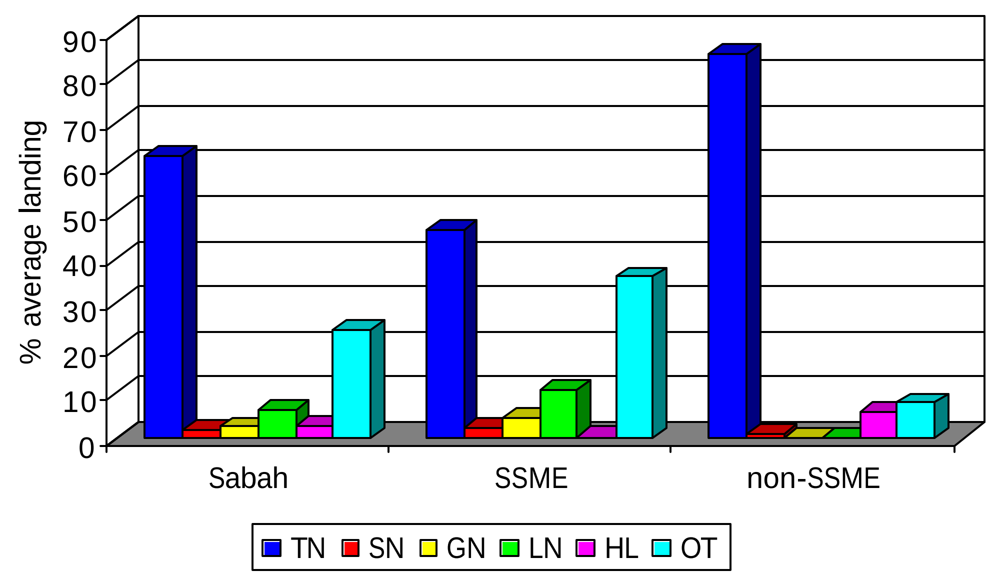


Figure 266b. Annual demersal landing breakdown by gear type in the SSME area, 1997-1999 (invertebrates)

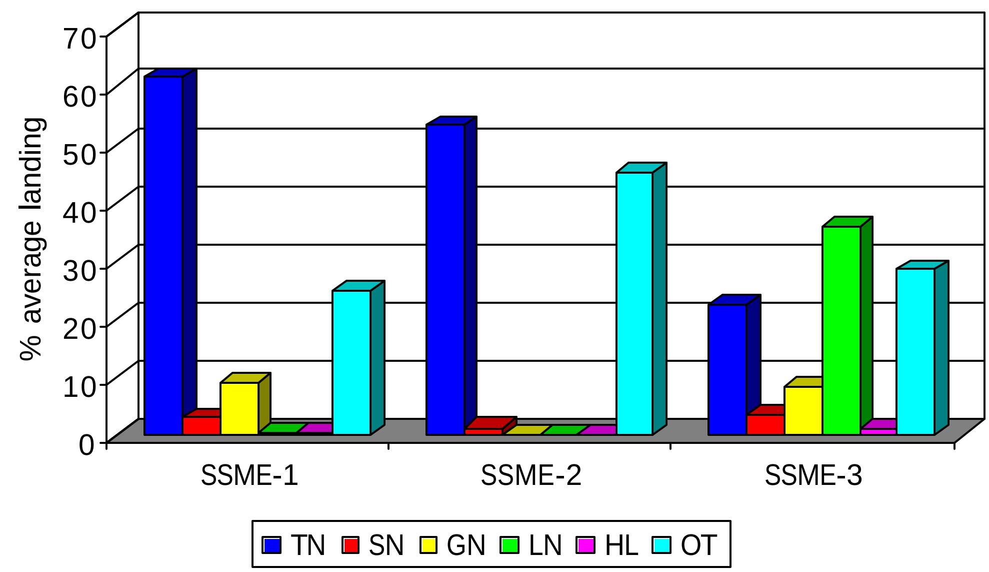


Figure 266c. Annual demersal landing breakdown by gear type in the non-SSME area, 1997-1999 (invertebrates)

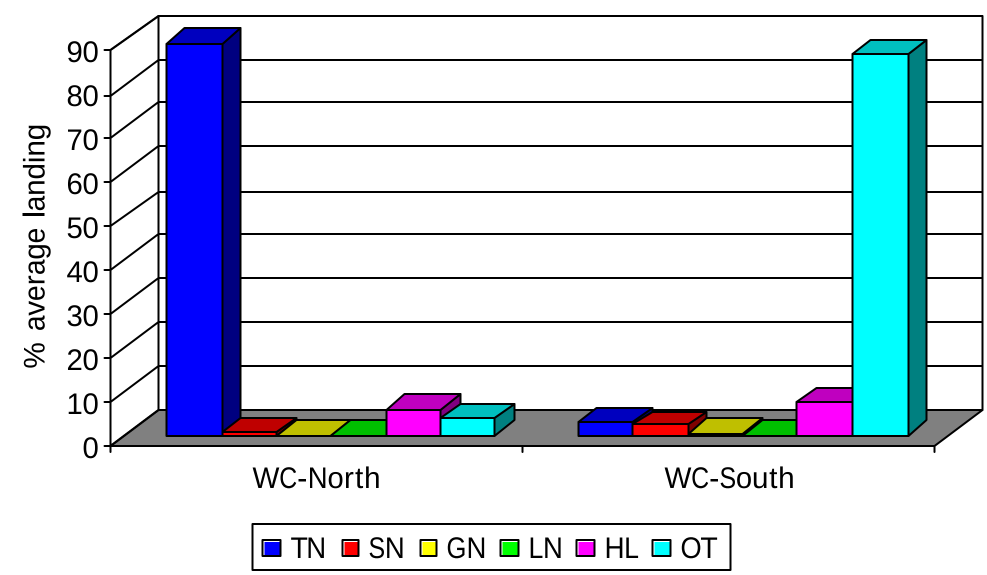


Figure 266d. Annual demersal landing breakdown by gear type in the WC-North (non-SSME area), 1997-1999 (invertebrates)

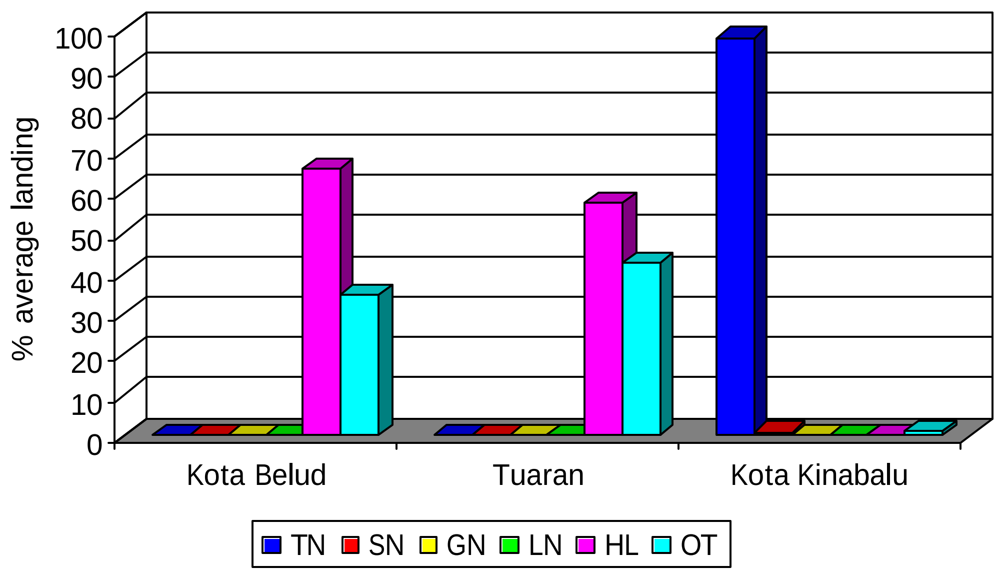


Figure 266e. Annual demersal landing breakdown by gear type in the WC-South (non-SSME area), 1997-1999 (invertebrates)

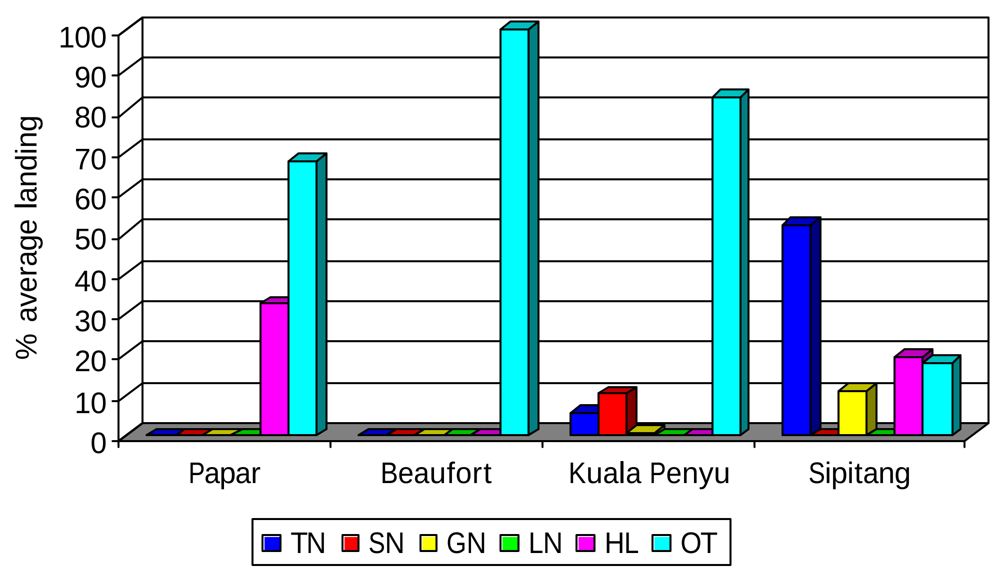


Figure 266f. Annual demersal landing breakdown by gear type and district in the SSME-1 area, 1997-1999 (invertebrates)

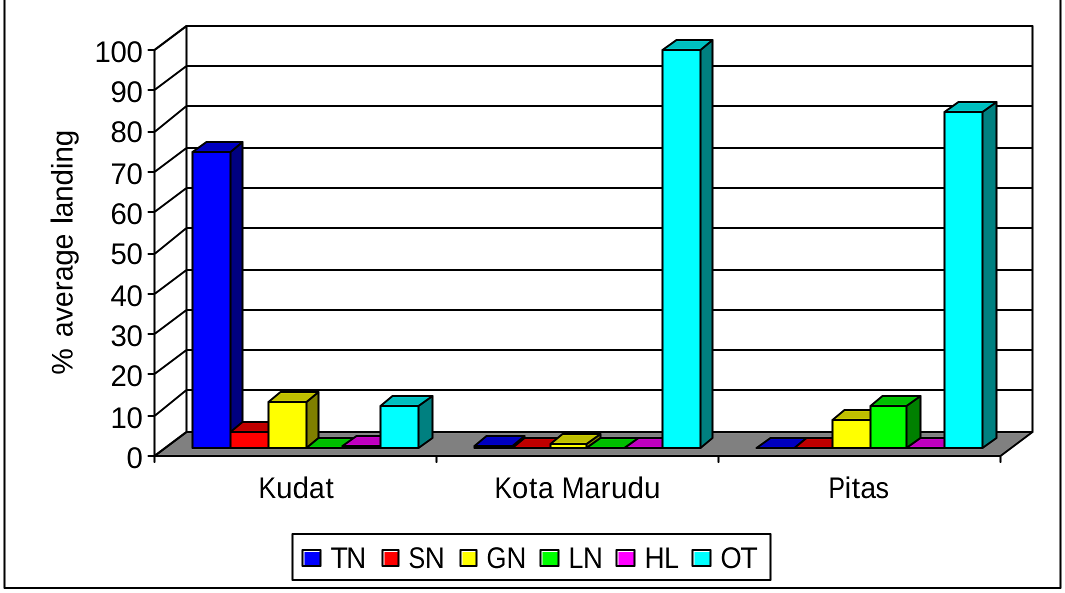


Figure 266g. Annual demersal landing breakdown by gear type and district in the SSME-2 area, 1997-1999 (invertebrates)

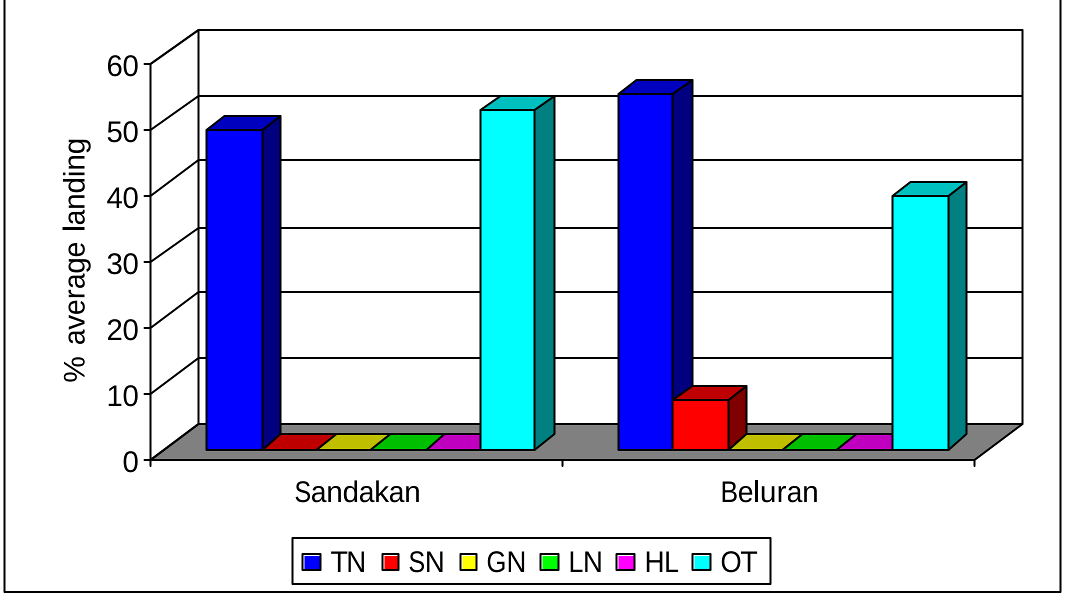


Figure 266h. Annual demersal landing breakdown by gear type and district in the SSME-3 area, 1997-1999 (invertebrates)

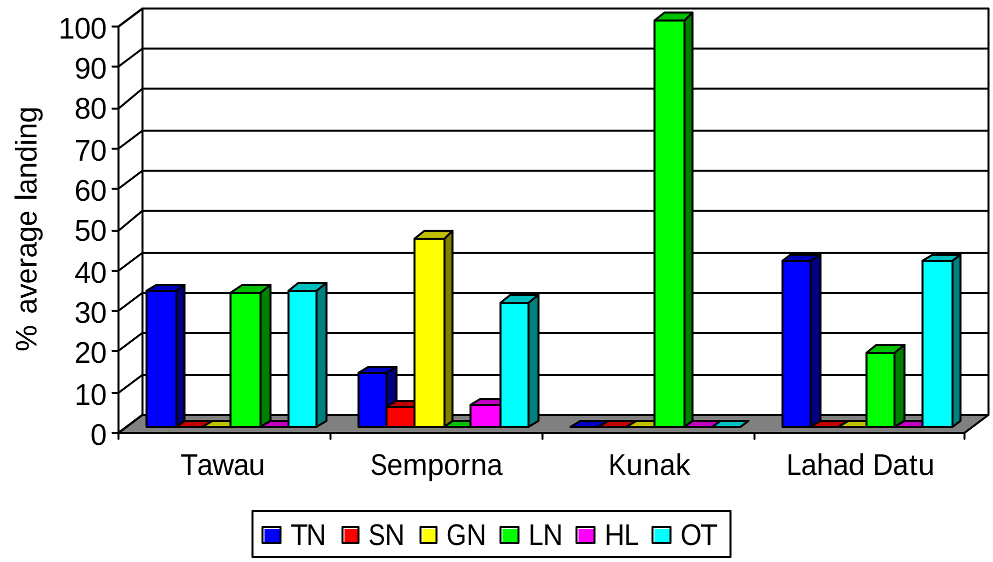


Figure 267a. Annual pelagic landing breakdown by gear type, Sabah 1997-1999

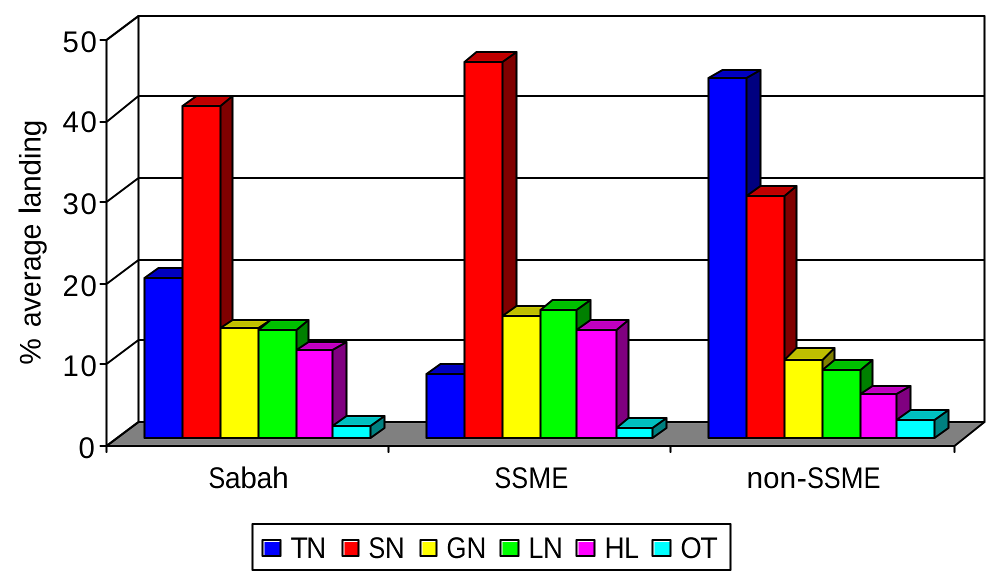


Figure 267b. Annual pelagic landing breakdown by gear type in the SSME area, 1997-1999

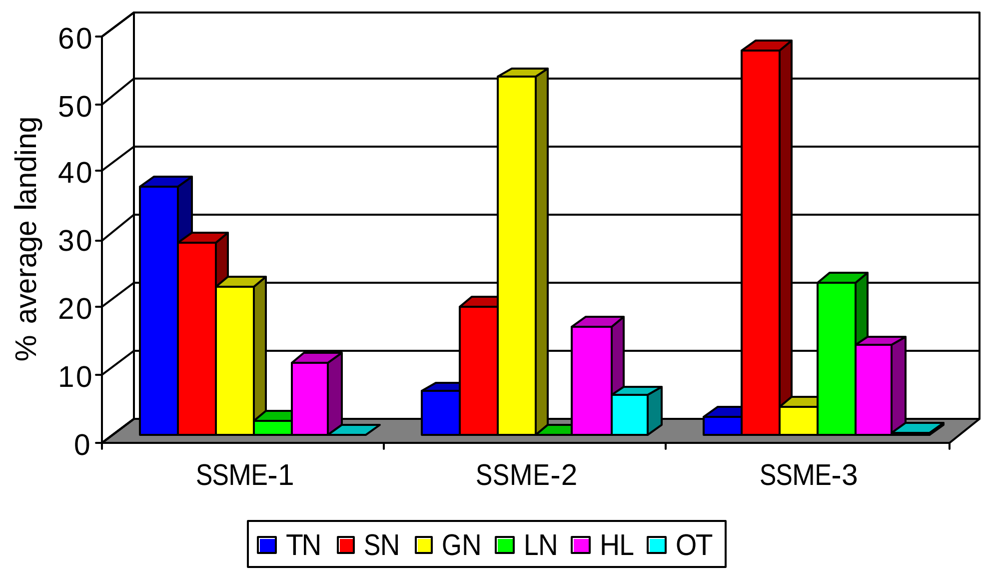


Figure 267c. Annual pelagic landing breakdown by gear type in the non-SSME area, 1997-1999

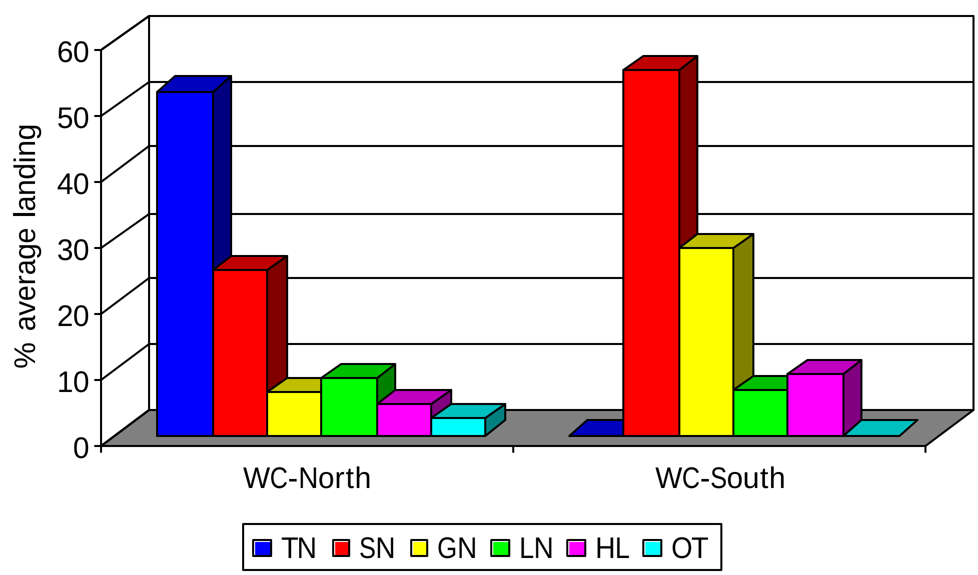


Figure 267d. Annual pelagic landing breakdown by gear type in the WC-North (non-SSME area), 1997-1999

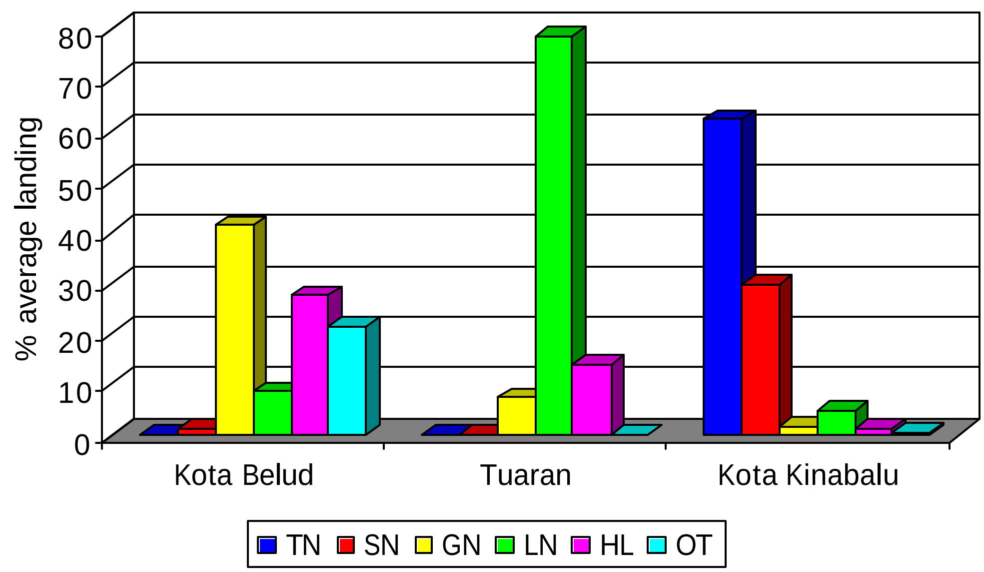


Figure 267e. Annual pelagic landing breakdown by gear type in the WC-South (non-SSME area), 1997-1999

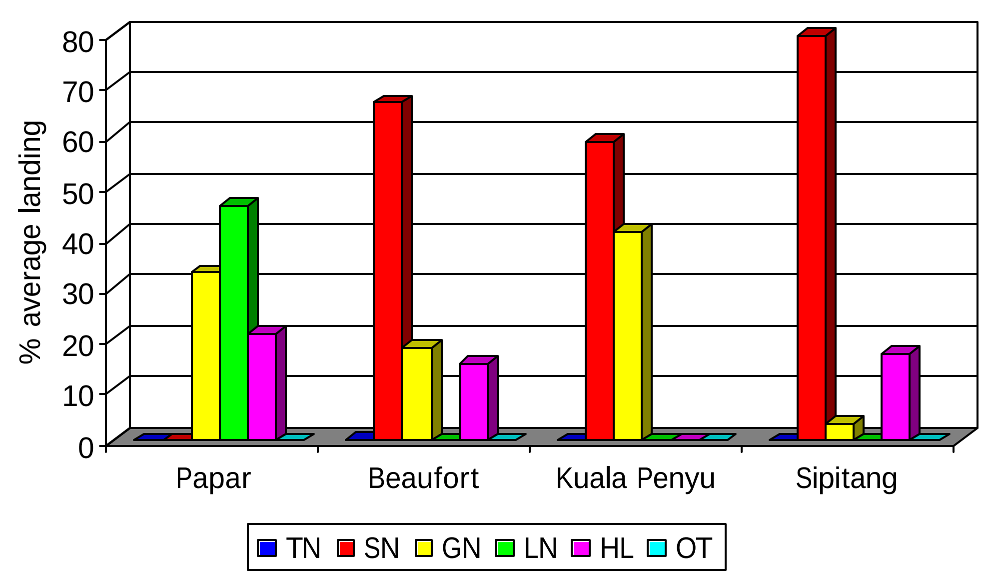


Figure 268a. Annual pelagic landing breakdown by gear type in the SSME area, 1997-1999

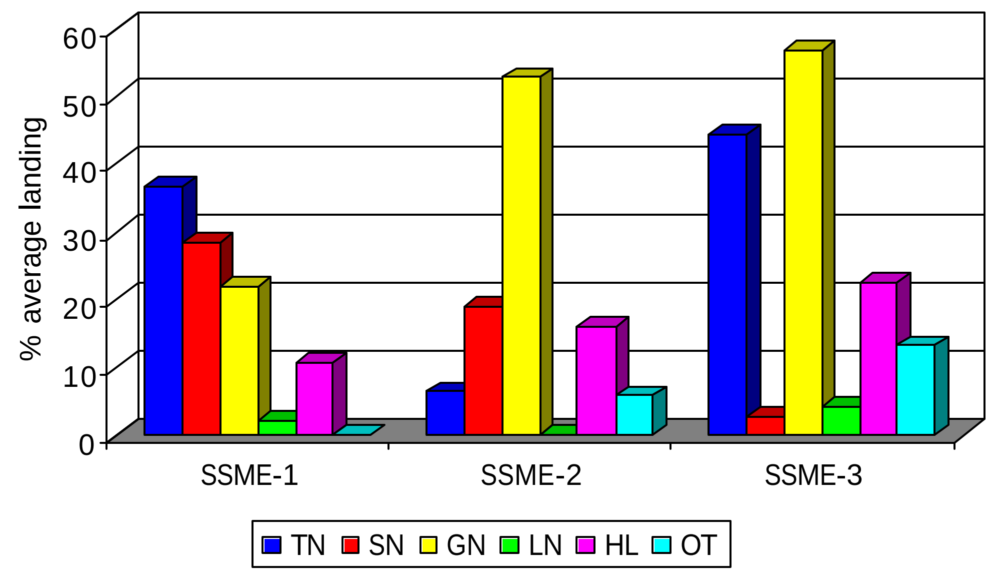


Figure 268b. Annual pelagic landing breakdown by gear type and district in the SSME-1 area, 1997-1999

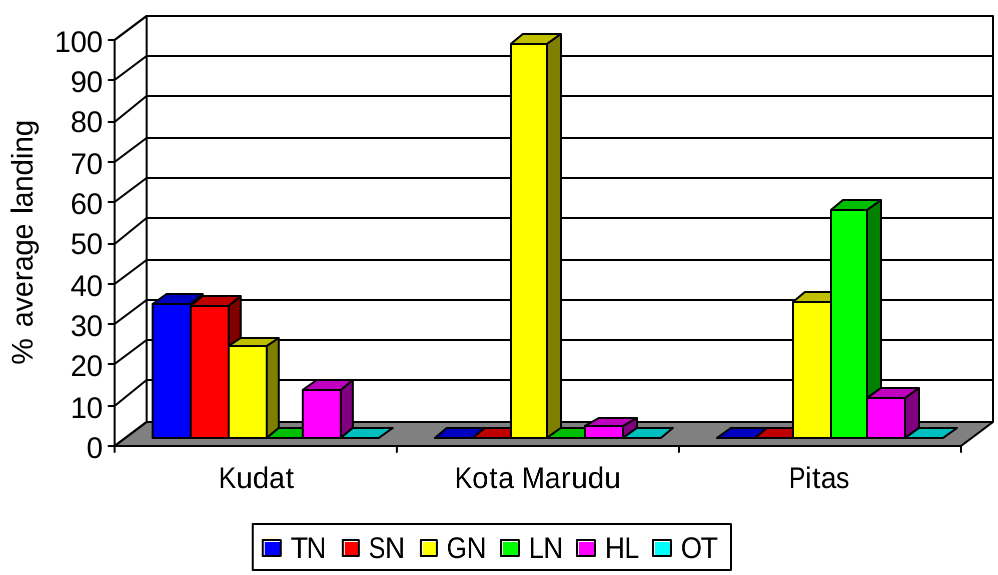


Figure 268c. Annual pelagic landing breakdown by gear type and district in the SSME-2 area, 1997-1999

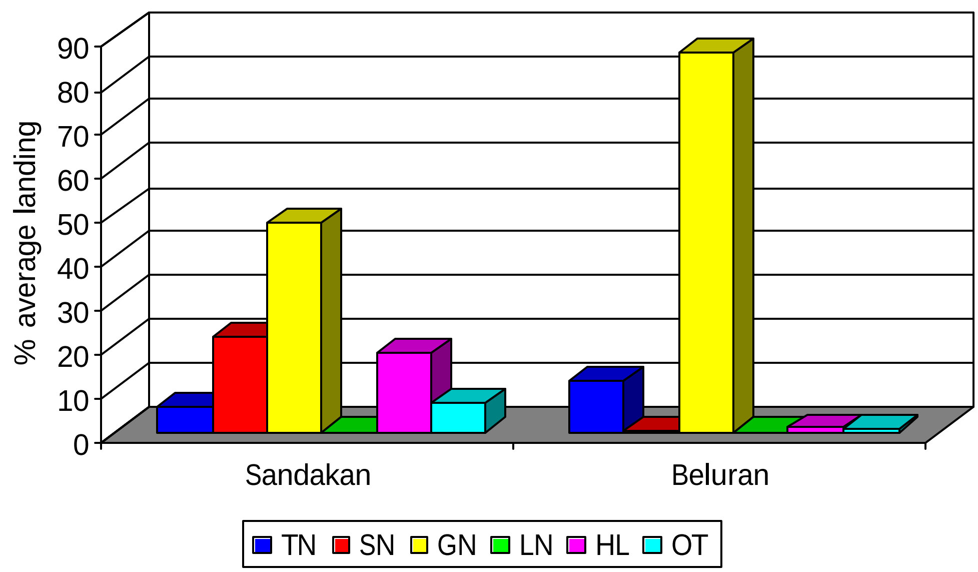


Figure 268d. Annual pelagic landing breakdown by gear type and district in the SSME-3 area, 1997-1999

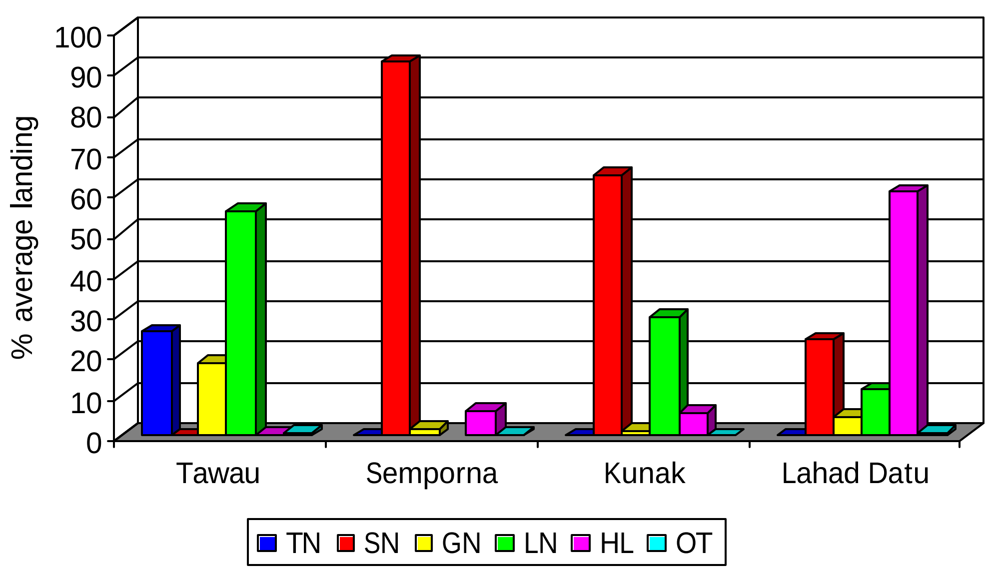


Figure 269a. Annual mackerel landing breakdown by gear type, Sabah 1997-1999

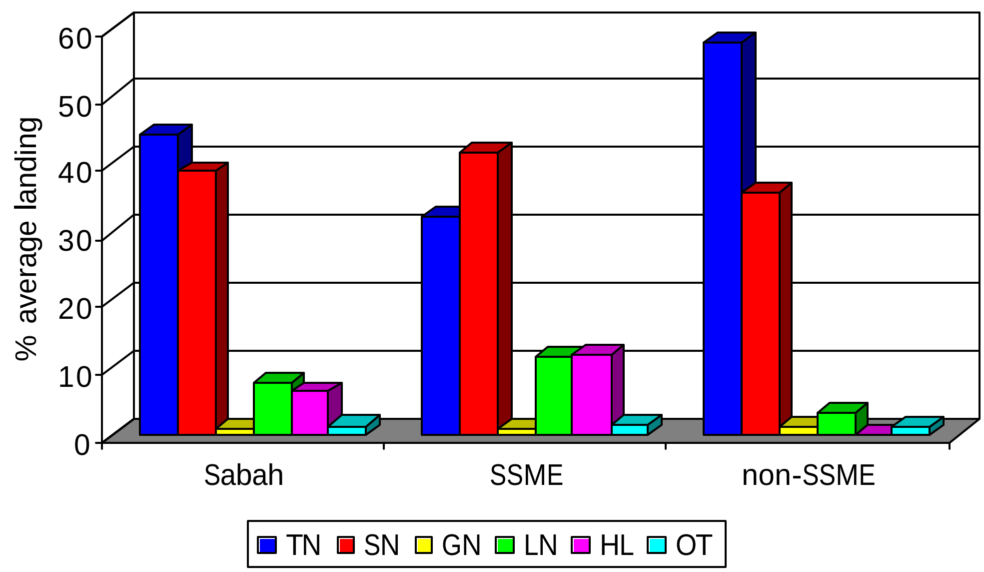


Figure 269b. Annual mackerel landing breakdown by gear type in the SSME area, 1997-1999

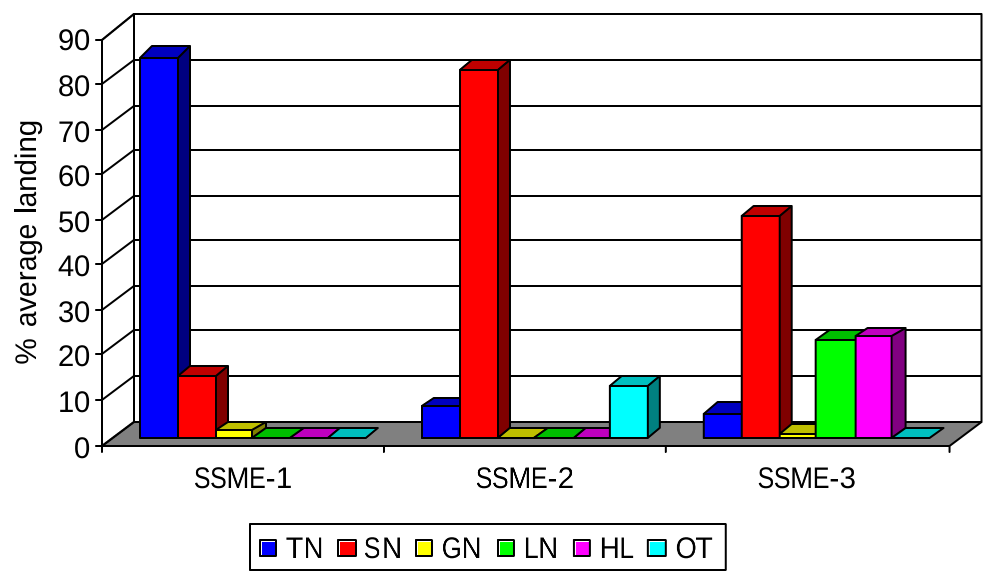


Figure 269c. Annual mackerel landing breakdown by gear type in the non-SSME area, 1997-1999

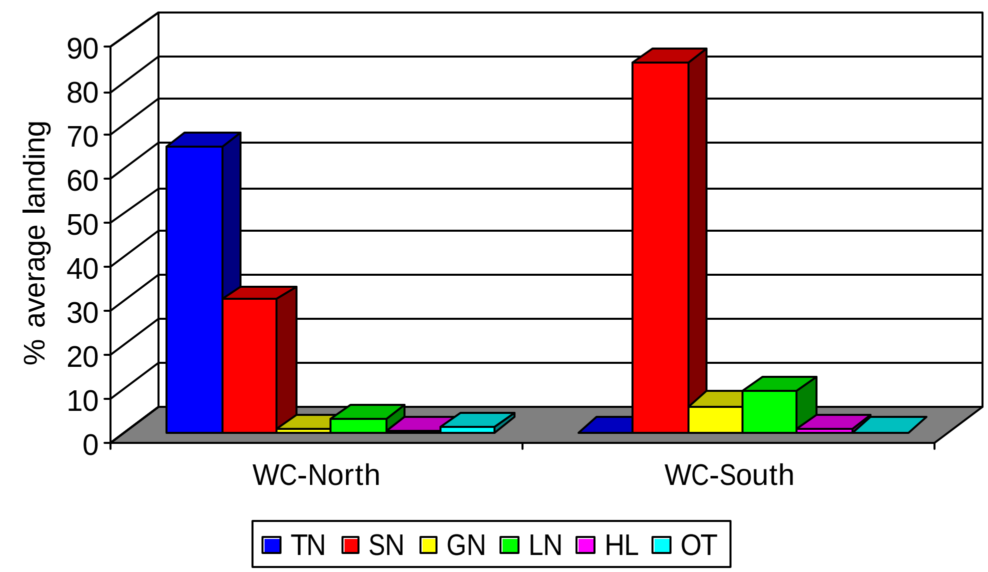


Figure 269d. Annual mackerel landing breakdown by gear type in the WC-North (non-SSME area), 1997-1999

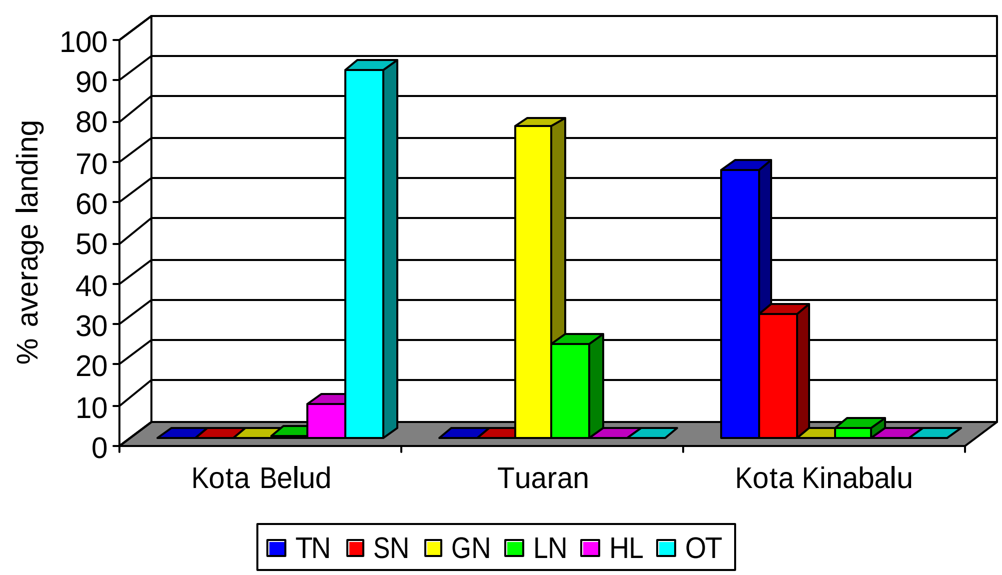


Figure 269e. Annual mackerel landing breakdown by gear type in the WC-South (non-SSME area), 1997-1999

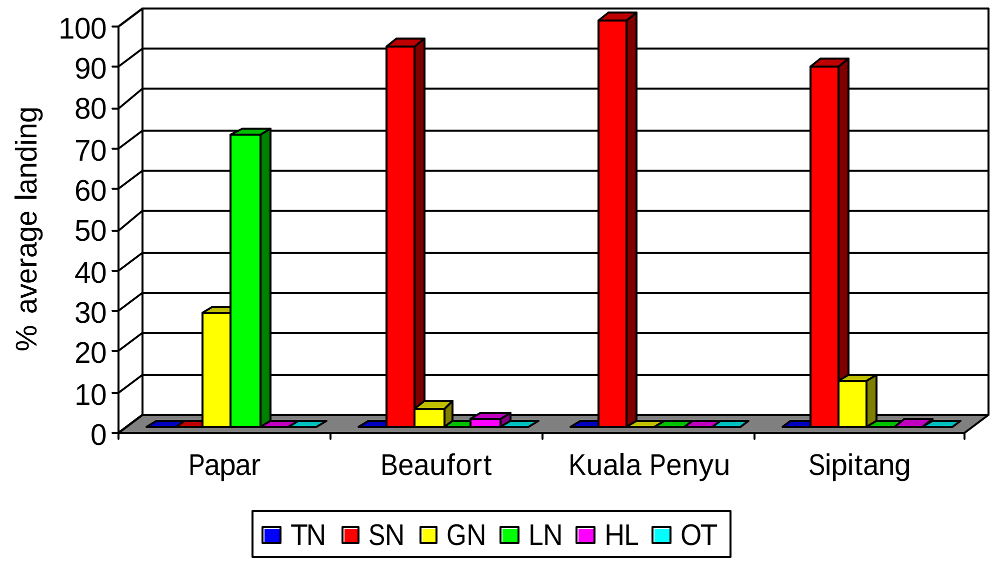


Figure 269f. Annual mackerel landing breakdown by gear type and district in the SSME-1 area, 1997-1999

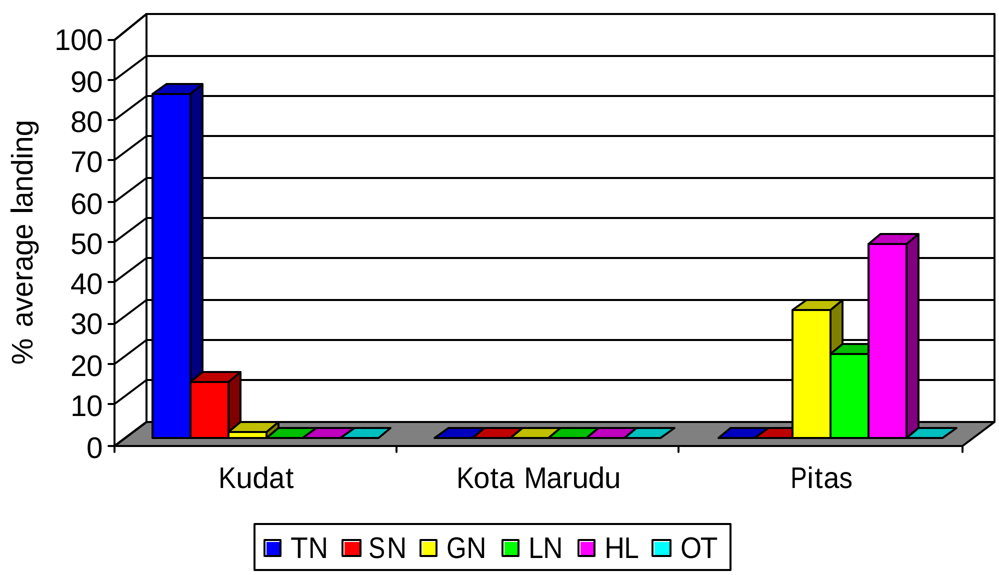


Figure 269g. Annual mackerel landing breakdown by gear type and district in the SSME-2 area, 1997-1999

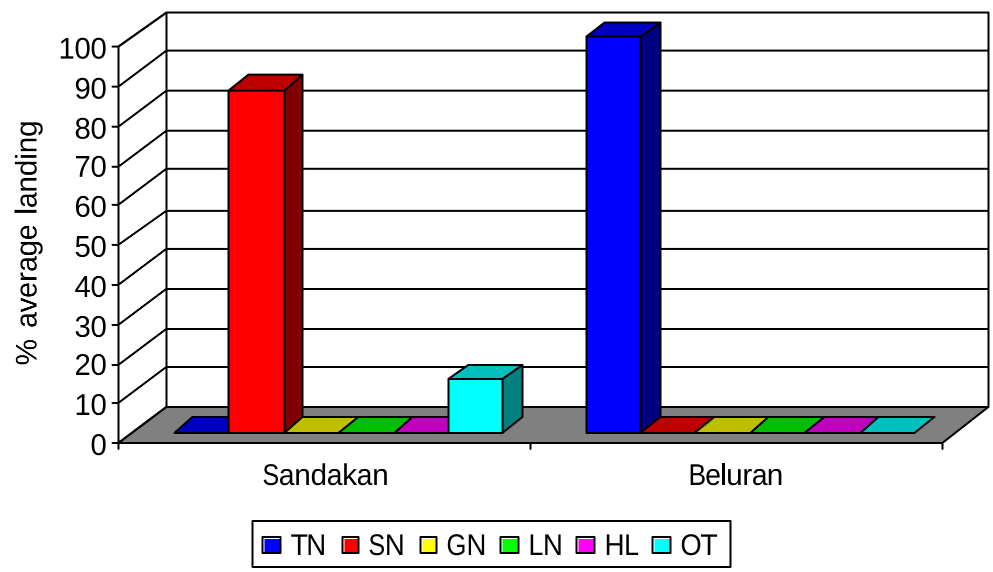


Figure 269h. Annual mackerel landing breakdown by gear type and district in the SSME-3 area, 1997-1999

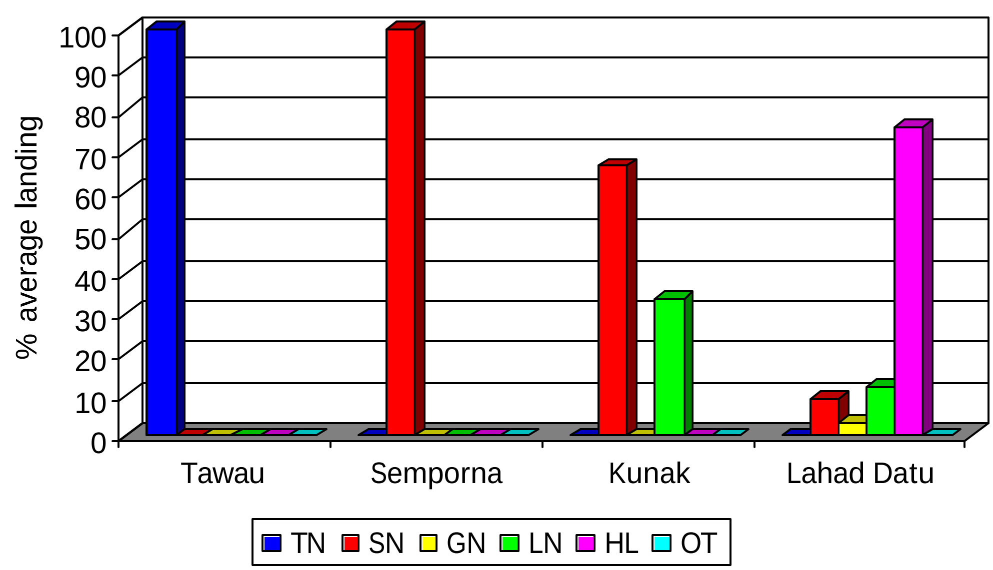


Figure 270a. Annual round scad landing breakdown by gear type, Sabah 1997-1999

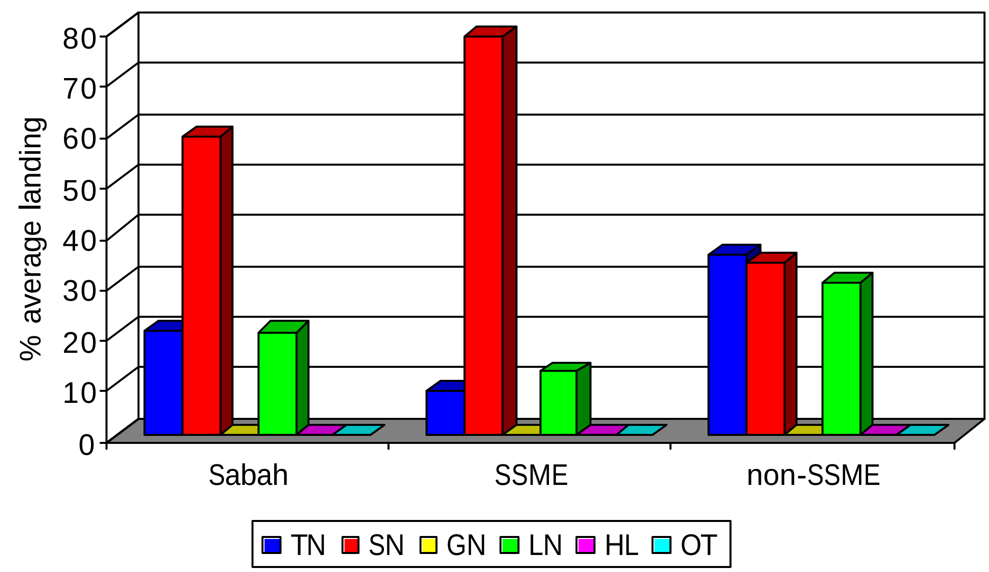


Figure 270b. Annual round scad landing breakdown by gear type in the SSME area, 1997-1999

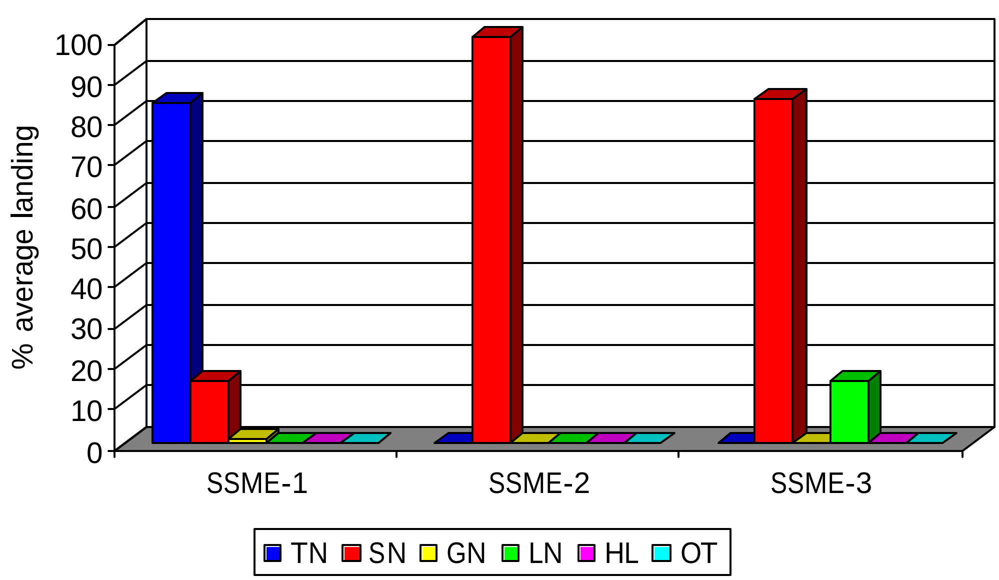


Figure 270c. Annual round scad landing breakdown by gear type in the non-SSME area, 1997-1999

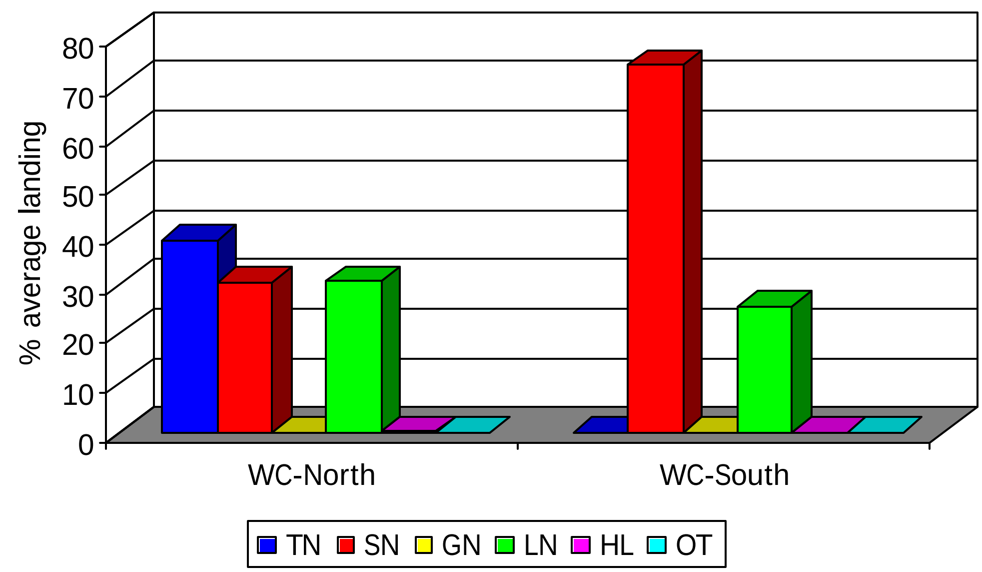


Figure 270d. Annual round scad landing breakdown by gear type in the WC-North (non-SSME area), 1997-1999

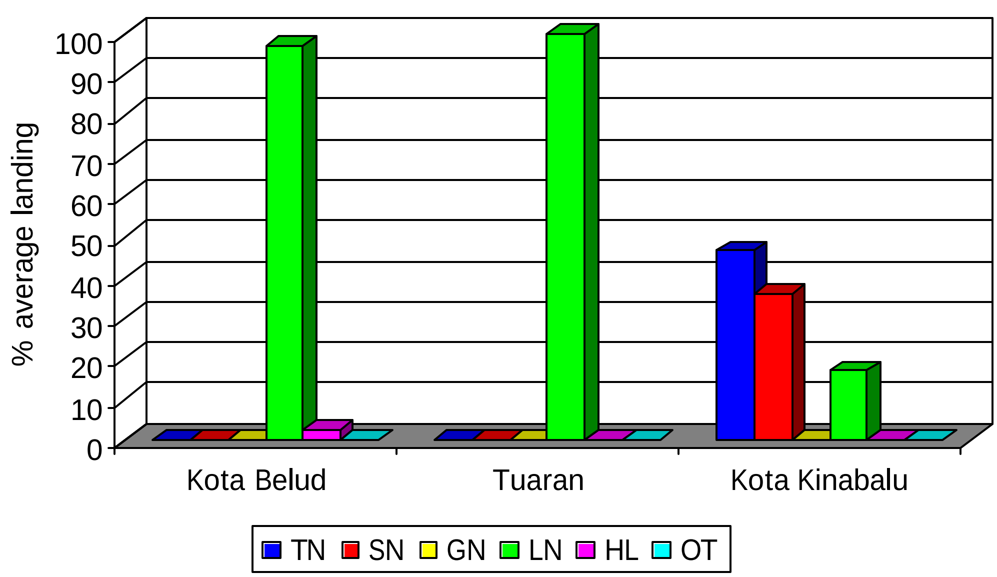


Figure 270e. Annual round scad landing breakdown by gear type in the WC-South (non-SSME area), 1997-1999

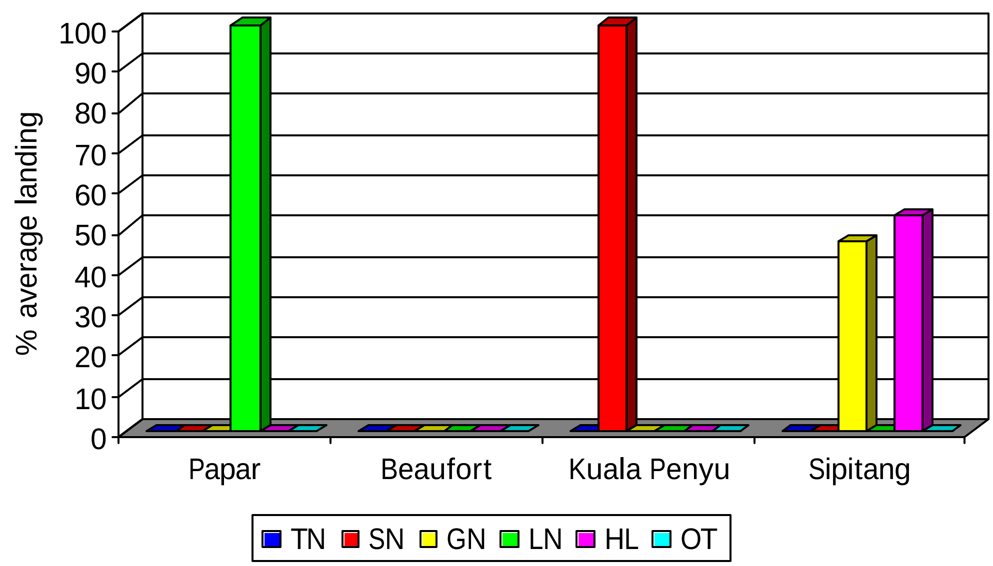


Figure 270f. Annual round scad landing breakdown by gear type and district in the SSME-1 area, 1997-1999

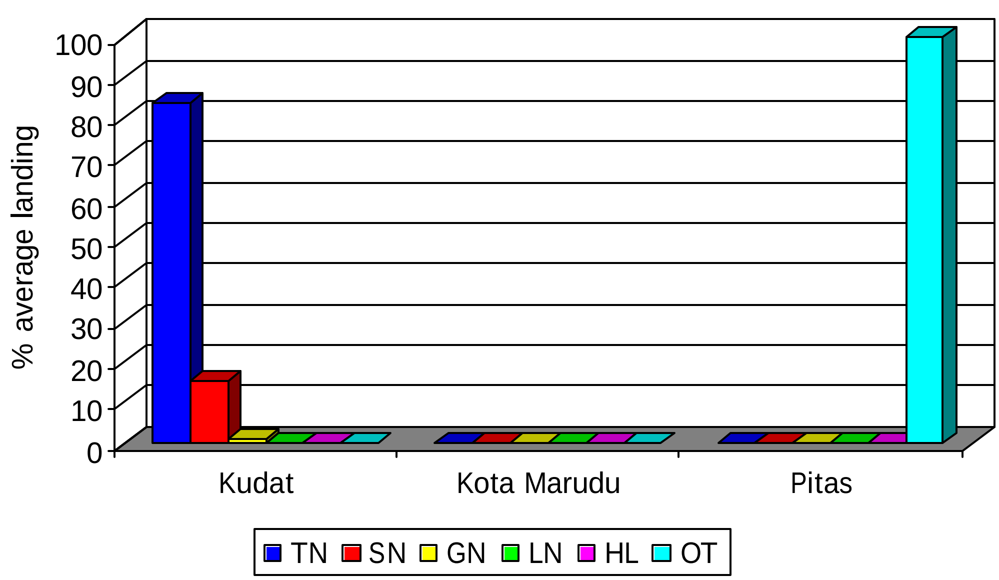


Figure 270g. Annual round scad breakdown by gear type and district in the SSME-2 area, 1997-1999

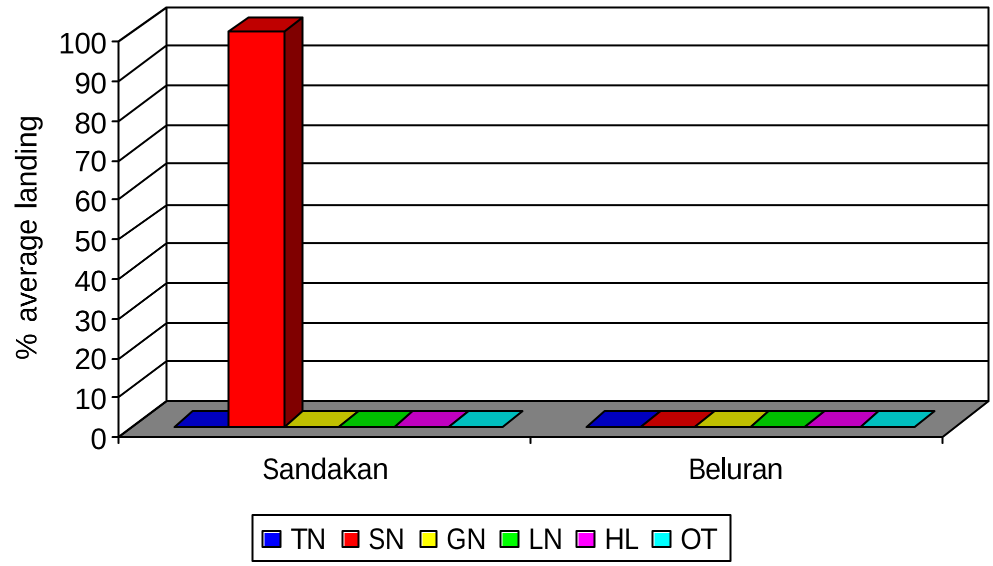


Figure 270h. Annual round scad landing breakdown by gear type and district in the SSME-3 area, 1997-1999

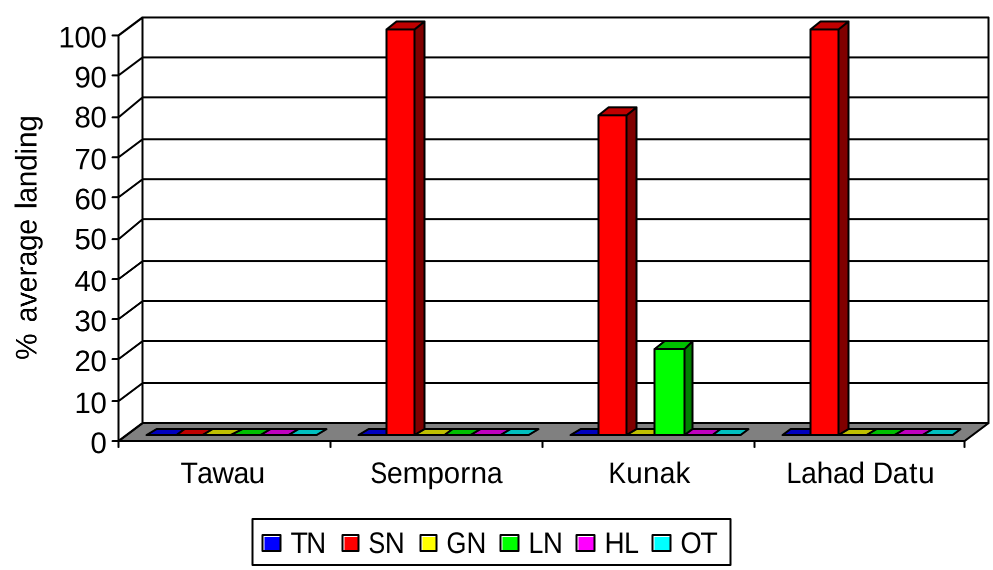


Figure 271a. Annual sardine landing breakdown by gear type, Sabah 1997-1999

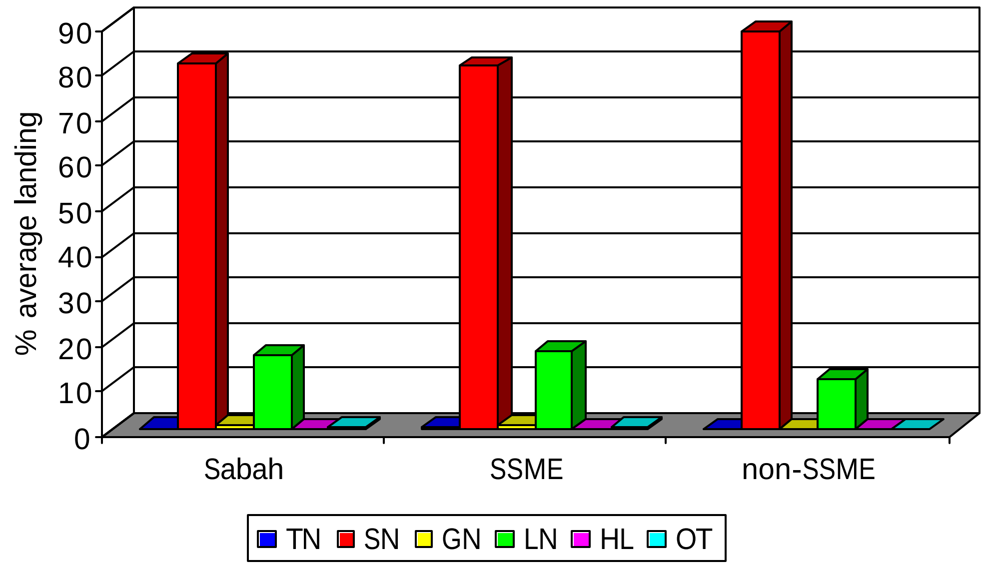


Figure 271b. Annual sardine landing breakdown by gear type in the SSME area, 1997-1999

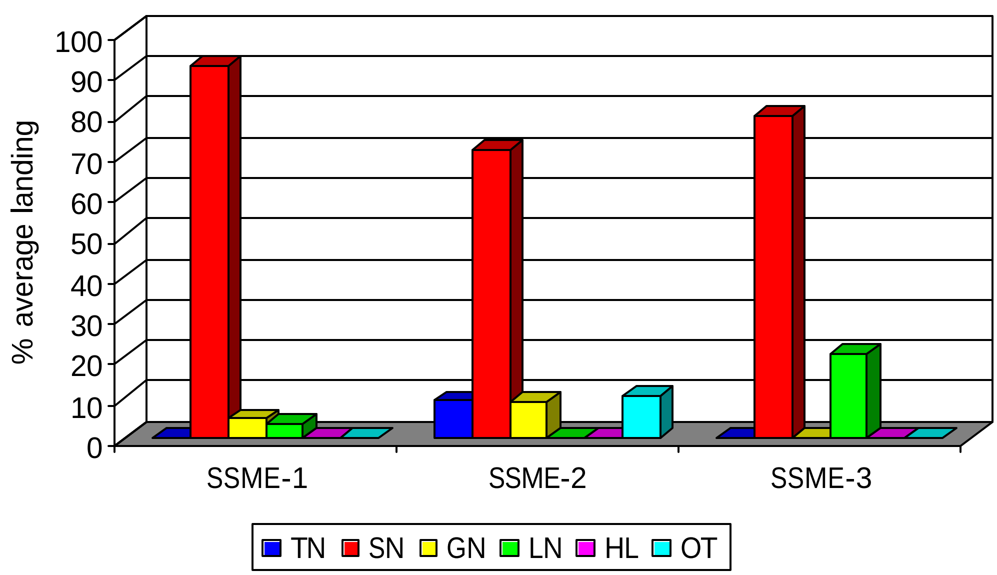


Figure 271c. Annual sardine landing breakdown by gear type in the non-SSME area, 1997-1999

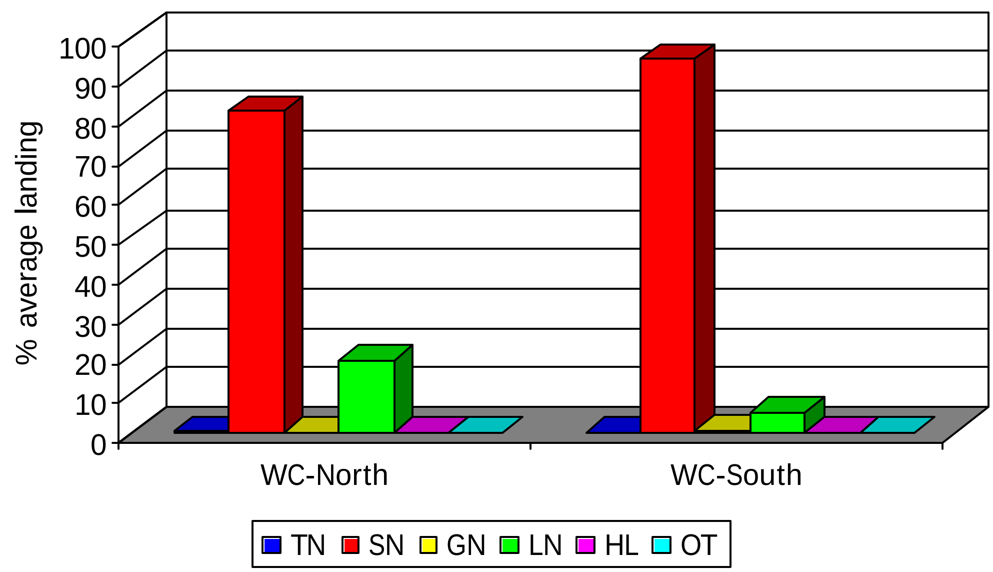


Figure 271d. Annual sardine landing breakdown by gear type in the WC-North (non-SSME area), 1997-1999

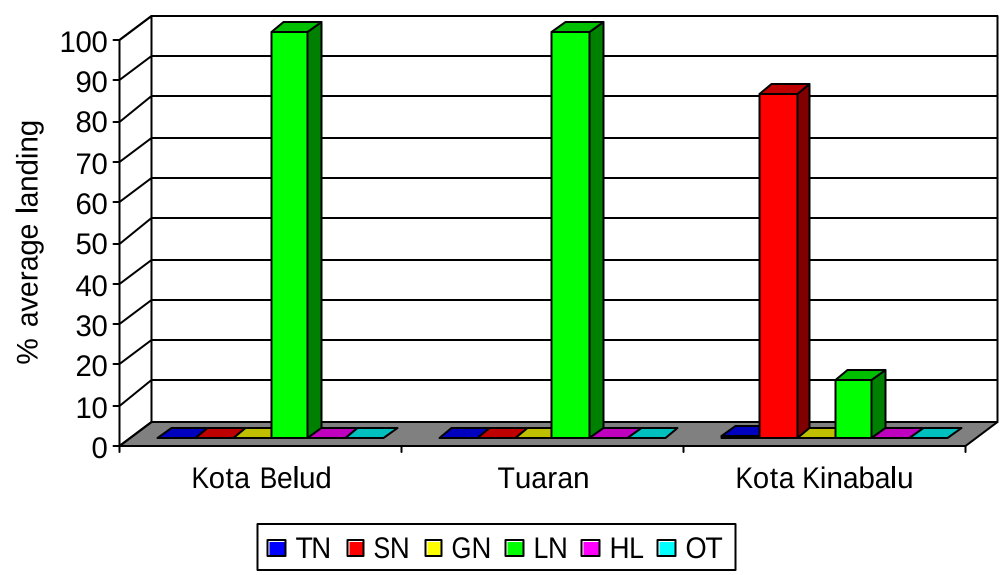


Figure 271e. Annual sardine landing breakdown by gear type in the WC-South (non-SSME area), 1997-1999

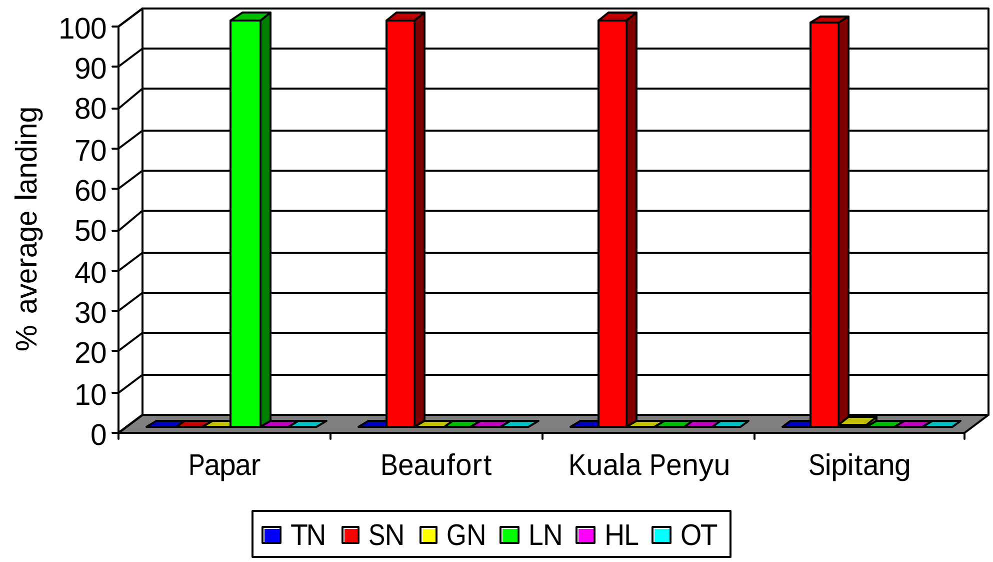


Figure 271f. Annual sardine landing breakdown by gear type and districts in the SSME-1 area, 1997-1999

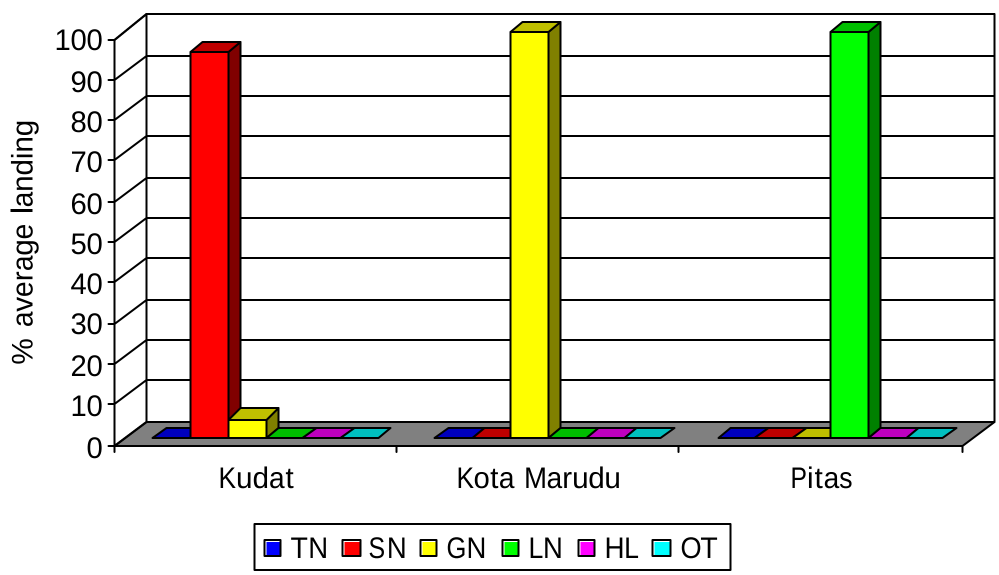


Figure 271g. Annual sardine landing breakdown by gear type and districts in the SSME-2 area, 1997-1999

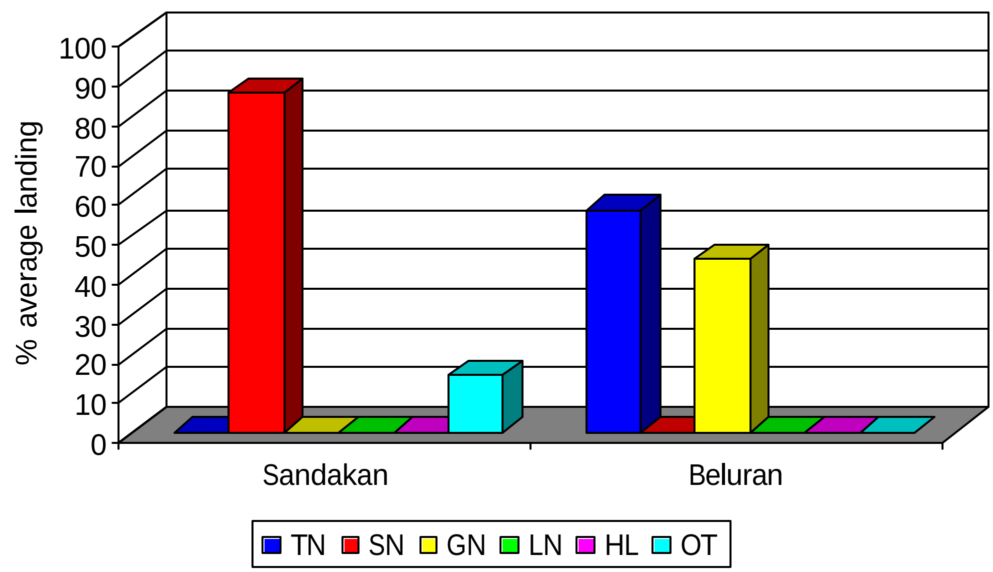


Figure 271h. Annual sardine landing breakdown by gear type and districts in the SSME-3 area, 1997-1999

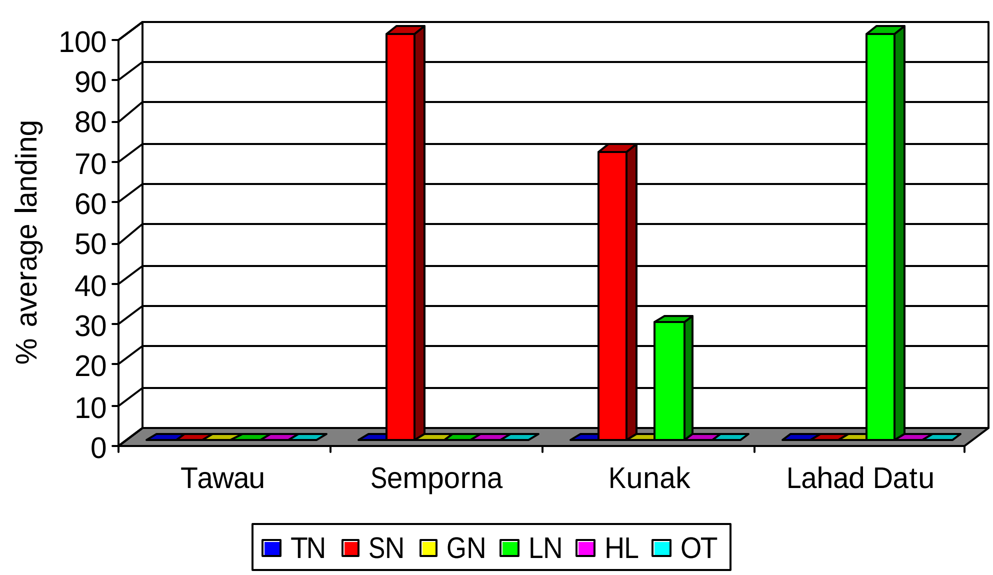


Figure 272a. Annual anchovy landing breakdown by gear type, Sabah, 1997-1999

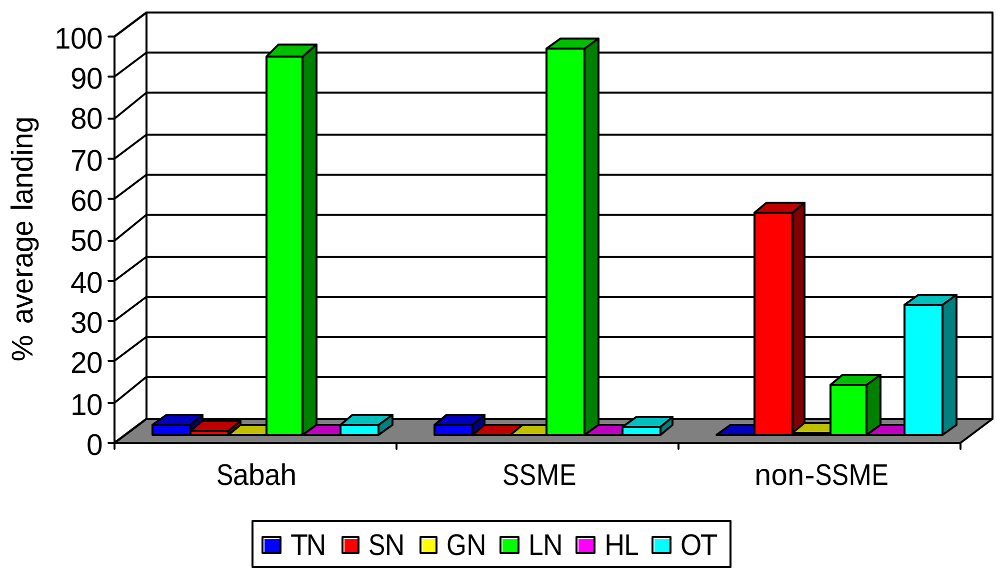


Figure 272b. Annual anchovy landing breakdown by gear type in the SSME area, 1997-1999

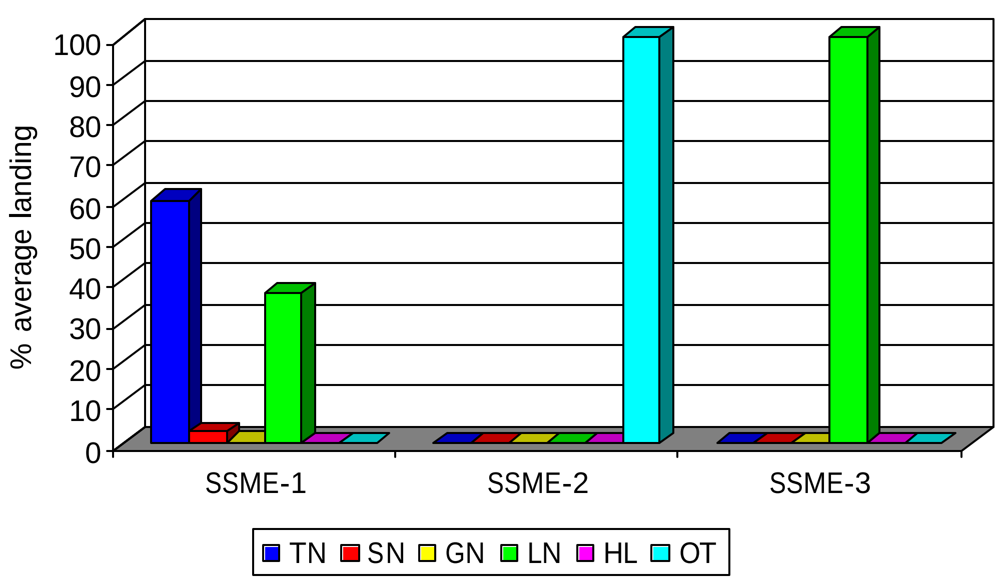


Figure 272c. Annual anchovy landing breakdown by gear type in the non-SSME area, 1997-1999

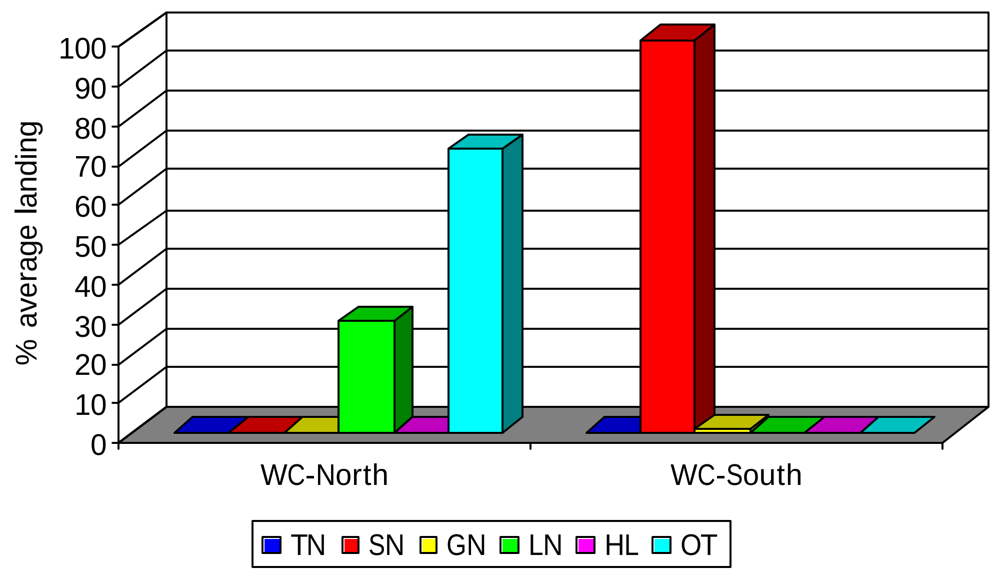


Figure 272d. Annual anchovy landing breakdown by gear type in the WC-North (non-SSME area), 1997-1999

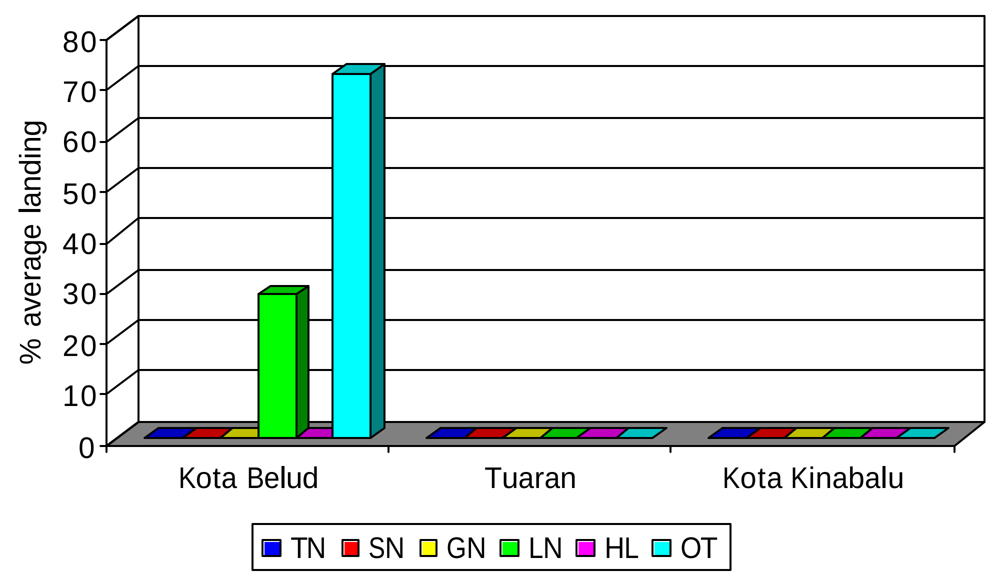


Figure 272e. Annual anchovy landing breakdown by gear type in the WC-South (non-SSME area), 1997-1999

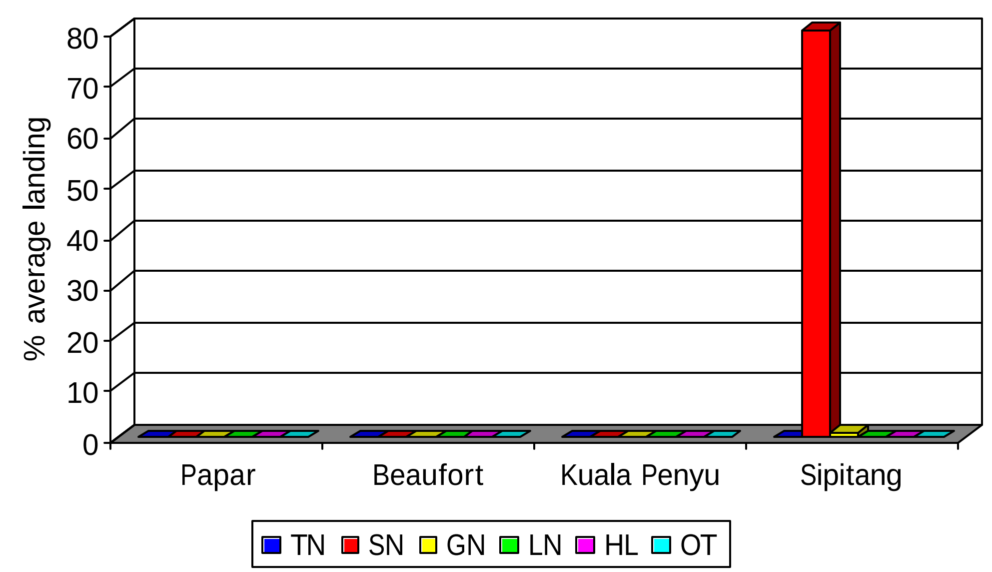


Figure 272f. Annual anchovy landing breakdown by gear type and districts in the SSME-1 area, 1997-1999

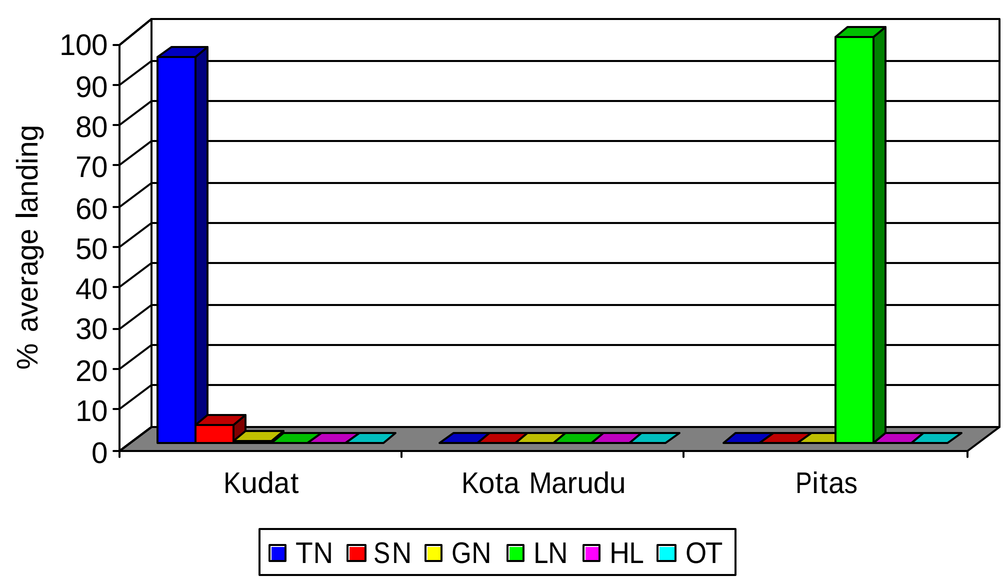


Figure 272g. Annual anchovy landing breakdown by gear type and districts in the SSME-2 area, 1997-1999

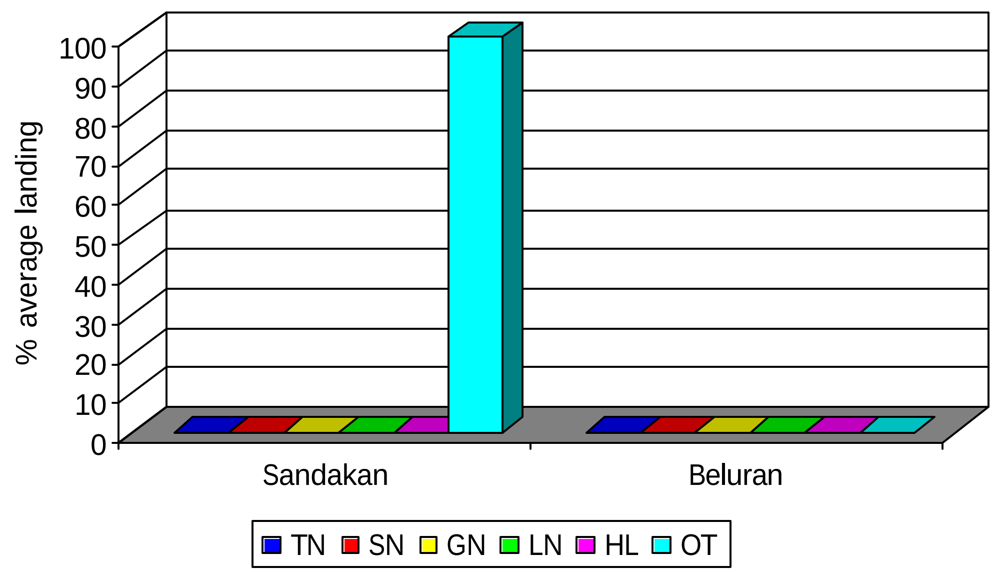


Figure 272h. Annual anchovy landing breakdown by gear type and districts in the SSME-3 area, 1997-1999

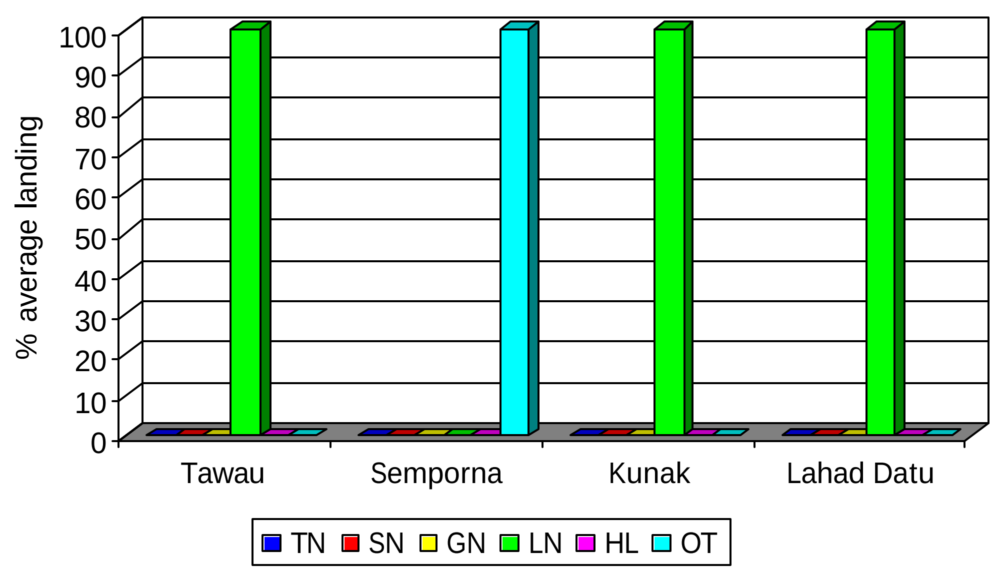


Figure 273a. Annual tuna landing breakdown by gear type, Sabah 1997-1999

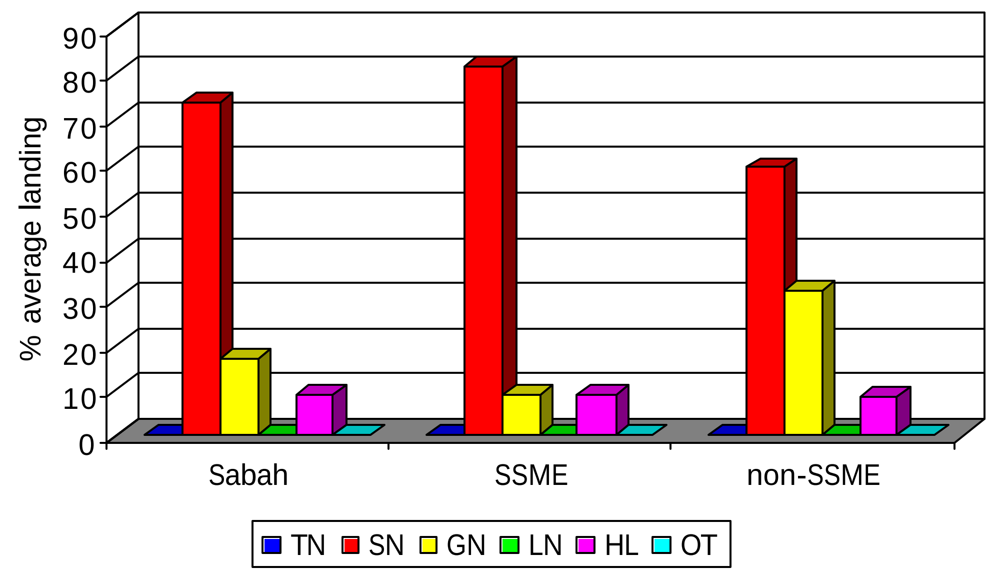


Figure 273b. Annual tuna landing breakdown by gear type in the SSME area, 1997-1999

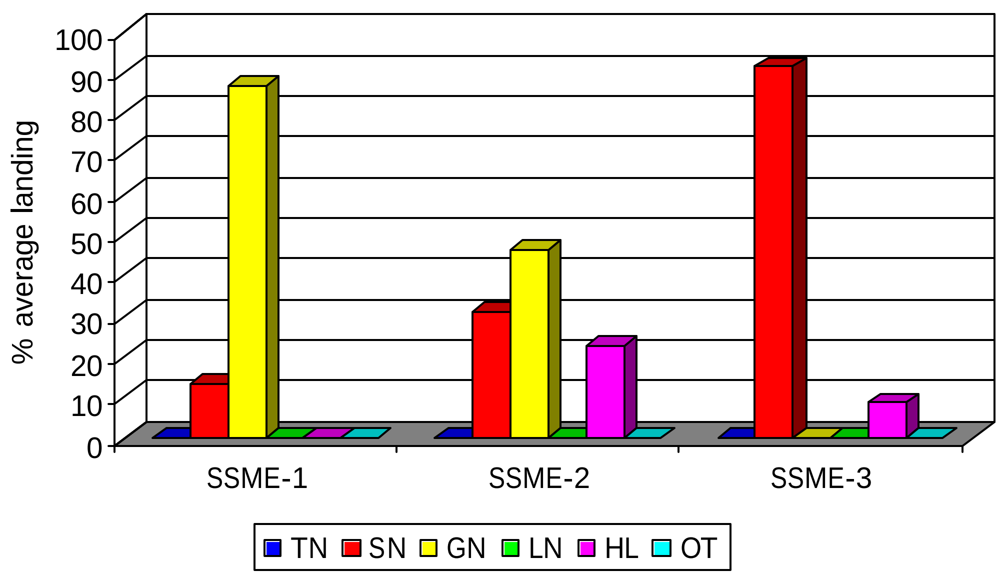


Figure 273c. Annual tuna landing breakdown by gear type in the non-SSME area, 1997-1999

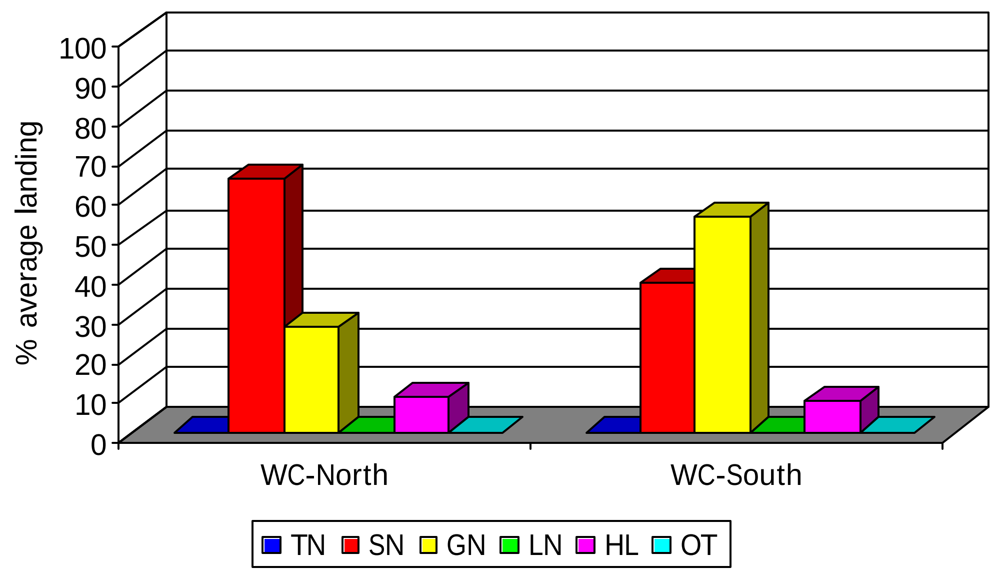


Figure 273d. Annual tuna landing breakdown by gear type in the WC-North (non-SSME area), 1997-1999

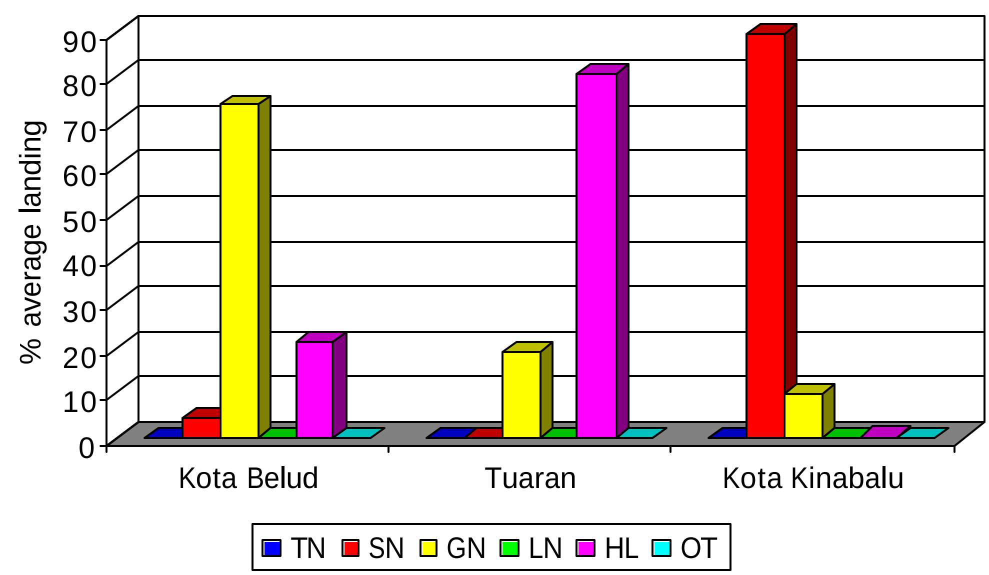


Figure 273e. Annual tuna landing breakdown by gear type in the WC-North (non-SSME area), 1997-1999

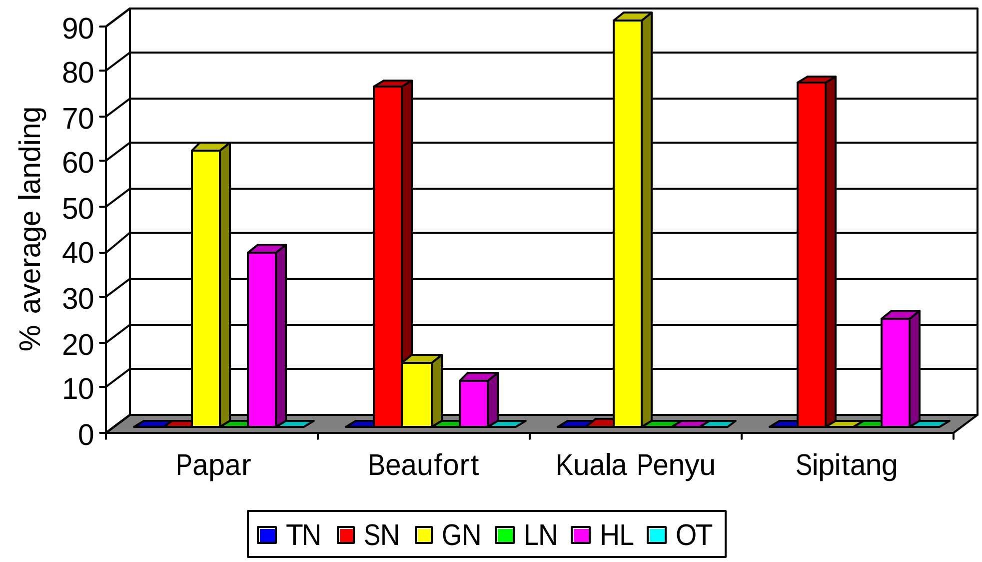


Figure 273f. Annual tuna landing breakdown by gear type and districts in the SSME-1 area, 1997-1999

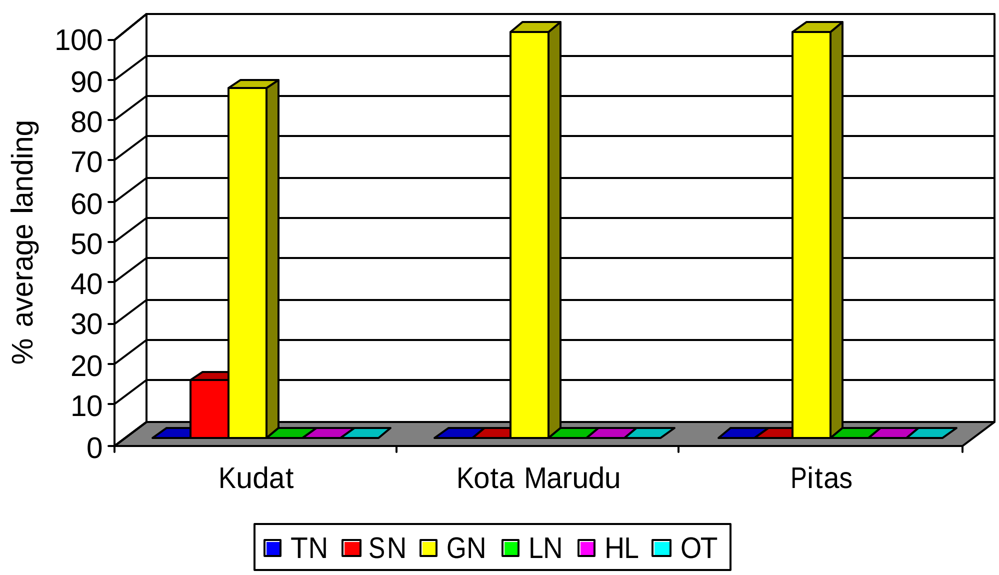


Figure 273g. Annual tuna landing breakdown by gear type and districts in the SSME-2 area, 1997-1999

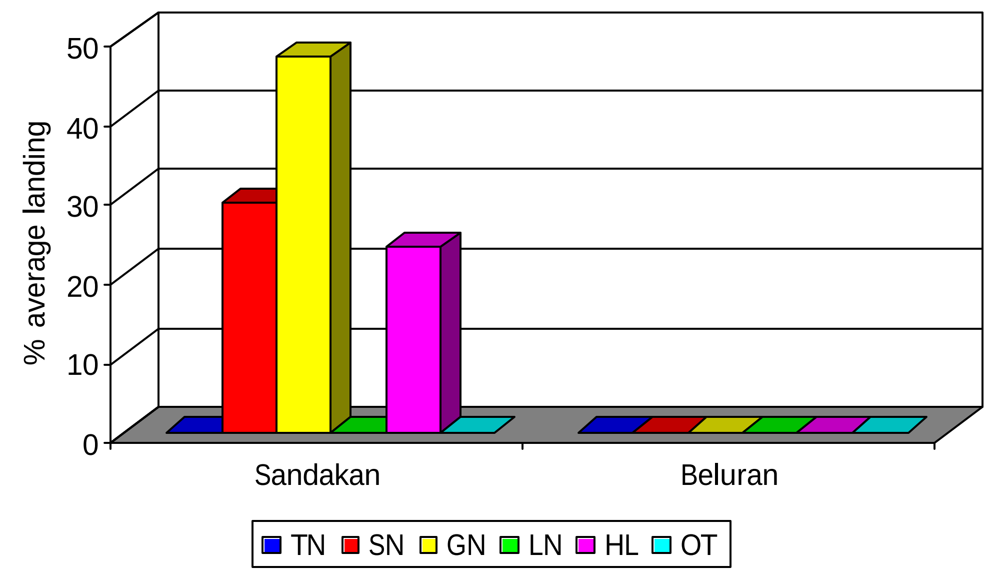


Figure 273h. Annual tuna landing breakdown by gear type and districts in the SSME-3 area, 1997-1999

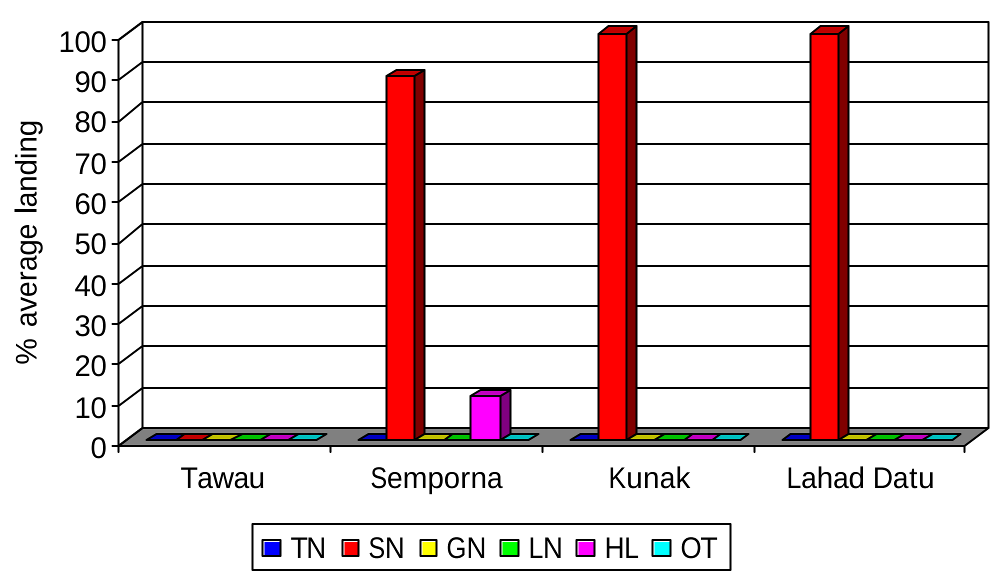


Figure 274a. Annual misc. pelagic landing breakdown by gear type, Sabah, 1997-1999

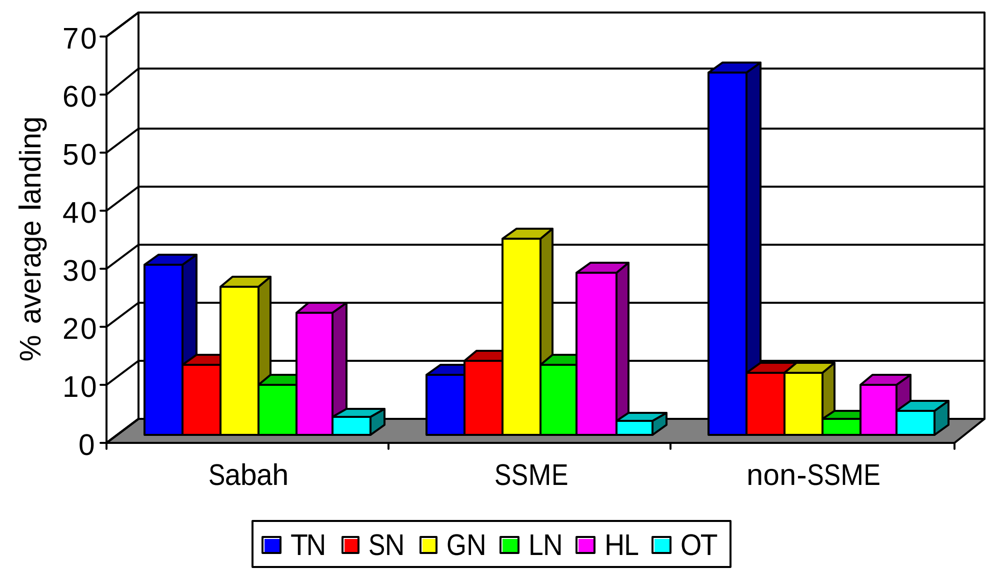


Figure 274b. Annual misc. pelagic landing breakdown by gear type in the SSME area, 1997-1999

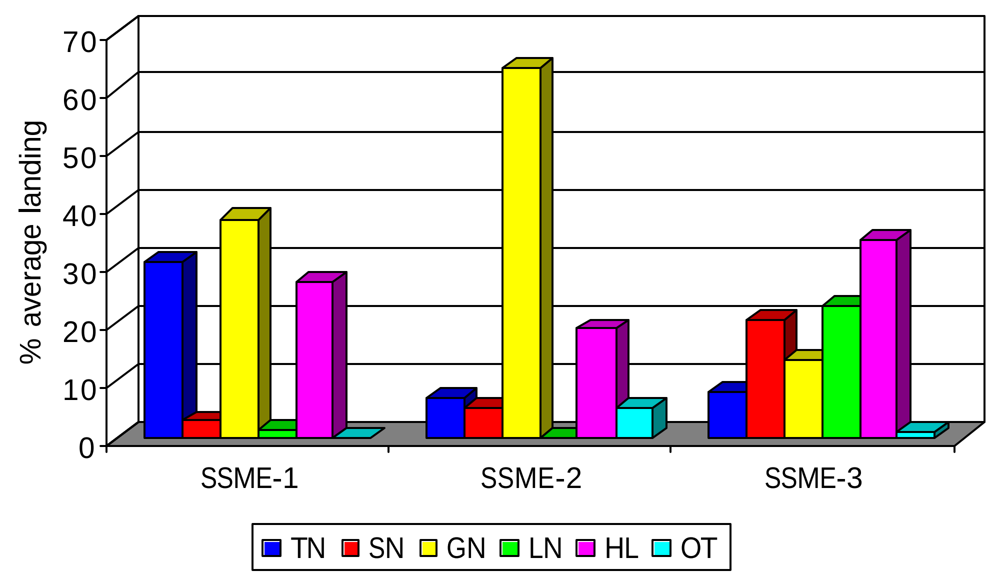


Figure 274c. Annual misc. pelagic landing breakdown by gear type in the non-SSME area, 1997-1999

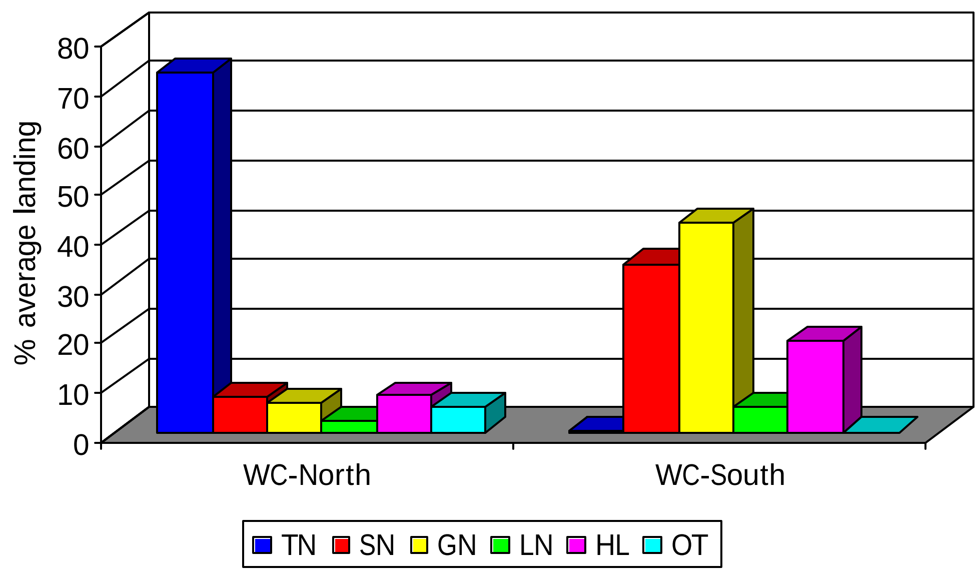


Figure 274d. Annual misc. pelagic landing breakdown by gear type in the WC-North (non-SSME area), 1997-1999

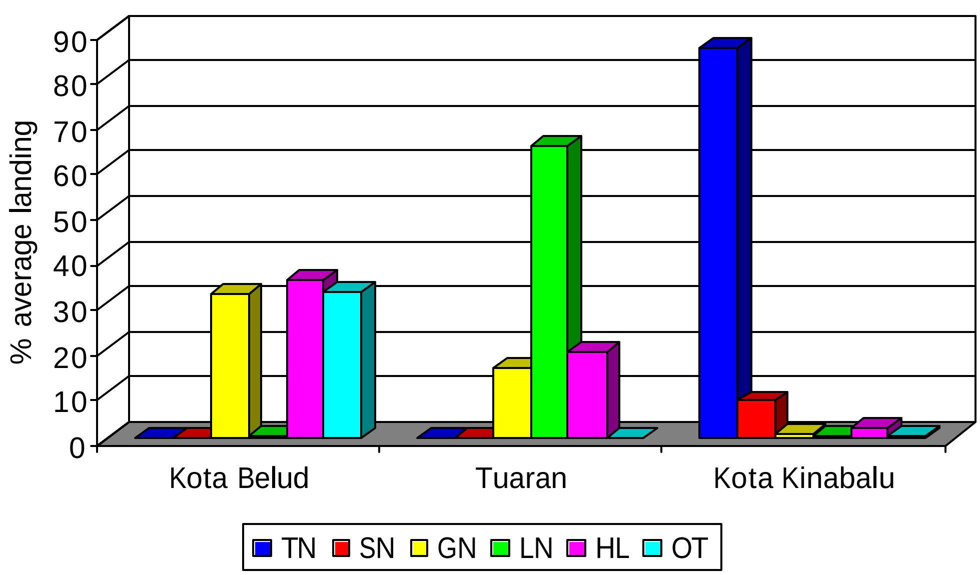


Figure 274e. Annual misc. pelagic landing breakdown by gear type in the WC-South (non-SSME area), 1997-1999

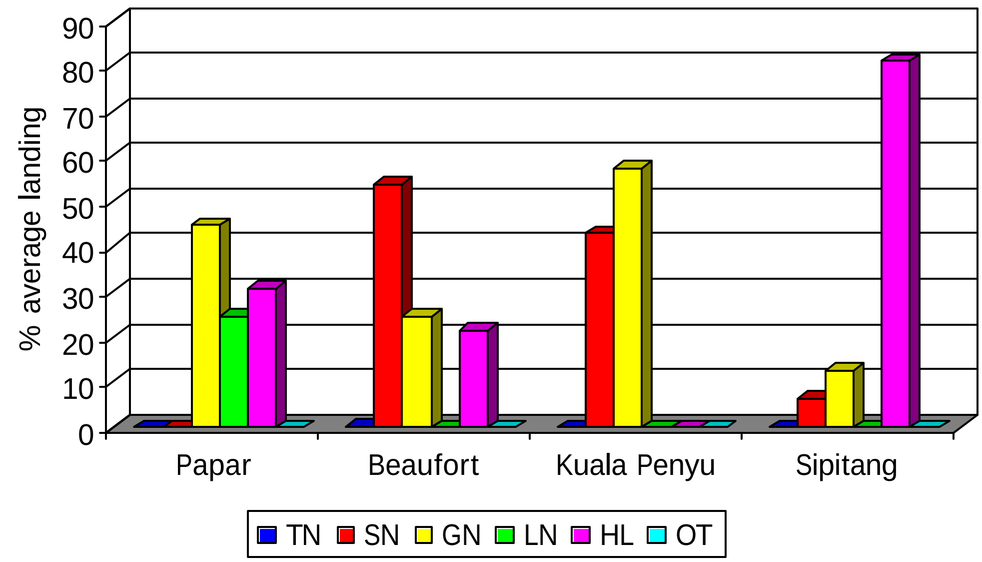


Figure 274f. Annual misc. pelagic landing breakdown by gear type and districts in the SSME-1 area, 1997-1999

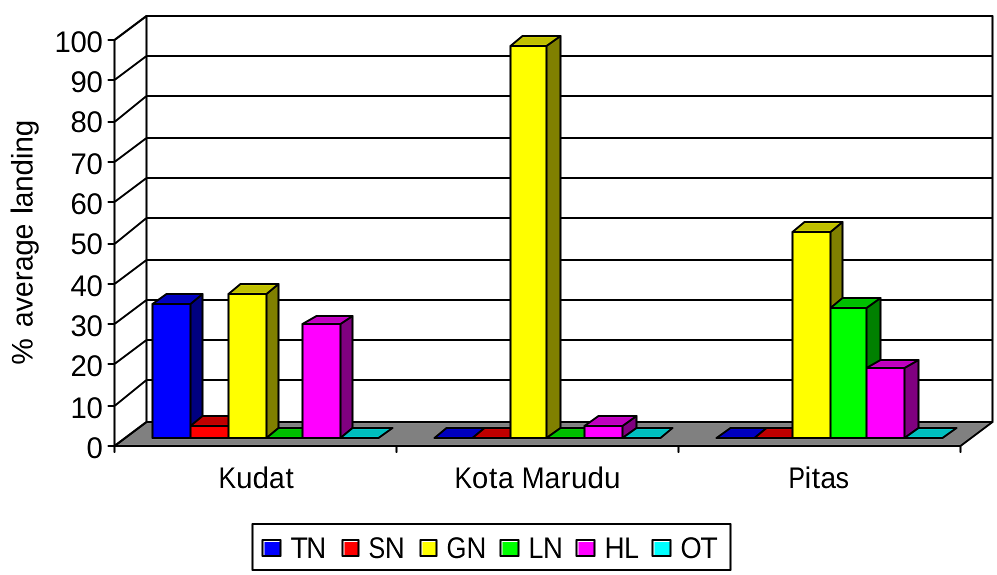


Figure 274g. Annual misc. pelagic landing breakdown by gear type and districts in the SSME-2 area, 1997-1999

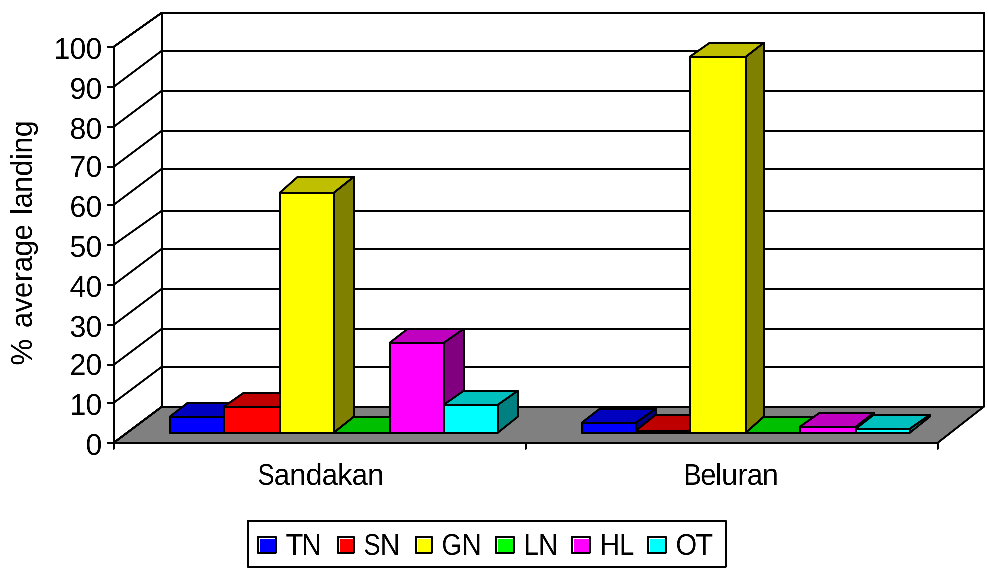


Figure 274h. Annual misc. pelagic landing breakdown by gear type and districts in the SSME-3 area, 1997-1999

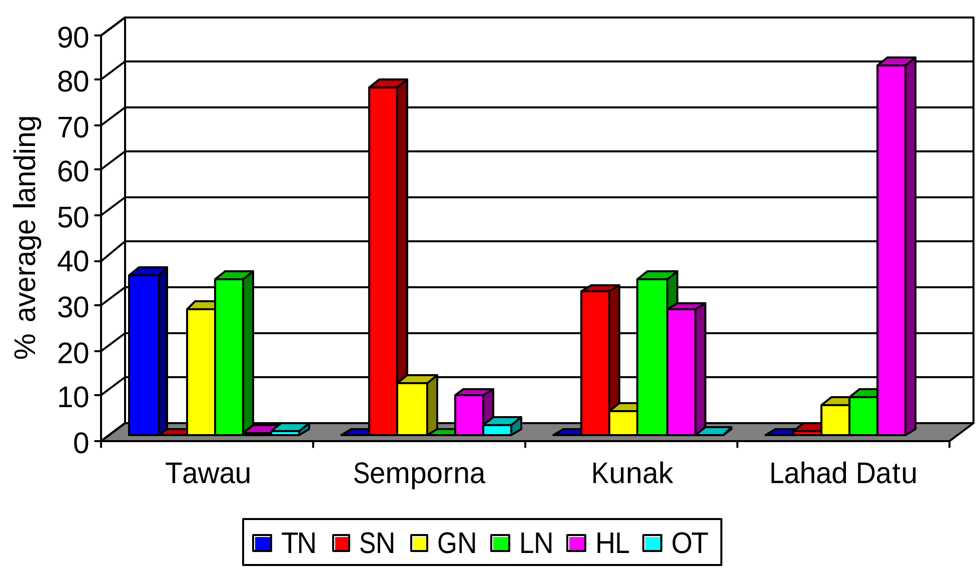


Figure 275a. Average returns to fishermen by fishing region, Sabah, 1998-1999 (metric ton)

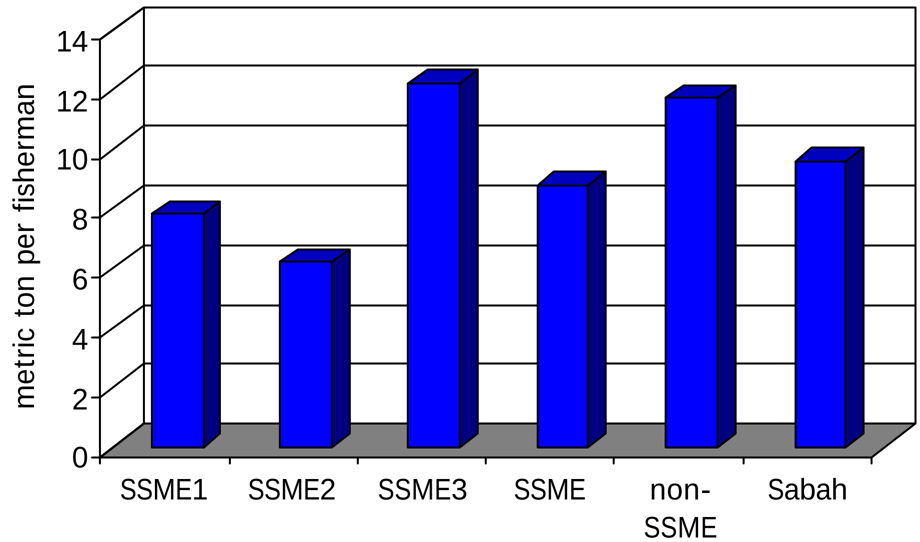


Figure 275b. Average returns to fishermen by fishing districts in the SSME area, 1998-1999 (metric ton)

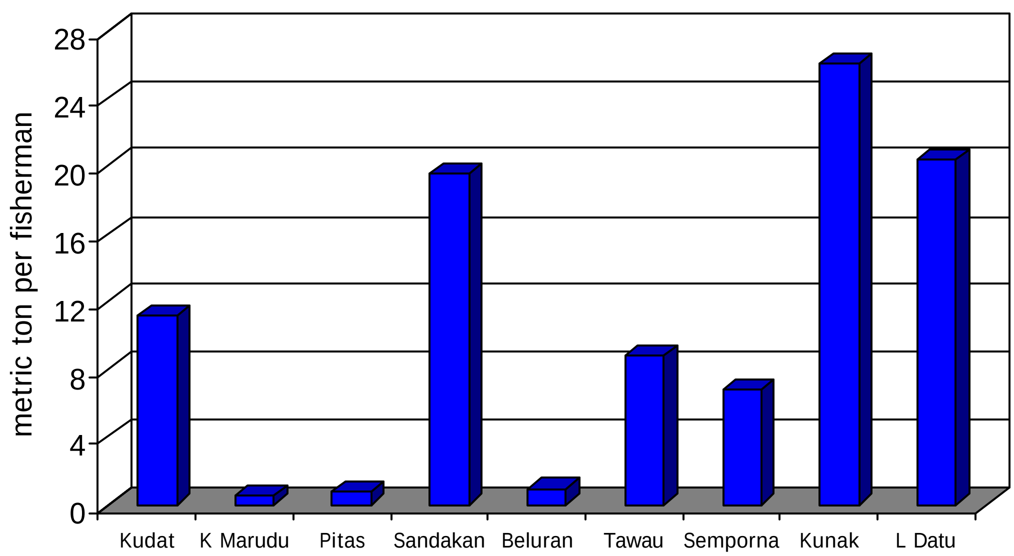


Figure 275c. Average returns to fishermen by fishing region, Sabah, 1998-1999 (RM '000)

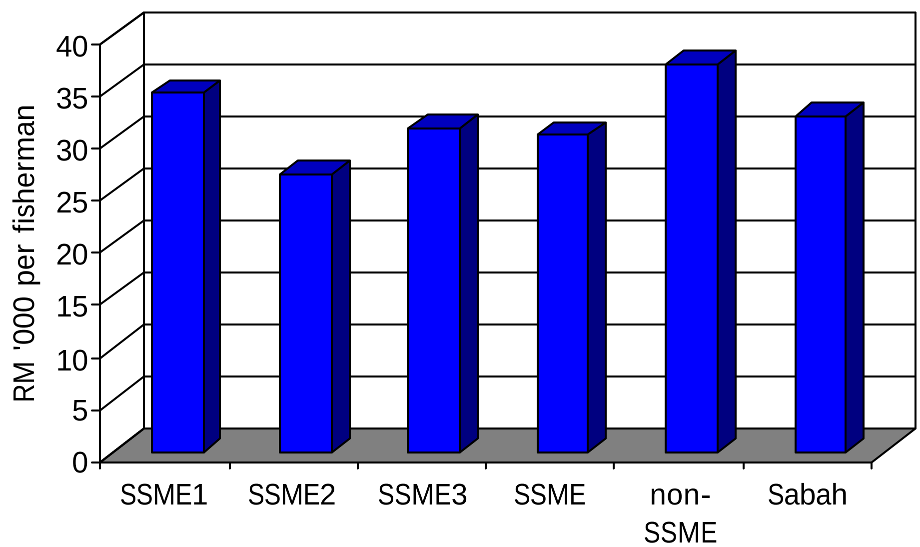
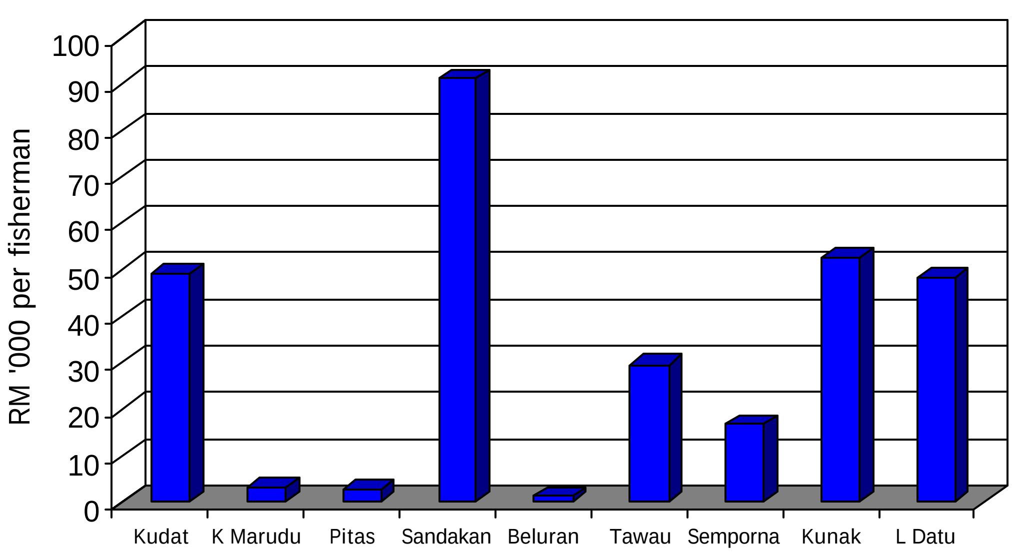


Figure 275d. Average returns to fishermen by fishing districts in the SSME area, 1998-1999 (RM'000)



Marine Aquaculture

The present development of the marine aquaculture sector in Sabah is still in its initial phase. In terms of operation scale, most small-scale farms predominate, with most operations carried out on a subsistence level supplementing incomes of coastal communities. Only a few farms of medium scale operations are commercially oriented in practice, among them, shrimp farming and holding cage culture. Marine aquaculture mainly deals, in order of importance, in the culture of tiger shrimp (*Penaeus monodon*) in brackish water ponds, cage culture targeted for the LRFT in Hong Kong, fish culture in brackish water ponds[157], seaweed (*Eucheuma cottonii*) culture, oyster culture[158] (*Crassostrea* spp.) and green mussel (*Perna viridis*) culture. Besides the above, other marine aquaculture practices include the fattening of mangrove crabs in brackish water ponds, sea cucumber grow-out (mainly sand fish) and abalone ranching. At present, no information is available on the culture methods used and production output from these minor aquaculture activities.

Statistics on the marine aquaculture systems in Malaysia and in Sabah are given respectively in **Tables A22-A24** and **Table A72**. The estimated marine aquaculture production in 1997-1999 is shown in **Table A73**, **Figures 276a-276d** and *Tables 197-198*. Marine aquaculture production in 1999 amounted to 5,454 metric tons with a farm gate value of RM72.6 million. The production volume in 1999 had increased by 13.4% from 4,810 metric tons in 1998. However, the production value had declined by 33.3% from RM108.9 million in 1998. The increase in the production volume had been attributed by 68.5% increase in dried seaweed production despite a 32.2% decline in shrimp production. The decline in 1999 production value had been attributed by 43.6% decline in shrimp contribution, due to white spot disease outbreak in 1999, that make respectively 85-87% and 56-57% of the annual marine aquaculture production value and volume in 1997-1999. Overall, marine aquaculture contributed 2.3-2.7% by volume and 8.8-12.8% by value to the total fisheries production (including from freshwater) in Sabah during the 1997-1999 period. Because of declined shrimp production in 1999, contribution from marine aquaculture had declined by 31.5% by value, from 12.8% in 1998 down to 8.8% in 1999.

In 1998, total marine aquaculture production amounted to 4,810 metric tons with a farm gate value of RM108.84 million. Shrimp culture contributed 56.5% by volume and 86.8% by value to the total production (farm gate price: RM34.8/kg). Cage culture makes up 4.1% by volume and 9.70% by value to the total production (farm gate price: RM53.2/kg). On the other hand, seaweed culture contributed 37.1% by volume but only 3.3% by value to the total production (farm gate price: RM2.0/kg). Oyster and mussel culture contributed respectively 1.7% and 0.6% by volume and 0.2% and 0.05% by value to the total production. Oyster and mussel respectively have a farm gate price of RM2.4/kg and RM1.9/kg based on the 1998 production.

In 1999, total marine aquaculture production amounted to 5,454 metric tons with a farm gate value of RM72.58 million. Shrimp culture contributed 33.8% by volume and 73.5% by value to the total production (farm gate price: RM29.0/kg). Cage culture makes up 8.7% by volume and 17.0% by value to the total production (farm gate price: RM26.1/kg). On the other hand, seaweed culture

[157] Culturing of milkfish (*Chanos chanos*) in brackish water or tidal ponds, targeting for the Filipino and Indonesian community, had been practiced in Tawau and Sandakan in the early 80s. However, due to limited demand, most of the ponds had been abandoned and with some replaced with shrimp farming. Important non-shrimp species cultured in brackish water ponds include barramundi, mangrove snapper, estuarine grouper and mangrove crab (fattening). At present, nore information is available on the production of these species in brackish water ponds.

[158] Two main species of oyster are cultured in Sabah: with *Crassostrea iredalei* in the non-SSME area and *Crassostrea belcheri* in the SSME area

contributed 55.2% by volume but only 9.1% by value to the total production (farm gate price: RM2.2/kg). Oyster and mussel culture contributed respectively 1.7% and 0.6% by volume and 0.3% and 0.06% by value to the total production. Oyster and mussel respectively have a farm gate price of RM2.0/kg and RM1.4/kg based on the 1999 production.

Except for oyster culture, marine aquaculture in Sabah is SSME-based (**Table A72**). About 99.4% of the total shrimp pond area falls within the SSME area, marine cage culture (50.5% cage units), seaweed farming (100% farm area), and mussel culture (65.8% farm area). The SSME area contributed 100% or 3,008 metric tons to the total seaweed production, 99.6% or 1,836 metric tons to the shrimp production, 61.5% or 20.2 metric tons to the mussel production, and 54.5% or 259 metric tons to the marine cage culture production. The non-SSME area contributed 99.9% to the oyster production of 95 metric tons in 1999. Overall, the SSME area contributed 94.0% by volume and 93.8% by value to the total marine aquaculture production in 1999. The SSME area contributed 100% to the seaweed production (RM6.62 million), 99.7% to the shrimp production (RM53.22 millon), 66.7% to the marine cage culture production (RM8.26 million), 43.9% to the mussel production (RM20,460) and only 0.1% to the oyster production (RM250).

Table 197: *Marine aquaculture production volume, Sabah (metric ton)*

CULTURE SYSTEM	1997	1998	1999	% change 1997-1999
Shrimp Culture	2,900.0	2,717.0	1,843.1	-36.4
Cage Culture	227.0	198.0	474.5	+109.0
Seaweed Culture	1,825.9	1,785.0	3,008.4	+64.8
Green Mussel Culture	29.0	27.1	32.9	+13.4
Oyster Culture	73.0	83.2	95.0	+30.1
TOTAL	5,054.9	4,810.3	5,453.9	+7.9
Gross Fish Production	187,811.0	209,665.8	212,869.4	+13.3
% contribution	2.69	2.29	2.56	-4.8

Table 198: *Marine aquaculture production value, Sabah (RM'000)*

CULTURE SYSTEM	1997	1998	1999	% change 1997-1999
Shrimp Culture	75,500.0	94,579.0	53,363.6	-29.3
Cage Culture	11,378.0	10,534.0	12,362.1	+8.6
Seaweed Culture	1,861.9	3,570.0	6,616.1	+255.3
Green Mussel Culture	55.6	51.9	46.6	-16.2
Oyster Culture	320.8	200.4	193.1	-39.8
TOTAL	89,116.3	108,835.3	72,581.5	-18.6
Gross Fish Production	720,531.6	849,956.2	827,319.6	+14.8
% contribution	12.37	12.80	8.77	-29.1

Tiger Shrimp Culture

In 1998, total cultured shrimp production in Malaysia amounted to 8,387 metric tons comprising of 98.5% tiger shrimp and 1.5% banana shrimp. Sabah contributed 28.1% to the total tiger shrimp production in 1998 making it the largest tiger shrimp producer in the country[159]. During the 1997-1999 period, tiger shrimp culture contributed respectively 33.8-57.4% (mean: 49.2%) by volume and 73.5-86.9% (mean: 81.7%) by wholesale value to the annual marine aquaculture production in the state.

[159] Sarawak is now the largest shrimp producer in Malaysia following the serious white spot disease in Tawau in late 1999. Unconfirmed reports suggest that Sarawak contributed at least 4,000 metric tons of cultured tiger shrimps in 2000.

Shrimp culture in Sabah is practiced by intensive culture in brackishwater ponds[160]. At present, there are 68 active shrimp farms in the state with a total pond area of 996 ha (**Table A72**). In 1998, there are 6,382 brackish water ponds with a total pond area of 5,848.5 ha in the country. Including ponds still under construction, brackishwater ponds in Sabah make up 22.9% and 45.2% of the country's total number and pond area.

About 85.3% of the 68 active shrimp farms fall within the SSME area, with 49 farms in Tawau, Sandakan (9) and Lahad Datu (1). About 99.4% of the ponds developed for tiger shrimp culture fall within the SSME area, with 924 ha in Tawau (farm size: 19.3 ha/farm), followed by 62 ha in Sandakan (6.9 ha/farm) and 4 ha in Lahad Datu (4.0 ha/farm). On the other hand, there are 10 shrimp farms in the non-SME area with a total pond area of 5.9 ha, with 9 farms in Papar (farm size: 0.6 ha/farm) and 1 farm in Beaufort (0.8 ha/farm). The biggest shrimp farms in the state are in Tawau, where farm sizes range between 4 to 34 acres per farm.

Shrimp farming practices are becoming more intensive in recent years, as farmers gained more experience in pond management and try to maximize economic returns, particularly in response to the present high prices for exported shrimp. Almost all the cultured shrimps are destined for the export market in Japan, Europe and USA[161]. In 1999, shrimp production was estimated to be around 1,843 metric tons with a wholesale value around RM53.4 million (**Figure 276**). The SSME area contributed 99.6% or 1,836 metric tons to the 1999 production, with 97.9% (1,798 metric tons) from Tawau, followed by Sandakan (38 metric tons) and Lahad Datu (0.05 metric tons). In the non-SSME area, Papar contributed 0.4% (6.72 metric tons) to the 1999 production. Production in Beaufort only amounted to 0.03 metric tons from 2 ponds with an area of 0.75 ha. The shrimp production had declined by 36.4% from 2,900 metric tons in 1997. White spot disease outbreaks in Tawau between late 1998 and early 1999 had attributed to the decline in production. The loss in production was estimated to be around 1,200 metric tons with a farm gate value of RM42 million.

There are around 20 small to medium-scale shrimp hatcheries in Sabah, with most of them based in Tawau. The total production in 1999 estimated from these hatcheries was 235 million shrimp post-larvae (PLs). Shrimp hatcheries in Sabah have rearing tank capacities of 40-205 m^3 and annual production capacities of 2.5-19.2 million shrimp PLs. Most shrimp hatcheries in Sabah have larval rearing tanks of 20-35 metric tons. The larval tank systems used were based on the Taiwanese type, probably reflecting the influence of Taiwanese consultants and joint ventures with Taiwan during the early stages of development of the shrimp industry in Sabah. In general, the feeds and feeding practices used in Sabah hatcheries are basically similar, with some minor variations. Larval feeds used for feeding protozoea I to mysis III in Tawau include artificial plankton, dried algae and microencapsulated feed. In the Menggatal hatchery, *Skeletonema costatum* was cultured in the hatchery and fed to protozoea I to mysis III stages. *Artemia* newly hatched larvae were commonly used to feed larvae from mysis II to PL_{20}. Artificial plankton (British Petroleum) and microencapsulated feeds (Higashimaru) were imported from Japan; dried algae (*Spirulina*) (King's Brand) from Singapore; and *Artemia* cyst (Superior 90,OSI) from the USA

[160] Average stocking density of 25-25 PLs/m^2 with shrimp post larvae of PL_{18}-PL_{20}. Feed comprised of formulated feed imported from Peninsular Malaysia and other countries in the region, supplemented with fresh trash fish. Normal water exchange during the 1st month @every 3-7 days at 5% pond volume, everyday at 10% pond volume during the 2nd month, and everyday at 20-50% pond volume in subsequent months.

[161] In 1999, total shrimp exports including cultured shrimps amounted to 6,709.5 metric tons valued at RM185.50 million (57.8% total export value). About 29% of the export volume was exported to other parts of Malaysia and 71% to overseas markets. About 48.2% of the overseas shrimp consignments were exported to Japan, followed by Hong Kong (20.2%), Europe (18.8%), USA (6.1%), Australia (0.3%) and other parts of Asia (6.5%).

Artificial plankton (BP), dried algae (*Spirulina*) and microencapsulated feed were used at the feeding rate of 10-16 mg/larva/day, increasing daily by 10-20%. *Artemia* newly hatched larva were used for feeding from mysis II to PL_{20} at a rate of 100-200/fry/day.

In Tawau, the grow-out period by intensive method averaged around 170 days/crop or 1.4 crops per year, with annual yields around 45 metric tons/farm or 3.43 metric tons/acre. In general, compared to Peninsular Malaysia and other countries in the region, the cost structure of shrimp culture in Sabah is associated with relatively high labor costs per kg of shrimp production and higher overhead costs (*Table 199*).

Economic returns from shrimp culture are highly favourable. However, the future expansion and sustainable development of this sector need to address various issues:

- Hatchery management to supply high quality healthy shrimp post-larvae;
- Water quality and environmental management in pond farms;
- Supporting infrastructure (electricity, roads and water supplies);
- Zoning of shrimp aquaculture areas to allow development to proceed in harmony with other coastal resource users; and
- Institutional support.

In Sabah, very few shrimp farms have been developed in mangrove areas around the coastline, and mostly in the Sandakan district. It is noticeable that some shrimp ponds in Sandakan had been abandoned, in part due to the poor environmental conditions commonly found in ponds constructed on mangrove soils (which are naturally acidic when disturbed). The development of shrimp farms in the Tawau area has taken place mostly in supra-tidal coconut plantation land, and so has not impacted on mangroves.

Utilisation of mangroves for shrimp farming represents only an insignificant portion of the total 320,000 ha mangrove area in Sabah[162]. At present, it is now a government policy to discourage marine aquaculture development including shrimp farming in mangrove areas including areas being previously gazetted for aquaculture. In view of the increasing marketing problems anticipated with shrimp ponds built in mangrove areas, and the general unsuitability of mangrove areas for shrimp pond development (mainly because of poor soils and difficulties in draining ponds), the use of the mangrove located aquaculture reserves for future shrimp farm development needs to be carefully considered and whenever possible should be avoided.

The distribution channel for cultured shrimp is efficient; buyers are also processors/exporters who buy shrimp directly from the farmers around Tawau. Usually after agreeing on the *ex-farm* price, the buyer goes to the farm prepared with ice, boxes and transportation for the harvested shrimp. The shrimp is then sent directly for processing, which will take an hour if the plant is located in Tawau or longer for other places like Sandakan or Kota Kinabalu. Most of the processed products are block frozen shrimp sold for export and only an insignificant quantity goes to local markets such as restaurants, hotels or other retail chains.

Marine Cage Culture

During the 1997-1999 period, marine cage culture contributed respectively 4.1-8.7% (mean: 5.8%) by volume and 9.7-17.0% (mean: 4.8%) by wholesale value to the annual marine aquaculture production in Sabah. In 1998, Sabah contributed only 3.3% (198 metric tons) to the country total

[162] This figure is the Mangrove Forest Reserve, as reserved (gazetted) by the State Government, and under the management of the Department of Forestry. The actual area of coastal mangroves in Sabah, including *Nipa* wetland is greater.

cage culture production of 6,023 metric tons. The total cage culture production of 6,023 metric tons in 1998 comprised of 50.0% mangrove snappers (*Lutjanus* spp.), 33.0% barramundi, 7.7% groupers, 3.5% mangrove crab, 0.3% tilapia and 5.5% others. Sabah contributed almost 100% of the grouper output from the cage culture production. The small portion from Sabah, with a farm gate price of RM53/kg, make up at least 50% of the country's grouper exports to Hong Kong in 1998.

Marine cage culture in Sabah is practiced in sheltered lagoons and estuaries of islands and along the coast. To date, no open water cage culture had been used. In general, there are two types of cage culture operations currently being practiced:

- *Cultivating type*: Fish are fed and grown over certain time period ranging from 3-12 months or more. The stocking size ranges from 0.1 to 1.0 kg with marketed size between 0.5 to 1.5 kg. M ost of these operators are small-scale farmers or fishermen. Some of the cultured fishes, comprising mainly of high value species, are sold to holding operators from time to time. Seeds are obtained from the wild using traps and hook & lines. Some small-scale operators also received incentives in the form of free barramundi fries from DOF Sabah.

- *Holding type*: This type operation is commercial in nature involving big players in the LFRT business. In the holding type, cage operators do not hold the fish for grow-out purposes, where most of the fishes comprised of groupers and other high value reef fishes including Napoleon wrasse targeted for the LRFT markets in Hong Kong, Singapore, Taiwan and some to Peninsular Malaysia. The average holding period varied between 2 to 10 days or more depending on the next consignment and distance from the nearest port of exit. Depending on supplies from local fishermen, the preferred marketable size is commonly between 0.5 to 1.5 kg or more.

In some cases, cage operators practice a combination of both holding and culture types, and very varied types of operations characterize the existing sector. Present cage culture statistics do not distinguish between these two types of operation.

All marine cage culture farms in Sabah used trash fish caught by their own gears or purchased from nearby fish landing sites. Trash fish is generally in good supply in Sabah, with the price in the range RM0.20-0.60/kg. Trashfish normally include sardine, threadfin beam and round scad, but trashfish species composition varies from different fishing grounds. Trash fish is available throughout the year, especially in the large fish landing sites of Kudat, Sandakan and Semporna. In areas away from the main fish landing sitess, such as in Tuaran, trash fish was sometimes not locally available. The feeding rate for caged fish depends on the availability of trash fish, size and body weight. Cage operators mostly feed big fish or those nearly reaching marketable size, with 2-4% of body weight per day. Farmers feed the smaller fish (0.1-0.3 kg) with 3-10% of body weight twice per day. There was no information on the food conversion rate, which would normally vary from 5:1 to 10:1 for farms feeding trash fish. Holding operations tended not to feed fish, which were starved for a few days prior to transportation.

Marine cages used in Sabah are mostly box-shaped structure, constructed with nets of variable mesh and type suspended from floating platforms, with flotation provided by oil drums/styrofoam blocks or others. The box net is commonly reinforced with a rope material and weighted to prevent collapse of the structure with water movement (except for some solid net boxes made from 'netlon' and with bamboo as the frame). Nets are mostly made of knotted polyethylene of mesh sizes ranging from 0.5" to 4", and are set within a raft frame, which may include 2-4 or more cages (four is a common number, particularly for small-scale operators). The nets are of varying size, with smaller nets (1 m^3) being used for nursing small fish and larger nets (up to 93 m^3) for culture of bigger fish. The net cages are mostly covered with a net to prevent fish from jumping out (especially during rough weather) and for keeping bird and mammalian predators out. The number of cages per farm is very variable, ranging from small-scale operators with two cages, to large commercial operators with more than 10 cages.

In 1999, there are 247 marine cage farms in Sabah (1,613 cage units with combined cage space of 55,161 m^2) in 12 coastal districts. These farms comprised of both small-scale to commercial operations owned by enterprises or trading houses involved in the international live fish trade. Small-scale farms tend to predominate commercial types, which are operated either using family labor or joint ventures among fishermen or coastal fishing communities mainly in the districts of Kota Marudu, Pitas, Beluran, Kota Belud, Beaufort and Kuala Penyu. These farms comprised of both cultivating and holding types, with most holding type farms supplying high value species to commercial farms. An average small-scale farm in Sabah has around 2-9 cages (8-23 m^2/cage unit). On the other hand, commercial cage culture farms comprising mainly of holding type operations are mainly concentrated in Kudat, Sandakan, Tawau, Semporna, Tuaran and Kota Kinavalu. An average commercial farm has around 11-23 cages (100-140 m^2/cage unit). The cage size used is highly variable, ranging from small cages (1 m^2/unit) for nursing and grow-out to very large types (450 m^2/unit) used for holding purposes.

Farms in the SSME area use larger cages (40 m^2/unit) compared to farms in the non-SSME area (28 m^2/unit), with the exception of Tuaran (39 m^2/unit). The total cage size is the SSME area (32,664 m^2) is 50% higher compared to the non-SSME area (22,497 m^2). In terms of culture operation intensity, cage culture farms in Tuaran make up 36.4% of the total cage culture size of 55,161 m^2, followed by Semporna (29.3%), Kudat (18.8%), Pitas (4.8%), Sandakan (4.1%), Kota Kinabalu (2.0%), Kuala Penyu (1.7%), Tawau (1.4%), Kota Marudu (0.4%), Kota Belud (0.4%), Beaufort (0.3%) and Beluran (0.3%). In the SSME area, Tawau has the largest number of cage units per farm (43 cages/farm), followed by Kudat (14), Beluran (14), Semporna (12.0), Pitas (6), Sandakan (5) and Kota Marudu (1). Cage culture farms in Semporna tend to use much bigger cages (450 m^2/unit) compared to other districts in Sabah, followed by Kudat (62 m^2/unit), Tuaran (38 m^2/unit), Pitas (37 m^2/unit), Kota Belud (20 m^2/unit) Kota Marudu (16 m^2/unit), Tawau (9 m^2/unit), Beaufort (7 m^2/unit), Sandakan (6 m^2/unit), Kuala Penyu (6 m^2/unit), and Beluran (2 m^2/unit).

In general, true cage culture *per se* in Sabah is still in the early stages of development, with most of the production coming from holding type operations with farms sourcing their seeds from wild stocks. At the present, only hatchery-sourced barramundi fries[163] (*Lates calcarifer*) are available to the private sector. However, the annual production of 200,000-odd 3-inch fingerlings is not still enough to meet the demand from small-scale cage operators. Up to this moment, R&D on the artificial propagation of high value reef fishes including grouper[164] is still in its infancy with some limited success in red snapper (*Lutjanus argentimaculatus*) and mouse grouper (*Cromileptes altivelis*). The state government until today does not allow the importation of marine fries including from Peninsular Malaysia.

Seeds for cage culture operations are mainly sourced from the wild, within Sabah waters itself or from neighboring countries. In local waters, fishes were mainly caught using fish trap and hook & line. Usage of cyanide to stun and collect high value reef fishes was reported to be on the

[163] At present, DOF Sabah is the main source of barramundi fries, which are given out as subsidies to small-scale farmers.

[164] Some success had been made on the artificial propagation of mouse grouper and red snapper. However, fry production is limited at the R&D level where high post larvae mortalities occurred within 2-weeks after hatching.

increase in recent years, especially in the districts of Kudat, Kota Belud and Semporna where cyanide fishing was reported to be quite rampant. Tuba fishing using poison sourced from the *Derris* spp. plant was reported to be on the increase in Semporna. It is a public secret that some of the fishes kept in most holding cages in Kudat were sourced from Palawan Island in the north and as far as Kalimantan – Indonesia in the south. Among most sought after reef fishes include *Cheilinus undulatus, Cephalopholis minatus*, *Cherodon schoenleini*, *Epinephelus* spp. and *Cromileptes altivelis*. Besides finfish, crustaceans (spiny lobsters, mantis shrimp, mangrove crab & pelagic crab) and miscellaneous invertebrates (abalone, shellfish) are also important components of the live fish trade in Sabah. Most of these are supplied to local live seafood restaurants, with live spiny lobsters and mangrove crabs also being exported to Hong Kong and Taiwan as well as to Sarawak and Peninsular Malaysia.

In 1999, there are 247 farmers involved in cage culture operations in Sabah, with 48.6% of them operating in the SSME area (**Table A72**). SSME-2 (63.3%) has the highest number of operators in the SSME area (120 farmers), followed by SSME-1 (32.5%) and SSME-3 (4.2%). However, no data is available on the breakdown of these cage culture farmers by operation type. There are 1,613 cage units in operation, with 50.5% of them in the SSME area. These cages are primarily used either for grow-out purposes or as holding/transition facilities for highly value reef fish species (*Table 199*). Large-scale holding cage culture operations are mainly carried out in Kudat, Tuaran, Kinarut, Semporna, Sandakan and Kota Kinabalu. A wide range of species are cultured, with popular species comprising mainly of high value reef fishes including groupers[165] targeted for the LRFT market in Hong Kong (**Figures 288a**-**288c**). In 1999, Sabah exported 586 metric tons of marine live fish[166] (mainly from cage culture operations) valued at RM21.3 million to Hong Kong (78.7%), Peninsular Malaysia (12.7%), Singapore (5.5%) and Taiwan (3.0%). The mean export value of marine live fishes had been underestimated throughout the years (**Figure 288d**). During the 1997-1999 period, the average prices to Hong Kong were reported between RM26-35/kg, Peninsular Malaysia (RM36-49/kg) and other countries (RM27-34/kg). Except for exports to other states within Malaysia, export prices to Hong Kong and other countries in the region are gross underestimates. After making corrections to annual export prices adjusted at 2-fold for Hong Kong and 1.5-fold to other countries (**Figure 288e**), the export value of marine live fishes in 1999 was estimated about RM27.8 million or 30.5% over current estimates. During the 1990-1999 period, about 86.0% of the live marine fish exports by volume had been exported to Hong Kong, followed by domestic markets in Malaysia (8.4%) and other countries (5.6%) (**Figure 288b**). This also translated to 88.9% of annual value of live marine fish being exported to Hong Kong, followed by Peninsular Malaysia & Sarawak (5.3%) and other countries including Singapore and Taiwan (5.8%) (**Figures 288f**-**288g**).

In 1999, marine cage culture production amounted to 474.5 metric tons with a farm gate value of RM12.4 million. Tuaran contributed 42.3% by volime to the total production in 1999, followed by Kudat (24.2%), Sandakan (15.0%), Semporna (9.9%), Beluran (3.6%), Kota Kinabalu (2.3%), Tawau (1.5%), Kuala Penyu (0.5%), Kota Marudu (0.4%), Beaufort (0.3%), Pitas (0.03%) and Kota Belud (0.03%). The SSME area contributed 54.5% to the total production in 1999, with SSME-1 contributing 45.1% (116.7 metric tons) to the SSME production share, followed with 34.0% (88.0 metric tons) from SSME-2 and 20.9% (54.0 metric tons) from SSME-3. On the other hand, Tuaran contributed 93.0% (200.8 metric tons) to the non-SSME share of the total

[165] Grouper imports into Hong Kong amounted to 6,555 metric tons valued at HK$404 million in 1998. Imports from Malaysia amounted to 394 metric tons (6% total import) valued at HK$27 million. It is highly speculated that a significant portion of these groupers originated from Sabah.
Data source: http://www.enaca.org/grouper/Research/Economics/1999/07/MK991001.htm

[166] The total export value of marine live fish for the LRFT market is grossly estimated. For more details, please refer to **Figures 288d-288f**

production, followed by 5.0% (10.8 metric tons) from Kota Kinabalu, 1.2% (2.6 metric tons) from Kuala Penyu, 0.7% (1.5 metric tons) from Beaufort and 0.06% (0.1 metric ton) from Kota Belud.

There are 39 cage culture operators in the SSME-1 area, with 38.5% of them in Kota Marudu, and Pitas (30.8%) and Kudat (30.8%). Most of the marine cage culture farms in Kota Marudu and Pitas are operated on a joint venture basis. Marine cage culture operations in these districts are small-scale in nature, where the farmers directly involved in catching seeds from mangrove related environments using traps and hook & lines. On the other hand, marine cage culture operations in Kudat including in Banggi Island involved commercial operators who buy seeds from other fishermen or employ them to collect targeted species in reef areas on a contract basis using traps and hook & lines including the usage of cyanide. Cage culture operations in Pitas and Kota Marudu practice a combination of both holding and culture types, while operations in Kudat is more towards to the holding type. There are 254 cage units in the SSME-1 area, with 65.7% based in Kudat, Pitas (28.3%) and Kota Marudu (5.9%). Cage culture operations in Kudat involved large cages (62.1 m^2/unit) compared to Pitas (37.0 m^2/unit) and Kota Marudu (16.2 m^2/unit). In 1999, SSME-1 contributed respectively 24.6% and 45.1% to the total and SSME cage culture output of 475 metric tons. Kudat contributed the bulk (98.3%) of the SSME-1 cage culture production, followed by Kota Marudu (1.5%) and Pitas (0.1%). Most of the Kudat production comprised of high value reef fishes destined for the LRFT market. This is reflected from the high farm gate prices of marine cage culture output in Kudat (RM44/kg) compared to Kota Marudu (RM15/kg) and Pitas (RM14/kg). Although there is no compelling evidence, it is highly speculated that most of the high value cage culture fishes in Kudat were obtained by cyanide fishing. Farm supplies were obtained either from local waters or from neighboring countries in the region. Discussions with some people involved in the LRFT business revealed that local fish stocks are now on the decline where operations in Kudat depends on supplies from Palawan Island in the north and as far as Indonesia – Kalimantan in the south. Carrier boats based in Kudat make regular trips to Indonesia with normal collections up to 2-4 metric tons per trip. Besides cyanide fishing that had almost depleted local high value reef fish stocks, blast fishing is quite rampant in Kudat especially in the Banggi group of islands. A large portion of the blast fishing catches are supplied as feed to the local marine cage culture farms in the area.

There are about 76-odd fish cage culture operators in the SSME-2 area, with 93.4% of them (71) based in Sandakan. The SSME-2 cage culture operations in based mainly in Sandakan. There are a total of 438 cage units in the SSME-2 area, with 366 units in Sandakan and 72 units in Beluran. The cage in Sandakan (6.23 m^2/unit) is larger in size compared to those in Beluran (2.0 m^2/unit). Most of the cage culture activities in Sandakan are carried out in the sheltered lagoons and estuaries within the Sandakan Bay and nearby Bai Island. Compared to SSME-1 and SSME-3 that focuses on the culture of reef species, cage culture operations in the SSME-2 area involved mainly on mangrove-associated species including snappers (*Lutjanus argentimaculatus*) and groupers (*Epinephelus* spp.). Compared to the other areas in Sabah, SSME-2 focuses more on mangrove-associated species. In 1999, SSME-2 marine cage culture production amounted to 88 metric tons, with 71 metric tons from the Sandakan Bay and Bai Island. Cage culture operations in Sandakan and Beluran practice a combination of both holding and culture types, with farms in Sandakan practicing more towards holding type operations involving much higher value species. This is reflected from the higher farm gate prices of marine cage culture output in Sandakan (RM12/kg) compared to Beluran (RM9/kg).

In the SSME-3 area, there are only five cage culture operators respectively in Semporna (3) and Tawau (2). However, except for Kudat, cage culture farms in these districts are much larger compared to other districts in Sabah. Marine cage culture operations in Tawau have an average farm size of 43 cage units per farm compared to cage 12 units per farm in Semporna. However, the average sizes of cages used in Semporna (450 m^2/unit) are much larger compared to Tawau (9 m^2/unit). Marine cage culture operations in Tawau and Semporna practice a combination of both holding and culture types, with more oriented towards holding type operations. Marine cage culture in Tawau focused on mangrove-associated species obtained from fishermen using traps and hook & line in the Cowie Bay and high value reef fishes obtained from Kalimantan - Indonesia. On the other hand, marine cage culture operations in Semporna focused on reef-associated fishes obtained from fishermen using traps, hook & line and chemicals (cyanide & plant poisons) in the Darvel Bay and surrounding areas.

In 1999, SSME-3 marine cage culture production amounted to 54 metric tons, with 86.7% or 46.8 metric tons from Semporna. Production from Semporna comprised of much higher value reef fishes. This can be seen from the much higher farm gate prices of marine cage culture output from Semporna (RM43/kg) compared to Tawau (RM12/kg). The production in Tawau did not take into account the volume of high value reef fishes from Indonesia probably due to the relatively short holding period prior to transfer to Kota Kinabalu with a significant portion exported to Hong Kong and Peninsular Malaysia.

Marine cage culture operations in the non-SSME area are mainly carried out in Tuaran and Kota Kinabalu. Tuaran has the highest cage size area (20,083 m^2), making up 89.3% of the non-SSME total marine cage size area, followed by Kota Kinabalu (4.8%), Kuala Penyu (4.2%), Kota Belud (1.0%) and Beaufort (0.8%). On the other hand, Kota Kinabalu has the highest number of cages per farm (19.0 cages/farm), followed by Tuaran (9.0), Beaufort (8.0), Kuala Penyu (4.7) and Kota Belud (1.5). Marine cage culture farms in Tuaran used larger cages (38.5 m^2/unit) compared to Kota Belud (20.2 m^2/unit), Kota Kinabalu (11.4 m^2/unit), Beaufort (7.1 m^2/unit) and Kuala Penyu (6.4 m^2/unit). Cage culture operations in Tuaran, Kuala Penyu, Beaufort and Kota Belud practice a combination of both holding and culture types, which focused more towards mangrove-associated species obtained from fishermen using traps and hook & line in the area. On the other hand, the marine cage culture farms in Kota Kinabalu at Gaya Island comprised mainly of holding cages, which focused more on high value reef-asociated species obtained from local waters or from other areas in Sabah. Some of the cage culture farms in Kota Kinabalu and Tuaran are used to store high value fishes prior to export overseas.

In 1999, marine cage culture production in the non-SSME area amounted to 215.84 metric tons or around 45.5% of the state total production. Tuaran contributed 93.0% to the non-SSME total production, followed by Kota Kinabalu (5.0%), Kuala Penyu (1.2%), Beaufort (0.7%) and Kota Belud (0.06%). The type of fishes cultured is reflected by the stark differences in the farm gate prices of marine cage culture output from these districts. Kota Kinabalu has the highest farm gate prices of RM39/kg, followed by Beaufort (RM29/kg), Tuaran (RM18/kg), Kuala Penyu (RM17/kg) and Kota Belud (RM17/kg).

Distribution of live marine finfish is complexed. For cage culture products, it is difficult to establish a distribution channel as there is a grey area between cage culture and holding net operators who simply hold the wild fish for a few days, weeks, or even months waiting for export. However, it is believed that most of the culture systems basically involve rearing large size juveniles in cages or holding nets. There are two different trade types for marine finfish: one for the local market and the second for export. For the local market, species cultured are mostly seabass, various species of snappers and groupers, with most of the supplies coming from cage culture farms in Tuaran and Sandakan. For export markets, the species are high-value marine finfish like mouse grouper, leopard grouper and Napoleon wrasse, with most of the supplies coming from cage culture farms in Kudat, Semporna and Tuaran. High value fish and their fingerlings are supplied by fishermen, with most of them financed by a *taukeh* or bigtime holding cage operator. These *taukehs* cum middlemen and sometime live fish exporters as well also buy live fish from small-scale cage operators. There are around 40-odd live fish exporters in Sabah who are involved in the handling and export of live high value marine finfish and crustaceans (mangrove crab and lobster).

It is difficult to assess the size of the domestic market for live marine finfish as no official data are available. However, the general observation is that the main outlets for live marine finfish are the Chinese seafood restaurants, which serve seabass, snappers, black groupers, lobsters, abalone and shellfish. Farm gate prices for grouper (>0.5 kg upwards) is around RM 20/kg with middlemen selling to restaurants at RM 25-30/kg. Different restaurants charge different prices to consumers. However, steamed grouper is sold at between RM 35 to RM 45 per kg, which clearly indicates that the price in restaurants is at least double than that at the farm level. Meanwhile, the prices of live marine finfish for export are much higher, reflecting the prices in international markets. Farm gate prices for live mouse grouper and Napoleon wrasse are around RM 85-100 per kg.

There is increasing international concern about the environmental impacts of the live fish trade (see report by Johannes and Riepen, 1995), in particular the impact of overfishing on coral reef communities, the effects of fishing practices on coral reefs (particularly where chemicals are used to capture fish), and the possible risk to human health through certain fishing practices.

The marine cage culture sector in Sabah relies almost exclusively (except for a small number of seabass fingerlings) on the capture and culture of wild marine fishes, and is to some extent a by-product of live fish trade whereby undersized fish are cultured for varying periods of time prior to marketing. Perhaps the most important current environmental issue concerning aquaculture development in Sabah relates to the utilisation of marine fish for cage culture, and the need to ensure a sustainable way of providing juveniles for aquaculture. If done correctly, aquaculture can also provide a basis for conservation efforts for endangered species, as an alternative to collection of fish from the wild.

Poor capture and handling practices may be leading to unnecessary damage to high value marine fishes, particularly where fish are captured using chemicals such as cyanide and plant poisons. Selective harvesting of large fish, which may take many years to mature, can also have serious negative impacts on the natural fishery. The capacity of natural resources to sustain the marine cage culture secor in Sabah is unknown. However, there are indications already that the juvenile and adult fish stocks of some species are being depleted, as fishermen and holding operations report that some species are becoming scarce. One example is the high value Napoleon wrasse, which is now seldom caught in local waters, with catches comprised mainly of juveniles in recent years. Indonesia and the Philippines have already banned the export of this species, because of concerns over the depletion of natural resources. In 1996, this fish had been placed on the IUCN 'Red List of Threatened Animals.'

During the capture of juvenile fish, there may be damage to other natural resources, particularly where fish are captured from reef areas. Some fishermen reportedly use sodium cyanide to capture fish sheltering in corals, which are encircled with a net to facilitate capture of temporarily immobilised fish (Ostrowski, 1994). The effects may include damage to the corals and coral reef biota, all of which can have negative impacts on fisheries resources, biodiversity and amenity (such as tourism) value. The use of sodium cyanide and compressed air to trap fish can have serious effects on the health of fishermen. There have been reported cases of paralysis among fishermen, due to anoxia and contaminated hookahs, and one death in a fishing village which villagers attributed to cyanide fishing.

Seaweed Culture

Sabah is the only producer of seaweed in the country. Of the many species of seaweeds utilised, red and brown seaweed dominate the world seaweed trade. The two types of seaweed are used as raw material for producing carrageenan and alginates. World production of red and brown seaweeds in 1993 was 1.4 million metric tons and 4.9 million metric tons respectively. The main producers of red seaweed are China (193,230 metric tons), Japan (363,965 metric tons), the Philippines (381,154 metric tons) and Indonesia (105,000 metric tons). Carrageenan is mostly derived from *Eucheuma* spp. The Philippines is considered the main producer of *Eucheuma* spp., which supplies almost 80% of the world supply, followed by Indonesia (17%) and Malaysia (?). World total production of *Eucheuma* spp. in 1993 was estimated at about 87,000 metric ton, with the Philippines producing 70,000 metric tons (80%) and Indonesia 15,000 metric tons (17%).

During the 1997-1999 period, seaweed culture contributed respectively 36.1-55.2% (mean: 42.8%) by volume and 2.1-9.1% (mean: 4.8%) by wholesale value to the annual marine aquaculture production in Sabah. Seaweed farming is mainly carried out in the SSME-3 area. Seaweed farming had recently been introduced in Banggi Island (SSME-1), but no production statistics are available at the time of this writing.

Seaweed farming in Sabah is mainly carried in Semporna[167], the main seaweed-producing area in the state. In 1999, there are total of 566 households involved in seaweed farming, with 90.3% and 9.7% of them in Semporna and Kunak. The total farm area amounted to 290 ha (0.51 ha/farm), with 97.7% of the farm areas based in Semporna. The species cultured is the brown seaweed *Eucheuma cottonii*[168]. Previously *E. spinosum* had been cultured in Semporna but farmers have now stopped producing this species because of the international market preferences for *E. cottonii*, which have much higher carrageenan content[169]. In 2001, DOF Sabah had initiated preliminary R&D on the feasibility of culturing of *Gracilaria cangii* in brackish water ponds. Seaweed is targeted for the export market with a insignificant portion for human consumption[170]. The production of dried seaweed has increased dramatically in the past 3 years, with an annual production around 1,785-2,671 metric tons in 1997-1999, compared to only 303-386 metric tons in 1990-1992 (**Figure 276f**). Denmark is the traditional export destination for dried seaweeds, and in recent years exports to Denmark had declined with exports diverted to new markets in Hong Kong, Korea, China (**Figures 289a**-**289c** & **Table A82**). In the mid 90s, buyers from the Philippine buy dried seaweed directly from farmers in Semporna. Some reports suggest that at least one third of the annual production is sold to these buyers (AQMP, 1996). According to custom records, about 151 metric tons of dried seaweed valued around RM200,000 were exported to the Philippines in 1996. However, according to some reliable sources, this is a gross estimate considering that in-situ transactions and subsequent transportation of seaweed to the Philippines were often made without going through the official channels. Transportation of seaweed to Tawi-Tawi, one of the main seaweed producing areas in the Philippines, is only a couple of hours boat ride from Semporna. Estimates from sources in Semporna suggested that the actual 1996 export amount might be at least 4-5 fold more. In late 2000, two SRC (*semi-refined carageenan*) extracting plants were

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[167] Seaweed farming is also carried out in Kunak and Banggi Island – Kudat. Seaweed production from Kunak only makes up less than 2% of the annual production in 1997-1999. Seaweed farming in Banggi was initiated in late 1999 under the PPRT Program. No statistics were available at present, and reliable sources suggested that production in Banggi is less than 5 metric tons in 2000.

[168] It is still not known whether the *Eucheuma cottonii* in Sabah waters is *Kappaphycus cottonii* or *Eucheuma cottonii* var. *erecta* ?? In this report, its scientific name is still maintained as *Eucheuma cottonii*.

[169] *E. cottonii* produces only kappa-carageenan while *E. spinosum* produces only iota-carageenan

[170] Since late 1999, seaweed had been used by some restaurants in Semporna as a side salad dish.

established in Tawau and Semporna. However, these SRC plants are still operating far below its actual capacity because of limited raw materials. The current seaweed production of 3,000-odd metric tons from Semporna and Kunak is still inadequate. It is estimated that at least 10,000 metric tons of raw materials is needed by these SRC plants annually. At present, the current seaweed production of 3,000 metric tons is still inadequate for financially viable operations. At certain months, these SRC plants need to rely on raw materials imports from the Philippines, Indonesia and Cambodia. No statistics on SRC exports were available at this time of writing.

Seaweed farming in Semporna is carried out using the long-line method. Long-lines with seaweed seedlings attached to it are normally floated within a designated area, a culture method that is more suitable to the deeper water conditions in Semporna than the stake method, which is the common culture method in the Philippines. Because of the low tolerance of *Eucheuma* to brackish water, culture is possible only in full-strength seawater, at locations away from the influence of freshwater inflows such as rivers. In Semporna, seaweed farms are located in offshore areas over rocky, coral reef or sandy bottoms. The average seaweed farm covers an area of 1-2 acres. Farmers used nylon monofilament long-lines (0.5 mm diameter) across the farm area. One seaweed seedling of 0.1-0.2 kg is tied to the long line at 1-foot intervals. Depending on farm dimensions, the length of each longline normally varies between 180-220 meters. Each seaweed seedling of 0.1-0.2 kg will normally require a growth period around 2-3 months to grow to a total wet weight of 1-3 kg. Seaweed production statistics suggest an average yield of 10-15 metric tons dry weight/ha. Marketable seaweed are harvested every 2-3 months and subsequently sun-dried after cleaning. In normal weather, it takes around 4 days to sun-dry seaweed to around 35% moisture content. It is estimated that approximately 9 kg of wet seaweed will produce around 1 kg of partially dried seaweed.

Compared to other marine aquaculture systems, seaweed culture requires low capital investment and has a fast turnover rate. Construction cost, which is subsidized by DOF Sabah, includes bed preparation and long-lines. The only cash costs incurred by farmers are on fuel, floats, rope, and tie-tie (used for tying plants to the long-line), accounting for 24% of the total cost while non-cash cost (labor and seed) accounts for about 76% of the total cost to the farmers, indicating the subsistence level of production. Previous studies shown that an average seaweed farm of 0.75 acre in Semporna can produce up to 5 metric tons of dried seaweed (or 6 metric tons/acre). Family labor is the only source of labor in seaweed farming. Farmers receive a market price of RM 0.50 for wet seaweed and RM2.80 for dried seaweed in 2001, compared to only RM0.25 and RM 1.10 respectively for wet and dried seaweed in 1995. The increase in the number of buyers throughout the years, comprising of both middlemen and exporters, had lead to the significant increase in seaweed prices. In the late 80s, the market is monopolistic with dried seaweed prices being determined by only one local buyer. During that period, the prices for dried seaweed was only in the region of RM0.40-0.50 per kg.

Post-harvest handling of seaweed is very simple, involving mostly sun-drying since the seaweed exported is in dried form. After a culture period of 45-60 days, seaweed is harvested and washed in seawater to remove sand, mud, snails, barnacles or other foreign materials. While on the farm, the cleaned seaweed is sun-dried to a moisture content of around 35% by leaving it in the open air under the sun for about 4 days. Dried seaweed is then packed into polypropylene or jute sacks ready for delivery to the buyer/exporter. There is no grading for harvested seaweed and the only requirement determined by the buyer is the water content. At present, there is one plant in Semporna, which buy and processed seaweed for export. Further sun-drying is carried out by the plant on a concrete surface for 1-2 days to reduce the water content to 30%. The dried seaweed is then pressed hydraulically into bales of 100 kg, tied up using steel string, and kept in the store ready for export.

Oyster Culture

During the 1997-1999 period, oyster culture contributed respectively 1.4-1.7% (mean: 1.6%) by volume and 0.2-0.4% (mean: 0.3%) by wholesale value to the marine aquaculture production in Sabah. Oyster farming is mainly carried out in Tuaran, involving some 65 small-scale households. In 1999, oyster farms in Tuaran make up 98.7% of the state total farm area of 60,450 m^2 or 99.3% of the non-SSME total of 60,100 m^2. Other districts with oyster farming in Sabah include Kota Belud (424 m^2), Kota Marudu (270 m^2) and Sandakan (80 m^2). Labor-wise, the oyster farmers in Tuaran make up 50% of the state total number farmers (130) or 59% of the non-SSME total of 110 farmers. Oyster farmers in other districts include Kota Belud (45 farmers), Kota Marudu (15) and Sandakan (5).

Oyster farming was first started in the 1970s with no significant sectoral development throughout the 30-year period. Despite this long history, commercial oyster culture has only recently started, as seed ('spat') has become more widely available. At present, DOF Sabah is the only source of oyster spats sourced mainly from natural stocks in mangrove-associated environments with some limited supply from the hatchery. Besides oysters, the artificial propagation of ther mollusk seeds including green mussel, giant clam (*Tridacna squamosa*) and abalone had been developed by DOF Sabah, with limited success at the PL stage for abalone.

One significant constraint to the further development of the mollusk culture sector in Sabah is the periodic and unpredictable occurrences of Harmful Algal Blooms (HABs) of the toxic dinoflagellate *Pyrodinium bahamese* var. *compressum*[171]. HABs of red tide has led to outbreaks of PSP (paralytic shellfish poisoning) in wild and cultured molluscs making them harmful for human consumption for an extended time period. These had lead to problems in marketing both cultured and wild mollusks during the HAB duration. Red tide blooms are a naturally occurring event in the coastal waters of Sabah, and DOF Sabah has a regular monitoring programme established in most coastal districts to detect annual toxic events. Suitable mollusk culture sites in the SSME area need to be identified and developed in order for this sector to progress further.

In 1998, total mollusc production from Sabah was 110.29 metric tons consisting of oysters 83.15 metric tons and green mussels 27.14 metric tons mainly from Tuaran, Kota Belud and Tawau. This volume is very small compared to the total Malaysian production of 82,840.85 metric tons in 1998. However, Sabah is the largest cultured oyster producer in the country, contributing 60.4% to the total production, followed by Terengganu (29.0%), Johore (4.1%), Kedah (3.9%), Pulau Pinang (2.3%) and Kelantan (0.2%).

Oyster seed are collected from the wild by using several kinds of collectors, including cement cube, cement block and used tyres, with cement cube proven the most effective spat collector. The collected seed is then transplanted to the on growing system for culture to marketable size. Oysters (from 1 cm total length) take 6-8 months to reach market size of 9-12 cm. There are three methods in use for the culture of oysters in Sabah:

- *Raft method*: This method uses a 10'x20' raft made of sawn timber and HDPE float. One raft could cover about 100 hung strings with a total of 1,500 cement cubes with an estimated 4,500 spat attached.

[171] Red Tide blooms were first detected in Sabah in 1976 with a few human fatalities resulting from PSP cases. Since then, HABs occurred annually along the west coast of Sabah with significant blooms during the monsoon periods. Except for one incident of HABs detected in Tawau in the mid 90s, HABs occurrences are much confined to the non-SSME area, with most cases detected in Kuala Penyu, Kota Kinabalu, Tuaran and Kota Belud.

- *Rack method*: The method uses two types of rack; 200'x5' for grow out (6 cm) and 100'x5' for seed (3 cm). The racks were built on intertidal land (permanently) where racks on poles can be used for spat collection. The spats are then individually removed from these collectors for grow-out on the racks.

- *Long-line method*: The long-line method is a simple way of culturing oyster by using two poles as ends for the long-line. Strings with spats/collectors are hung along the long line at 1-foot intervals. The length of the long-line depends on the preferences of the farmers.

Oyster production in 1999 amounted to 93.67 metric tons with farm gate value of RM193,090 (farm gate price of RM2/kg). Tuaran contributed 98.5% or 92.16 metric tons to the total production, followed by Kota Belud (1.41 metric tons) and Kota Marudu (0.1 metric ton). No production was recorded for Sandakan in 1999.

Green Mussel Culture

Green mussel (*Perna viridis*) was brought in from Peninsular Malaysia in the early 90s, and spats of this species are now easily available from the wild. At present, mussel spats are mainly available in reasonable abundance found in Kota Belud, Tawau, Tuaran and Kota Marudu – the major mussel farming areas in Sabah. During the 1997-1999 period, mussel culture contributed respectively 0.56-0.60% (mean: 0.58%) by volume and 0.05-0.06% (mean: 0.06%) by wholesale value to the annual marine aquaculture production in Sabah. Despite its small contribution, mussel culture is now an important activity supplementing the income among some of coastal fishing community in Sabah. Most of the mussel production comes from community-based integrated marine aquaculture projects including mollusk culture in Tawau (Indrasabah), Tuaran (Mengkabong), Kota Belud (Sungai Umpul) and Kota Marudu (Teritipan).

Spats are collected from the wild using various kinds of collectors, with trammel nets being the most effective method. The collected seed is transplanted to the on growing system for culture to marketable size. Mussel takes 4 months to reach market size of 8-10 cm. Mussels are cultured using either the raft method and and long-line method, with the latter being the most popular method. In 1999, mussel culture systems involved 2,480 m^2 of culture area involving 119-odd farmers, with 50.1% of the culture area based in Tawau – 41 farmers, followed by Kota Belud (18.0%) – 41 farmers, Tuaran (16.2%) – 22 farmers and Kota Marudu (15.7%) – 15 famers. Overall, 65% of the mussel culture area is in the SSME area with 56 farmers (53% total) involved. In 1999, the mussel production amounted to 32.89 metric tons, with 60.8% contributed by Tawau, followed by Tuaran (33.4%), Kota Belud (5.0%) and Kota Marudu (0.7%). The focal point for mussel culture in Sabah is the Indrasabah Community-based Integrated Mollusk Culture Project in Tawau, which will be further developed as the Mussel Bowl in Sabah. In 2001, mussel production from Tawau is expected to increase to 100-odd metric tons.

Figure 276a. Marine aquaculture production in Sabah, 1999

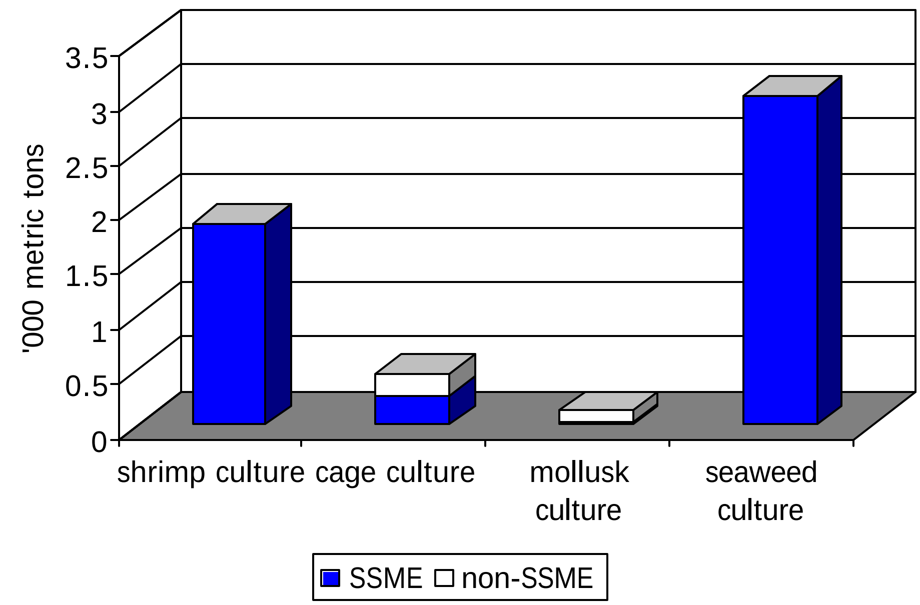


Figure 276b. Marine aquaculture production volume breakdown in the SSME area - 1999 ('000 metric ton)

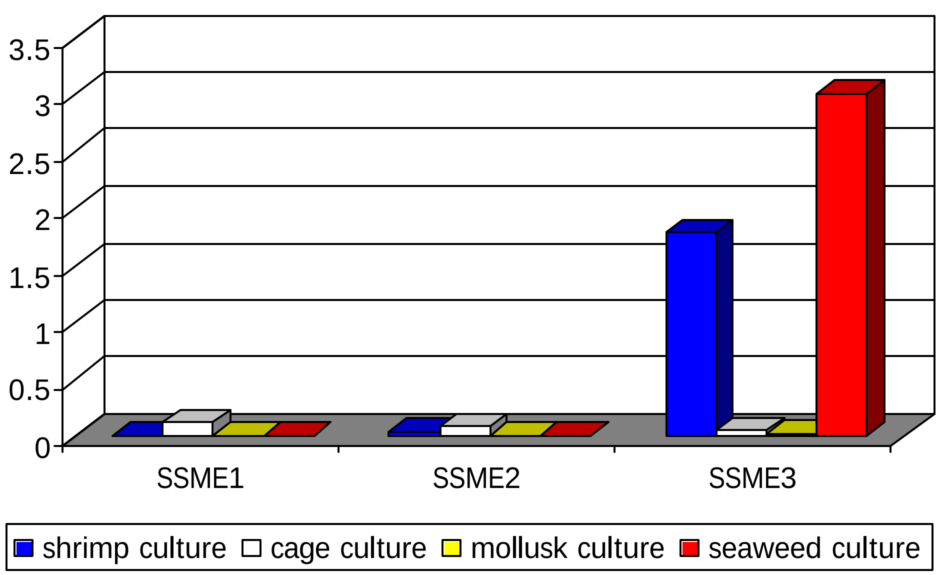


Figure 276c. Production from selected marine aquaculture systems in Sabah, 1991-1999 period

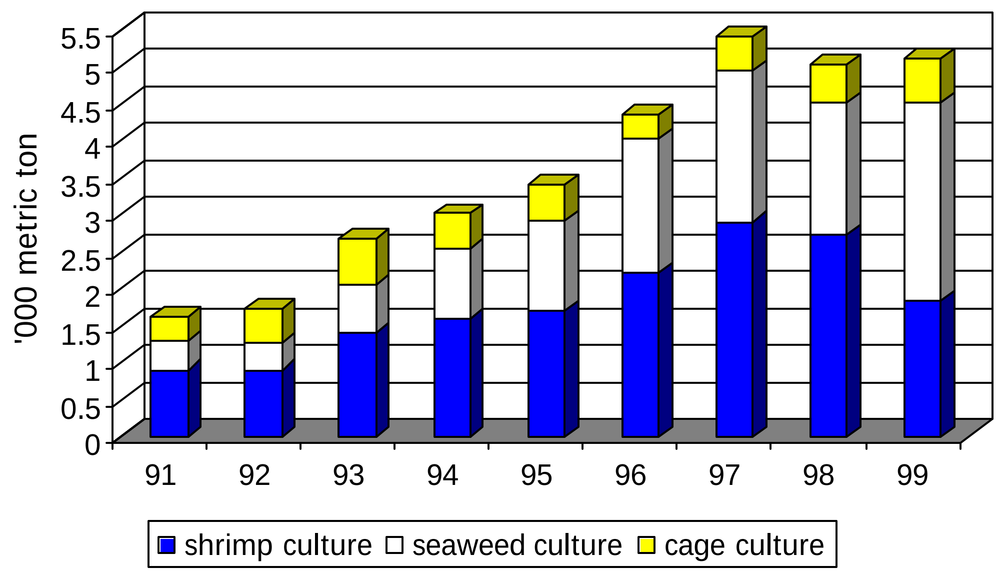


Figure 276d. Annual cultured tiger shrimp production in Sabah, 1991-1999 period

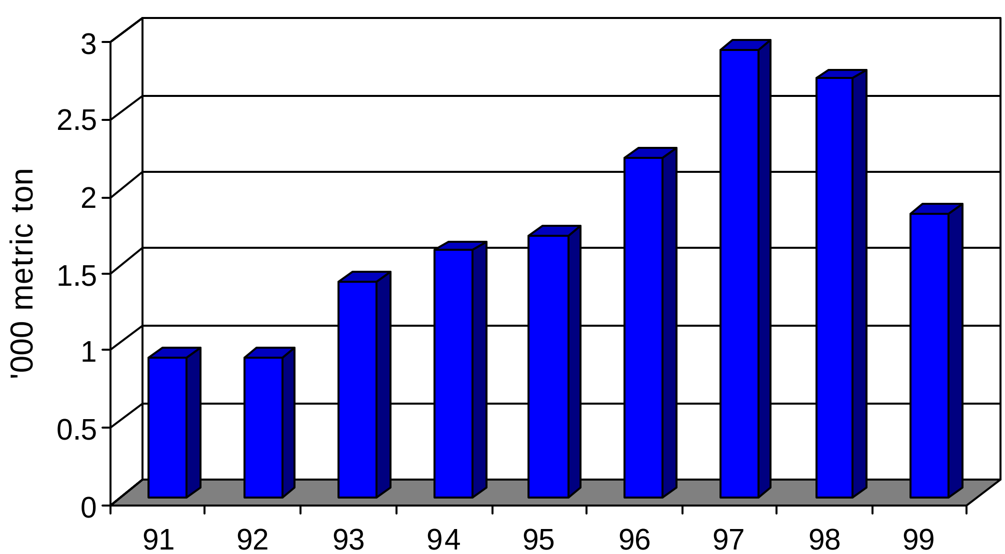


Figure 276e. Estimated marine cage culture production in Sabah, 1991-1999 period

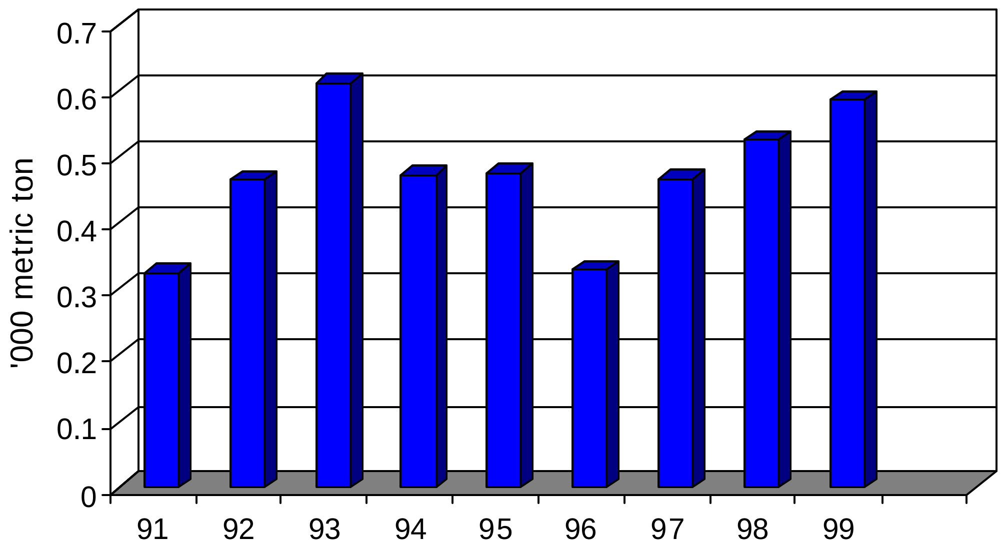


Figure 276f. Estimated dried *Eucheuma* seaweed production in Sabah, 1987-1999 period

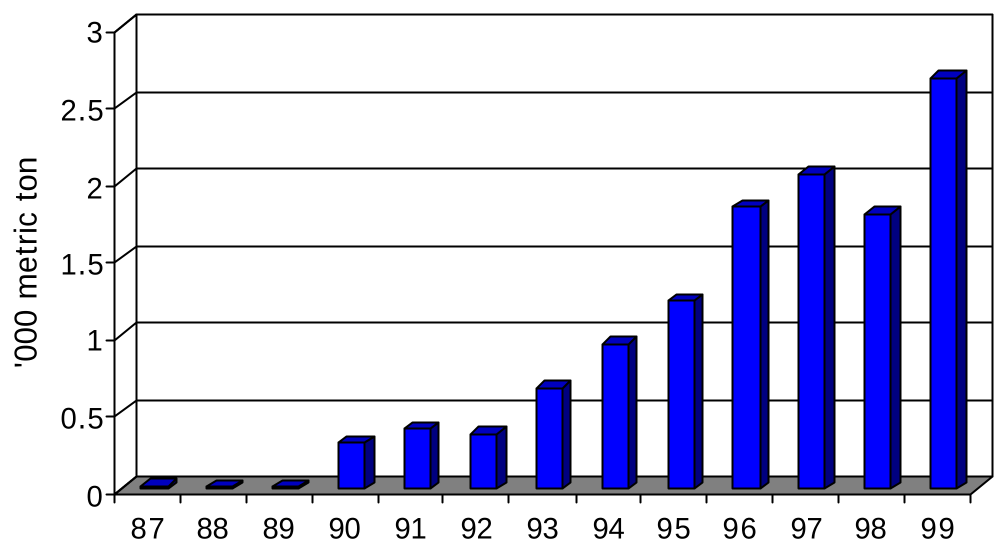
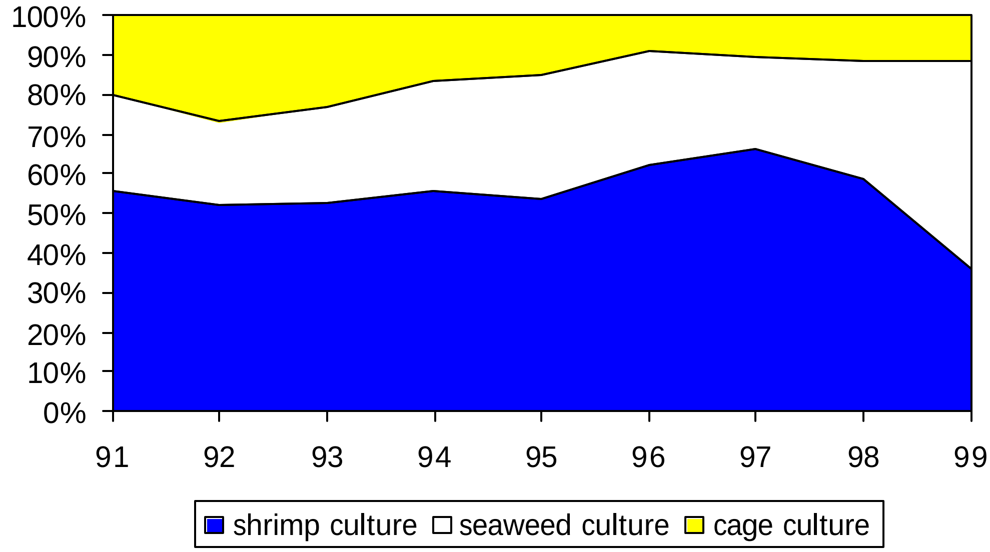


Figure 276g. Production from selected marine aquaculture systems in Sabah, 1991-1999 period (% annual volume)



Downstream Processing

Fish processing activities in Sabah are mainly carried out by 51 major commercial processing plants, out of which 15 are primarily involved in shrimp processing (**Table A74**). Other processing plants are involved in fish storage, processing fresh/frozen fish, shrimp, crabmeat, squid, fishmeal and seaweed including two seaweed SRC plants established in Tawau and Semporna in early 2001. The focal point of fish processing in Sabah is in the SSME area, with 40 of the processing plants in SSME-1 (5), SSME-2 (12), SSME-3 (23) and non-SSME (11) (**Figure 277a**). Most of the processing plants are based in Sandakan (11), Semporna (9), Tawau (8), Kota Kinabalu (6) and Kudat.

Depending on the source of raw materials, shrimp processing facilities in Sabah can be categorised into those mainly processing raw materials from capture fisheries and those processing cultured shrimps, the latter mainly based in Tawau. Processing plants that depend on trawler-sourced wild shrimps are mostly located in Sandakan. Most of the shrimp processing plants in Sandakan are now facing raw material shortages due to the decline of shrimp landings. Landings have steadily declined over the 1991-1999 period, from 6,702 metric tons in 1991 to only 2,880 metric tons in 1999. As a result of the raw material shortages, many plants in Sandakan have started sourcing cultured shrimp from Tawau. However, cultured production in Tawau, the major shrimp farming area in Sabah, has not been able to make up the shortfall in supply. This has resulted in stiff competition for raw material in Tawau and a corresponding increase in *ex-farm* prices.

Total cold storage capacity in Sabah, mostly in shrimp processing plants, is around 2,600 metric tons (**Table A72** & **Figure 277b**). The total ice production capacity by 118 ice plants located throughout the state amounts to around 1,443 metric tons, with 83% in the SSME area. Most of the shrimp processing plants use contact plate freezers for freezing and only a few use air blast freezers. Major product types are block frozen head-on, headless, PUD or PTO shrimp. Few produce semi-IQF product but none of the plants processes cooked shrimp or IQF shrimp.

Figure 277a. Distribution of fish processing plants in Sabah 1999

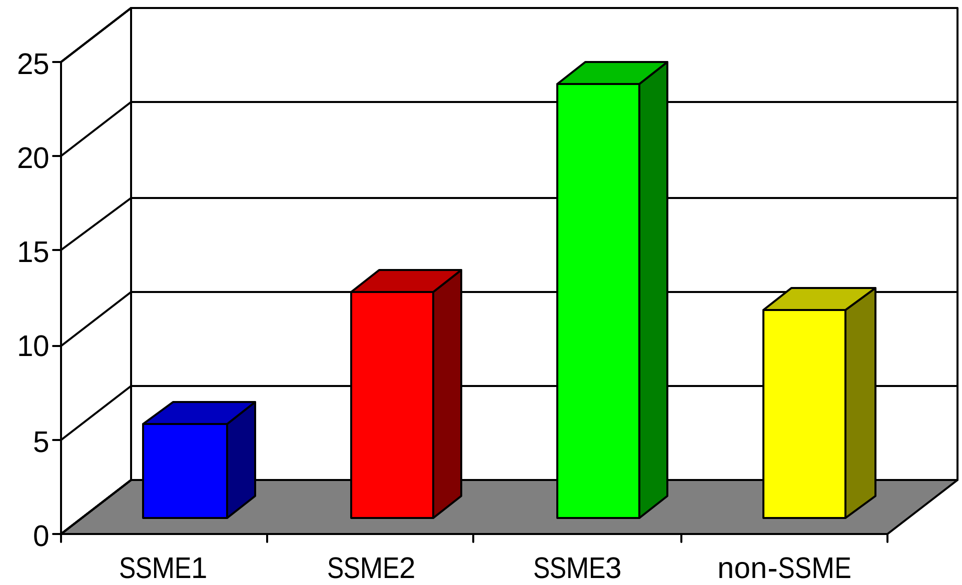
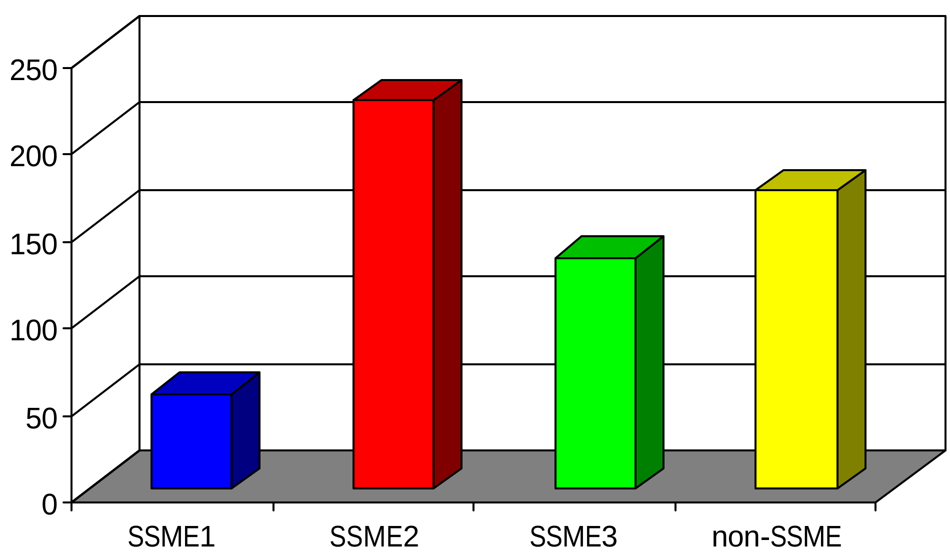


Figure 277b. Ice production capacity of fish processing plants in Sabah 1999 (metric ton per day)



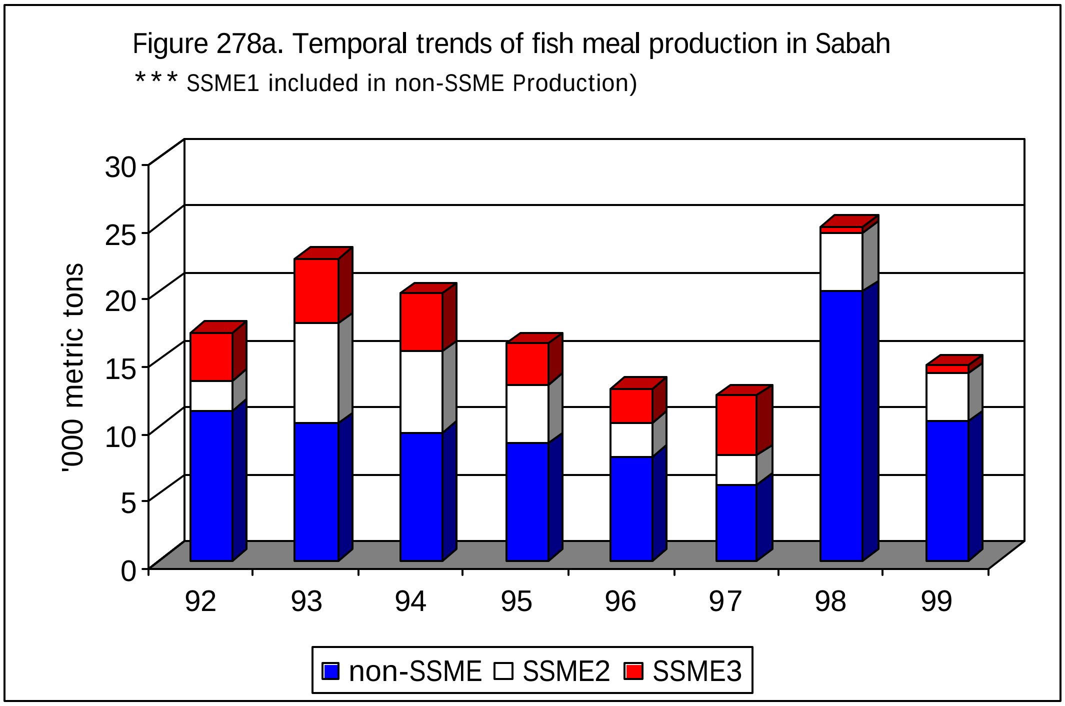


Figure 278a. Temporal trends of fish meal production in Sabah
*** SSME1 included in non-SSME Production)
'000 metric tons
0
5
10
15
20
25
30
92
93
94
95
96
97
98
99
non-SSME
SSME2
SSME3

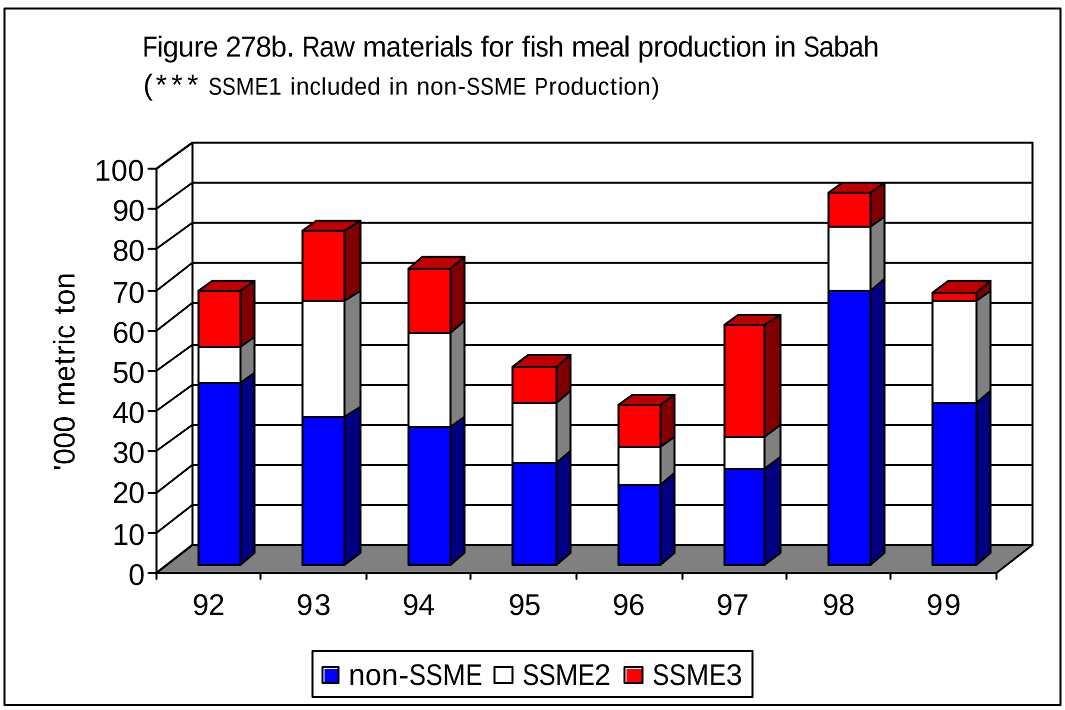


Figure 278b. Raw materials for fish meal production in Sabah
(*** SSME1 included in non-SSME Production)
'000 metric ton
0
10
20
30
40
50
60
70
80
90
100
92
93
94
95
96
97
98
99
non-SSME
SSME2
SSME3

Figure 278c. Temporal trends of raw materials utilization for fish meal production in Sabah (% total landings)

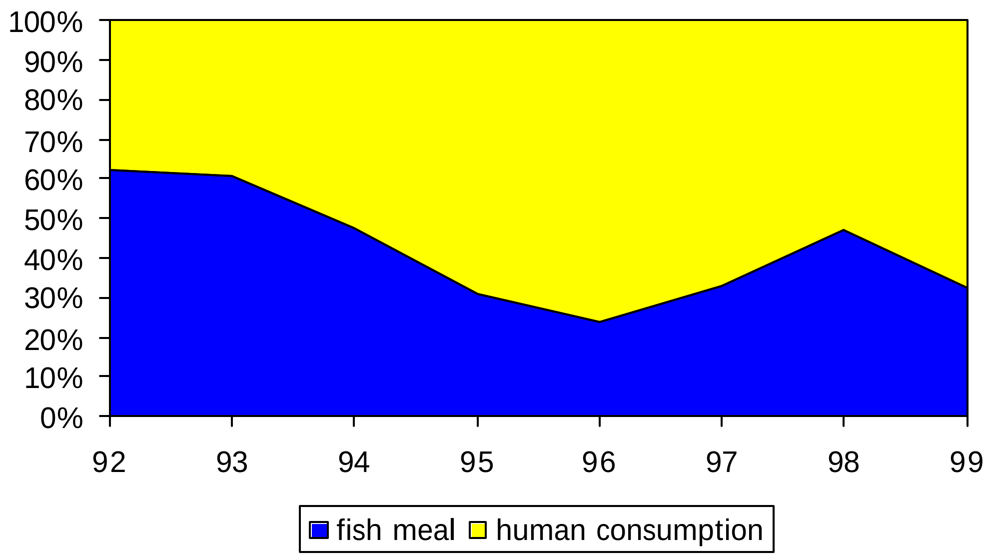
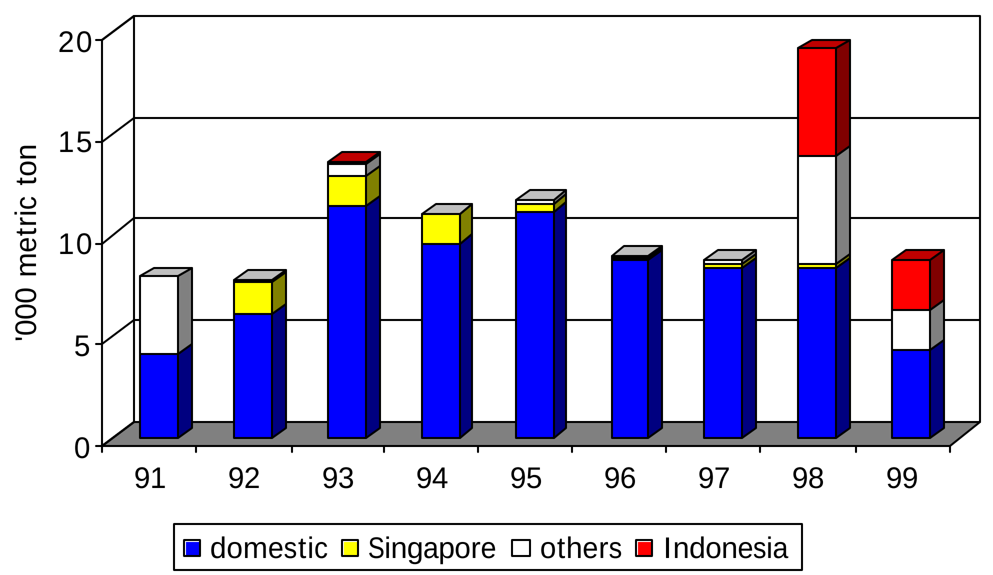


Figure 279a. Annual breakdown of fish meal exports by country, Sabah (1991-1999 period)



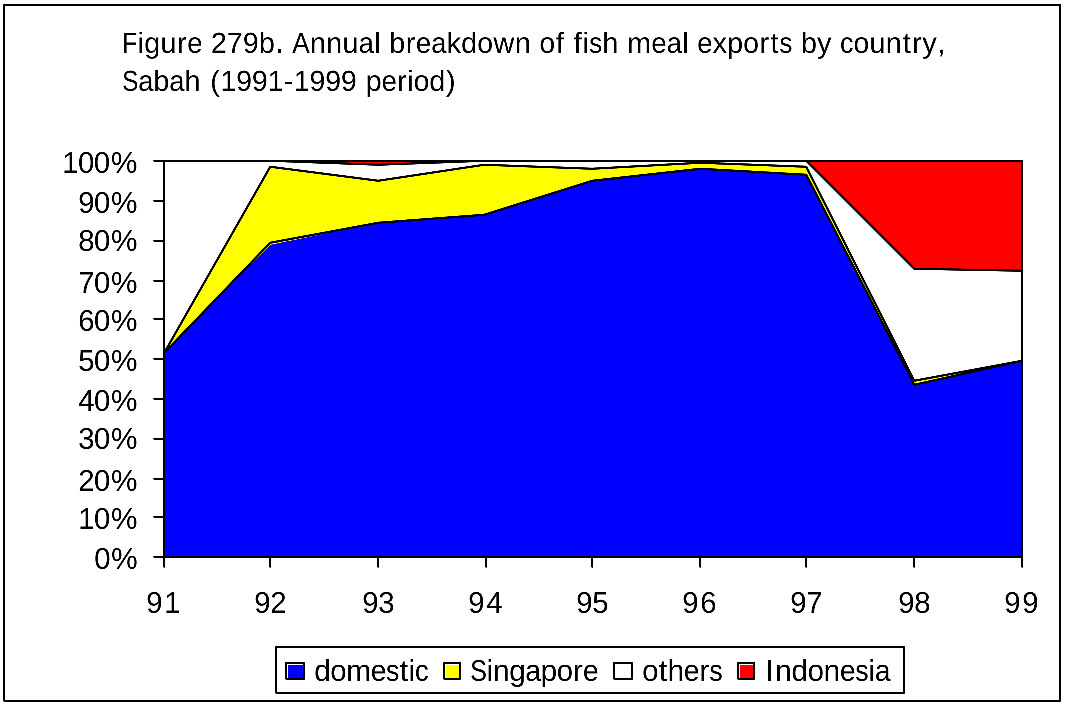


Figure 279b. Annual breakdown of fish meal exports by country, Sabah (1991-1999 period)
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
91
92
93
94
95
96
97
98
99
domestic
Singapore
others
Indonesia

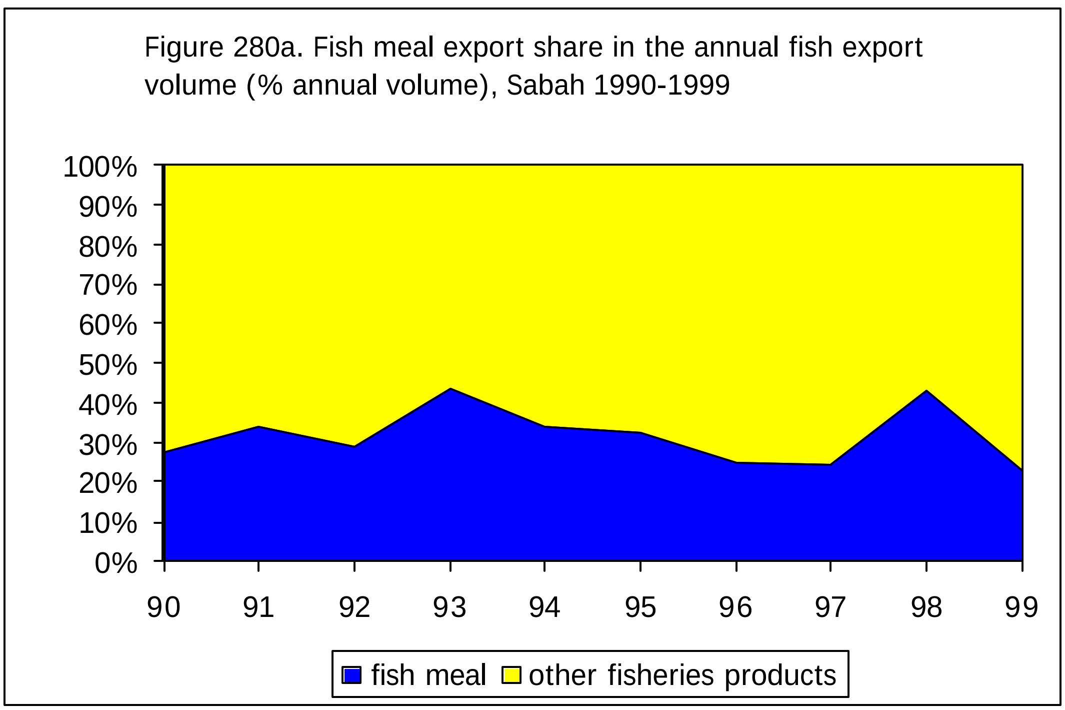


Figure 280a. Fish meal export share in the annual fish export volume (% annual volume), Sabah 1990-1999
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
90
91
92
93
94
95
96
97
98
99
fish meal
other fisheries products

Figure 280b. Fish meal export share in the annual fish export value (% annual value), Sabah 1990-1999

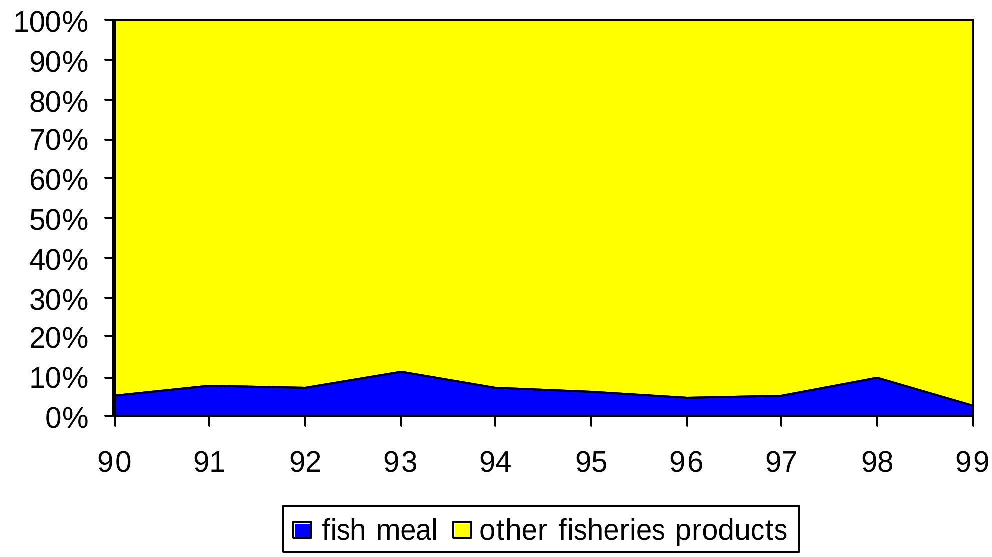


Figure 281a. Breakdown of fish meal exports by destination in 1997 (8,766 metric ton)

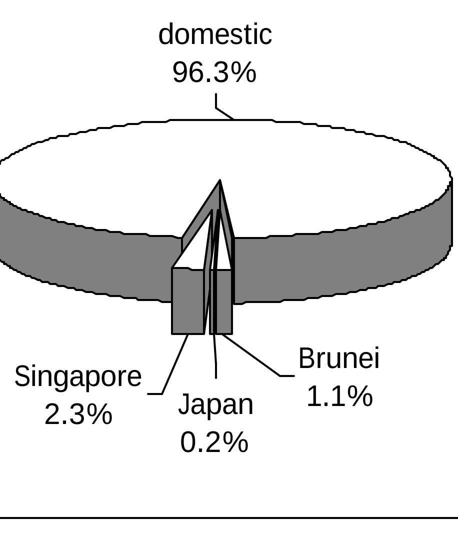


Figure 281b. Breakdown of fish meal exports by destination in 1998 (19,195 metric ton)

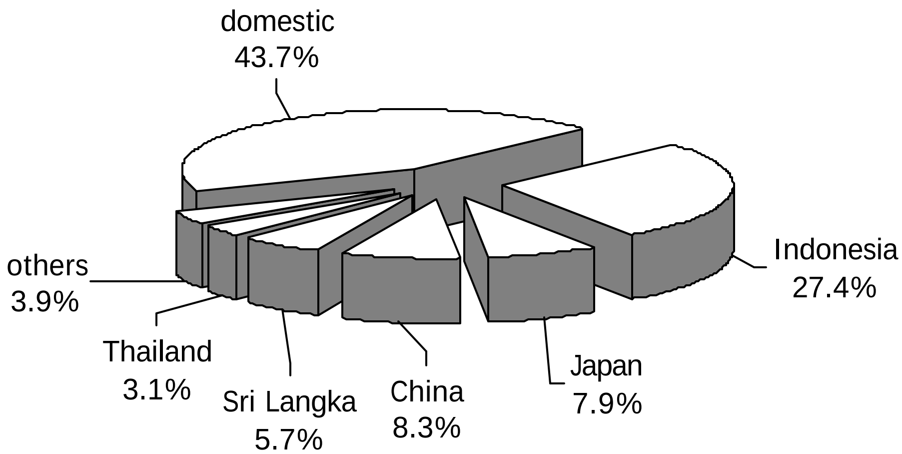
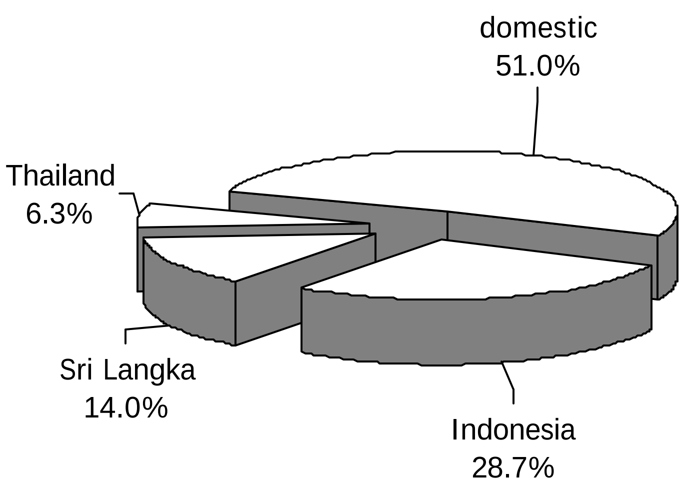


Figure 281c. Breakdown of fish meal exports by destination in 1999 (8,570 metric ton)



Fisheries Trade

Annual statistics on Sabah fisheries trade are shown in **Tables A77-A80** & **Figures 282-284**. During the last 10 years, fish exports had increased respectively 96.0% and 161.4% by volume and value, from 23,941 metric tons (RM122.1 million) in 1990 (**Figures 282a–282b**). On the other hand, fish imports only increased respectively 30.3% and 68.1% by volume and value during the same period, from 5,731 metric tons (RM23.9 million) in 1990. As a whole, Malaysia is a net importer of fisheries products; however, as a State, Sabah is a net exporter of fisheries products. Significant increase in the annual export volume since 1989 was mainly due to fish meal contribution. Fish meal make up respectively 23-44% (mean: 31.5%) by volume and only 2.4-11.0% (mean: 6.7%) by value of the annual fisheries export during the 1990-1999 period (**Figures 280a-280b**). The breakdown of the import and export of fisheries products in 1997-1999 are given respectively in **Figures 290a-290d**.

The export and import prices of fish and fisheries products in 1997-1999 were respectively at RM6.58-8.43/kg (mean: RM7.36/kg) and RM5.39-6.30/kg (mean: RM5.98/kg). The export price had increased by 980%, from RM1.34/kg in 1962 to its peak of RM14.56/kg in 1983, and then declined by 66% down to RM4.95/kg in 1993 before increasing by 70% to RM8.43/kg in 1999 (**Figure 282c**). The decline in export prices during the last 10 years was due to cheap fish meal exports that make up 23-44% of the annual export volume. The export price of fish meal ranged between RM0.90-1.63/kg (mean: RM1.25/g) during the 1990-1999 period. On the other hand, the mean import prices had increased by 380%, from RM1.31/kg in 1962 to its peak of RM6.30/kg in 1997, and then declined by 14.5% to RM5.39/kg in 1999. During the 1997-1999 period, fisheries trade were made with export prices (RM7.36/kg) transacted at 24% higher compared to import prices (RM5.94/kg). Fisheries trade in 1997-1999 made a surplus of 111,294 metric tons valued at RM0.76 billion. During the 10-year period, the balance of trade surplus had increased 124% by volume and 184% by value, from 13,579 metric tons (RM98.1 million) in 1990 to 30,371 metric tons (RM278.8 million) in 1999.

In 1997-1999, fish meal make up 31.2% of the annual total fisheries export volume, followed by chilled & frozen fish (25.4%), frozen and miscellaneous processed products (15.24%), frozen shrimp (14.7%), processed crustaceans (4.6%), processed fish products (1.4%), live fish (1.3%), frozen crustaceans (1.0%), canned fisheries products (0.4%) and other miscellaneous products (4.6%) (**Table A80**). Frozen shrimp make up 57.5% of the annual total export value, followed by frozen and chilled fish (12.8%), frozen and miscellaneous processed products (9.8%), frozen chilled and frozen fish (12.8%), fish meal (6.0%), live fish (5.7%), processed crustaceans (4.6%), frozen crustaceans (1.9%), canned fisheries products (0.2%) and other miscellaneous products (1.3%).

In 1997-1999, canned fisheries products make up 60.4% of the annual total fisheries import volume, followed by frozen and chilled fish (11.7%), fish meal (10.1%), processed crustaceans (3.3%), frozen and processed miscellaneous products (3.3%), frozen shrimp (1.1%), live fish including ornamentals (1.0%), processed fish products (0.7%), frozen crustaceans (0.2%) and other miscellaneous products (8.1%). Overall, canned fisheries products make up 61.1% of the annual total import value, followed by frozen and chilled fish (15.5%), live fish (5.8%), frozen and miscellaneous processed products (3.8%), frozen shrimp (3.0%), processed crustaceans (2.7%), fish meal (2.2%), processed fish (1.1%), frozen crustaceans (1.0%), and other miscellaneous products (4.5%).

Frozen shrimp exports amounted to 6,705.5 metric tons valued at RM184.5 million (RM27.50/kg) in 1999, making up 17.7% by volume and 57.83% by value of the total fisheries exports. About 34.3% was exported to Japan, followed by Peninsular Malaysia and Sarawak (28.9%), Hong Kong (14.3%), Europe (13.3%), USA (4.3%), China (2.3%) and other parts of Asia Pacific

(2.5%). On the other hand, frozen shrimp imports from Indonesia in 1999 amounted to 187 metric tons valued at RM3.05 million (RM16.31/kg), with most them value-added processed in Tawau prior to export. Discussions made with fish traders in Tawau suggested that the above import figures might be gross underestimates that only take into account the shrimp imports declared to customs through the barter trade gateway. It is estimated that the annual shrimp imports from Indonesia might be in the region of 1,500-2,000 metric tons valued at RM25-35 million, which were used as raw materials by shrimp processing plants in Tawau and exported to other states within Malaysia and other overseas markets including Japan.

Peeled shrimp exports in fresh, chilled and frozen forms amounted to 125.49 metric tons valued at RM3.09 million (RM24.65/kg) in 1999, making up 0.3% by volume and 1.0% by value of the total fisheries exports. About 55.0% of this commodity was exported to Peninsular Malaysia, followed by Brunei (35.8%), Hong Kong (4.5%), Sarawak (2.4%) and China (2.3%). On the other hand, imports amounted to 227.97 metric tons valued at RM0.67 million (RM2.95/kg), with 99.9% of the total imports from Indonesia.

Mangrove crab exports amounted to 862.95 metric tons valued at RM7.28 million (RM8.43/kg) in 1999, making up 2.3% by volume and value of the total fisheries exports. About 93.3% of the crabs were exported to Peninsular Malaysia, followed by Brunei (2.6%), Sarawak (1.5%), Taiwan (1.1%), Hong Kong (0.8%) and Singapore (0.6%). On the other hand, imports amounted to 44.82 metric tons valued at RM0.31 million (RM6.96/kg), with 82.7% and 17.3% respectively originating from Indonesia and Peninsular Malaysia.

Frozen squid and cuttlefish exports amounted to 4,111.51 metric tons valued at RM19.86 million (RM4.82/kg) in 1999, making up 10.9% by volume and 6.2% by value of the total fisheries export. About 19.2% of this commodity was exported to Peninsular Malaysia and Sarawak, followed by the Philippines (15.6%), Hong Kong (13.1%), China (11.6%), Singapore (8.6%), Japan (7.2%), Italy (6.7%), Thailand (5.8%), Taiwan (4.4%), USA (4.0%), Korea (1.7%), Australia (0.9%), Switzerland (0.6%) and Brunei (0.5%). On the other hand, imports from Peninsular Malaysia only amounted to 1.60 metric tons valued at RM10,201 (RM6.38/kg) in 1999.

Frozen octopus exports amounted to 1,162.28 metric tons valued at RM5.84 million (RM5.02/kg) in 1999, making up 3.1% by volume and 1.8% by value of the total fisheries exports. About 70.0% of this commodity had been exported to USA, followed by Korea (6.0%), Peninsular Malaysia and Sarawak (5.1%), Singapore (4.8%), Thailand (4.7%), Italy (3.5%), Japan (2.5%), Australia (1.7%), Hong Kong (1.5%) and the Philippines (0.1%). Imports from Peninsular Malaysia only amounted to 0.16 metric ton valued at RM5,609 (RM35.06/kg) in 1999. The high import price suggested that this commodity might have comprised of quality grade octopus supplied to hotels, Japanese restaurants and supermarkets in Sabah.

Sea cucumber or *Beche-De-Mer* exports amounted to 106.81 metric tons valued at RM1.85 million (RM17.30/kg) in 1999, making up 0.3% by volume and 0.6% by value of the total fisheries exports. About 38.4% of this commodity was exported to other states within Malaysia, followed by Hong Kong (30.9%), Korea (19.9%), China (9.2%), Singapore (0.6%), Japan (0.5%), Brunei (0.3%) and USA (0.1%). Imports amounted to 13.91 metric tons of lower grade sea cucumbers valued at RM84,120 (RM6.05/kg), with 13.89 metric tons valued at RM81,612 (RM5.88/kg) from Peninsular Malaysia and 20 kg valued at RM2,508 (RM125.40/kg) originating from India.

Fish meal products make up 31.2% of the annual fisheries export volume in 1997-1999, with trade transactions made with import prices (RM1.38/kg) slightly 5.2% higher than export prices (RM1.31/kg). In 1999, fish meal exports amounted to 8,550 metric tons valued at RM7.66 million (RM0.90/kg). Fish meal exports represented 23.3% by volume and 2.5% by value of the total fisheries exports in 1999. About 50.9% of the fish meal was exported to domestic markets within Malaysia, followed by Indonesia (28.8%), Sri Langka (14.0%), Thailand (6.3%) and China (3.0%). Domestic fish meal exports amounted to 4,352.3 metric tons in 1999, with 88% and 12% respectively to Sarawak and Peninsular Malaysia. In 1999, fish meal imports into Sabah amounted to 1,176.3 metric tons worth RM1.26 million (RM1.07/kg), making up 6.0% by volume and 1.1% by value of the total fisheries imports. About 3.4% and 96.6% of these fish meals originated respectively from Sweden and Peninsular Malaysia.

In 1997-1999, chilled and frozen fish make up 25.4% of the annual fisheries export volume, with trade transactions made at import prices (RM7.79/kg) around 110.3% higher than export prices (RM3.70/kg). Frozen fish make up 82.6% of the annual export, followed by fresh & chilled fish (15.2%) and frozen fish fillet (2.2%). This also included imported products from Indonesia that had been value-added processed in Tawau prior to export. In 1999, exports amounted to 10,629 metric tons valued at RM42.0 million (RM3.95/kg), which represented 28.1% by volume and 13.2% by value of the total fisheries exports. Frozen fish make up 79.5% of the export volume, followed by fresh & chilled fish (16.8%) and frozen fish fillet (3.7%). On the other hand, imports amounted to 639 metric tons valued at RM5.2 million (RM8.27/kg) comprising of 97.2% and 2.8% by volume respectively of fresh & chilled fish and frozen fish fillets.

Frozen fish exports amounted to 8,448 metric tons valued at RM27.34 million (RM3.24/kg) or around 22.3% and 8.6% of the total export volume and value in 1999. About 33.3% had been exported to markets within Malaysia, followed by Japan (18.3%), Australia (15.8%), China (11.0%), Taiwan (8.1%), Hong Kong (6.7%), the Philippines (2.9%), Singapore (2.4%), Brunei (1.0%), Italy (0.3%), Korea (0.15%) and USA (0.003%). Tunas make up 18.9% by volume and 14.9% by value of this trade commodity in 1999. Tuna exports amounted to 1,599 metric tons valued at RM4.08 million (RM2.55/kg), with 95.7% exported to Japan, followed by Peninsular Malaysia (3.8%) and Australia (0.5%). Sardine exports amounted to 244 metric tons valued at RM0.18 million (RM0.75/kg), with 50.9% exported to Australia and 49.1% within Malaysia. Sardines exported to Australia are mainly used as raw materials in the pet food industry. In 1999, imports of frozen fish in 1999 amounted to 618 metric tons valued at RM4.9 million (RM7.88/kg) or 8.3% and 12.1% of the total import volume and value. About 76.0% of these frozen fish imports originated from Indonesia, followed by Peninsular Malaysia (23.3%), Japan (0.3%), USA (0.2%), Norway (0.16%) and Australia (0.03%).

In 1999, exports of fresh and chilled fish had amounted to 1,790 metric tons valued at RM13.26 million (RM7.41/kg) making up 4.7% by volume and 4.2% by value of the total fisheries exports. Around 79.7% of the frozen fish products had been exported to Peninsular Malaysia, followed by Brunei (15.6%), Sarawak (2.2%), Taiwan (1.0%), Philippines (0.8%), Singapore (0.5%) and Hong Kong (0.2%). Overall, 81.9% of the frozen fish had been exported to domestic markets within Malaysia, with 97.3% and 2.7% of it to Peninsular Malaysia and Sarawak. No imports had been recorded in 1999, with 1.03 metric tons valued at RM27,837 (RM27.03/kg) and 0.26 metric ton of salmon valued at RM8,317 (RM32.00/kg) recorded respectively in 1997 and 1998. In 1997, chilled fish imports comprised of salmon (0.34 metric ton), cod (0.29 metric ton), eels (0.02 metric ton) and other assorted fish (0.38 metric ton).

Frozen fish fillet exports amounted to 391 metric tons valued at RM1.43 million (RM3.67/kg) or 1.0% and 0.4% of the total export volume and value in 1999. Around 81.0% had been exported to Korea, followed by the Philippines (7.0%), Peninsular Malaysia (5.4%), Hong Kong (1.7%), Singapore (1.5%), Brunei (1.4%), Sarawak (0.9%) and Taiwan (0.9%). Overall, about 93.7% of this commodity had been exported to overseas markets in 1999. In 1999, imports of this commodity amounted to around 18 metric tons valued at RM0.4 million (RM21.8/kg) or around 0.2% and 1.0% of the total import volume and value. About 67.2% had been imported from USA, followed by Norway (19.2%), Australia (7.6%), Peninsular Malaysia (5.9%) and Japan (0.1%). Overall, 94.1% of this commodity had been imported from overseas markets in 1999.

Exports of dried anchovies make up 1.8% by volume and 0.2% by value of the total fisheries exports in 1999. Exports amounted to 685.06 metric tons valued at RM751,351 (RM1.10/kg), with 95.8% exported to the Philippines, followed by Sarawak (4.0%) and Peninsular Malaysia (0.3%). On the other hand, imports of high grade dried anchovies from Peninsular Malaysia amounted to 14.71 metric tons valued at RM117,446 (RM7.98/kg), making up 0.2% by volume and 0.3% by value of the total fisheries imports.

Exports of dried fish maws amounting to 0.97 metric ton valued at RM46,550 (RM48.00/kg) make up an insignificant portion of the total fisheries exports in 1999. About 63.9% of this commodity was exported to Hong Kong, followed by Sarawak (33.0%), Brunei (5.1%) and Peninsular Malaysia (3.1%). On the other hand, imports in 1999 amounted to 0.42 metric ton valued at RM8,310 (RM19.86/kg), from China (0.38 metric ton) and Thailand (0.04 metric ton).

Exports of dried shark fins amounted to 11.01 metric tons valued at RM424,550 (RM38.56/kg) in 1999, with 83.9% exported to Peninsular Malaysia, followed by Sarawak (6.4%), Hong Kong (5.6%) and Brunei (4.0%). On the other hand, dried shark fin imports amounted to 0.47 metric ton valued at RM13,826 (RM29.42/kg), with 63.8% imported from Peninsular Malaysia, followed by the Philippines (34.0%) and Singapore (2.1%).

Exports of salted fish amounted to 57.52 metric tons valued at RM139,024 (RM2.42/kg) in 1999. About 38.8% of this commodity was exported to the Philippines, followed by Brunei (33.1%), Sri Langka (27.8%), Sarawak (2.6%) and Peninsular Malaysia (0.7%). On the other hand, imports of this commodity amounted to 8.86 metric tons valued at RM17,048 (RM1.92/kg), with 93.7% and 6.3% respectively imported from Indonesia and the Philippines.

Imports of canned fisheries products amounted to 3,699.3 metric tons valued at RM22.61 million (RM6.11/kg) in 1999, making up 49.5% by volume and 56.2% by value of the total fisheries imports. About 57.6% by volume of these canned products were imported from Peninsular Malaysia, followed by Thailand (34.6%), Indonesia (3.8%), China (3.7%) and other countries (0.3%). Some of these canned products had been exported to other countries in the region. In 1999, canned product exports amounted to 7.94 metric tons valued at RM49,923 (RM6.29/kg). About 63.0% had been exported to Peninsular Malaysia, followed by the Philippines (21.7%), Brunei (8.9%) and Indonesia (6.4%).

In 1999, export and import of fish and fisheries products respectively amounted to 37,480 metric tons (RM319.0 million) and 7,460 metric tons (RM40.2 million). Peninsular Malaysia, Hong Kong, Japan, China and USA are the top 5 export trading partners in 1999, which had contributed 55% by volume and 79% by value of the total fish exports. On the other hand, the top five import partners are Peninsular Malaysia, Indonesia, Thailand, USA and China, which had contributed 92% by volume and 94% by value of the total fish imports in 1999.

In 1999, about 8,816 metric tons or 23.3% of the total fisheries exports of 37,480 metric tons had been exported to Peninsular Malaysia, followed by Hong Kong (11.3%), Japan (11.2%), China (4.8%) and USA (4.3%). In terms of export value, about RM96.62 million or 30.3% of the total fisheries exports of RM319 million had been exported to Japan, followed by Peninsular Malaysia (26.0%), Hong Kong (15.7%), USA (5.1%) and China (2.2%)

About 3,747 metric tons or 50.2% of the total fisheries imports of 7,460 metric tons in 1999 had been imported from Peninsular Malaysia, followed by Thailand (17.4%), Indonesia (14.4%), USA (7.5%) and China (2.5%). In terms of import value, about RM21.63 million or 53.8% of the total fisheries imports of RM40.23 million had been imported from Peninsular Malaysia, followed by Indonesia (20.5%), Thailand (16.1%), USA (2.2%) and China (1.8%).

During the 1991-1999 period, around 34-52% (mean: 44.4%) of the annual export volume of fish and fishery products from Sabah are destined for Peninsular Malaysia and Sarawak (**Table A78** & **Figures 282a**-**282b**). Exports to these two destinations mainly consist of frozen fish, crustaceans, molluscs and fishmeal. Other major export markets are Japan, Hong Kong, Singapore, Europe, USA and other parts of the Asian region. Most of these overseas markets are accessed through transshipments via Peninsular Malaysia. Exports to Peninsular Malaysia are either sold locally or re-exported. Shrimp and some finfish species brought into Peninsular Malaysia are also used to produce value-added products such as cooked shrimp, battered and breaded shrimp, surimi and other products. During the last few years, the percentage of fisheries exports to overseas markets had increased by 38%, from 48% of the total volume in 1996 to 66% in 1999 (**Figures 284e**-**284f**). The significant increase was due to the substantial increase in fish meal exports to overseas markets in Indonesia, China, Hong Kong and Sri Langka. The value of fisheries products exported to overseas markets had increased during the last few years.

During the 1991-1999 period, about 23.4% of the annual overseas export volume had been exported to Japan, followed by Singapore (14.3%), Hong Kong (12.0%), Europe (7.2%), Americas[172] (6.4%) and other Asian countries (36.6%) (**Figures 284a**-**284b**). During the 9-year period, exports to Singapore had declined by 76%, from 3,300 metric tons in 1991 to only around 800 metric tons in 1999. Singapore's share of the annual overseas export volume had declined by 89%, from 25.6% in 1991 to only 2.7% in 1999. Exports to Japan had increased by 209%, from 2,200 metric tons in 1991 to 6,800 metric tons in 1998 before declining to 4,200 metric tons in 1999. Japan's share of the annual export volume had increased by 6.2% from 17.0% in 1991 to 23.3% in 1999, with peaks at 29-30% between 1994-1995. Exports to Hong Kong had increased by 187%, from 1,500 metric tons in 1991 to 4,300 metric tons in 1999. During the 9-year period, Hong Kong's share of the annual export volume had increased by 98.5% from 11.6% in 1991 to 23.1% in 1998 before declining to 9.9% in 1999. Exports to Europe increased by 217% from 600 metric tons in 1991 to 1,900 metric tons in 1997 before declining by 26% to 1,400 metric tons between 1998-1999. Europe's share of the annual export volume had increased by 137.5%, from 4.7% in 1991 to its peak of 11.0% in 1996 before declining to only 4.4% in 1999. Exports to the Americas had declined by 62% from 1,300 metric tons in 1991 to only around 500 metric tons in 1997 before increasing by 240% to 1,700 metric tons between 1998-1999. The American continent share of the annual export volume had declined by 76.1%, from 11.1% in 1991 to only 2.4% in 1998 before increasing to 6.2% in 1999. Exports to other Asian countries had shown the highest growth during the 9-year period, where annual exports had increased by 290% from 4,000 metric tons in 1991 to 15,600 metric tons in 1998 before declining by 19% to 12,600 metric tons in 1999. The significant increase during the last 3-years was attributed by significant increase in fish meal and sea weed exports. Its share of the annual export volume had increased by 67.4%, from 31.0% in 1991 to 51.9% in 1998-1999. Exports to Hong Kong had increased by 220% from 1,500 metric tons in 1991 to 4,800 metric tons in 1997, declined to 2,900 metric tons in 1998 and then increased to 4,300 metric tons in 1999. Hong Kong's share of the annual export volume had increased by 98.5%, from 11.6% in 1991 to 23.1% in 1998 before declining to 9.9% in 1999. During the 1997-1999 period, about 43.4% of the annual overseas export volume had been exported to other countries in the Asian region, followed by Japan (21.2%), Hong Kong (16.7%), Singapore (7.1%), Europe (6.5%) and the Americas (5.0%).

During the 1991-1999 period, about 45.8% of the annual overseas fisheries export value had been exported to Japan, followed by Hong Kong (17.3%), the Americas (11.0%), other countries in the Asian region (9.9%), Singapore (8.0%) and Europe (8.0%) (**Figures 284c**-**284d**). The value of fish products exported to Japan had increased by 2-fold during the 9-year period, from

[172] Americas include USA, Canada, Mexico and South America.

RM51.6 million in 1991 to RM110.9 million in 1998 before declining to RM96.6 million in 1999. Exports to Japan make up 41-50% of the annual fisheries export earnings during the 1991-1999 period, and its share of Sabah's foreign exchange derived from fish exports increased by 3.3% from 48.4% in 1991 to 50.1% in 1997 before declining to 42.2% in 1999. Exports to Hong Kong make up 8-22% of the annual value of fisheries exports, and its contribution to annual fisheries export earning had increased by 170.8% from 8.1% in 1991 to 21.9% in 1999. During the 9-year period, the value of fisheries exports to Hong Kong had increased by 482.6% from only RM8.6 million in 1991 to RM50.1 million in 1999. Exports to the Americas make up 3-20% of the annual value of fisheries exports, and its contribution to the annual export fisheries export earnings had declined by 84.4% during the 9-year period, from 19.9% in 1991 to only 3.1% in 1997 before increasing to 6.3-7.0% in 1998-1999. During the 1991-1999 period, exports to the Americas had declined by 74.5% from RM21.2 million in 1991 to RM5.4 million in 1997 before increasing to RM15-16 million in 1998-1999. On the other hand, exports to other countries in the Asian region make up 5-14% to the annual fisheries export value, and had increased by 153.2% during the 9-year period from 5.4% in 1991 to 13-14% in 1998-1999. During the 1991-1999 period, exports of fisheries products to these Asian countries had increased by 467.5% from only RM5.7 million in 1991 to RM32.4 million in 1998-1999. On the other hand, the value of fisheries exports to Singapore had declined by 65.2%, from RM13.8 million in 1991 to only RM4.8 million in 1998-1999. Exports to Singapore make up 2-13% of the annual export value between 1991 and 1999, and its contribution to Sabah's annual earnings from fish exports had declined by 84.2% from 13.0% in 1991 to only 2.0% in 1998-1999. The value of fish products exported to Europe had increased tremendously during the 1991-1999 period, which contributed 4-13% to Sabah's annual earnings from fish exports. Exports to Europe had increased by 444.6%, from only RM5.6 million in 1991 to RM30.5 million in 1999. During the 9-year period, Europe's contribution to Sabah's annual earnings from fish exports had increased by 153.2%, from only 5.3% in 1991 to 13.3% in 1999. During the 1997-1999 period, exports to Japan make up 46.1% of the annual fish export value, followed by Hong Kong (21.2%), Europe (12.3%), other countries in the Asian region (12.3%), the Americas (5.5%) and Singapore (2.6%).

Figure 282a. Temporal fish trade volume trend of fisheries trade, Sabah (1963-1999 period)

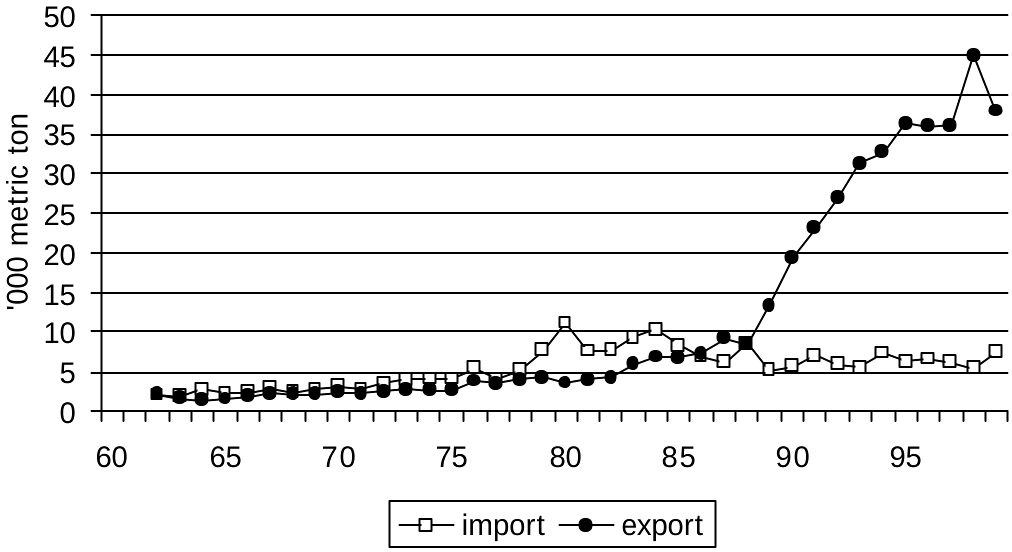


Figure 282b. Temporal fish trade value trend of fisheries trade, Sabah (1963-1999 period)

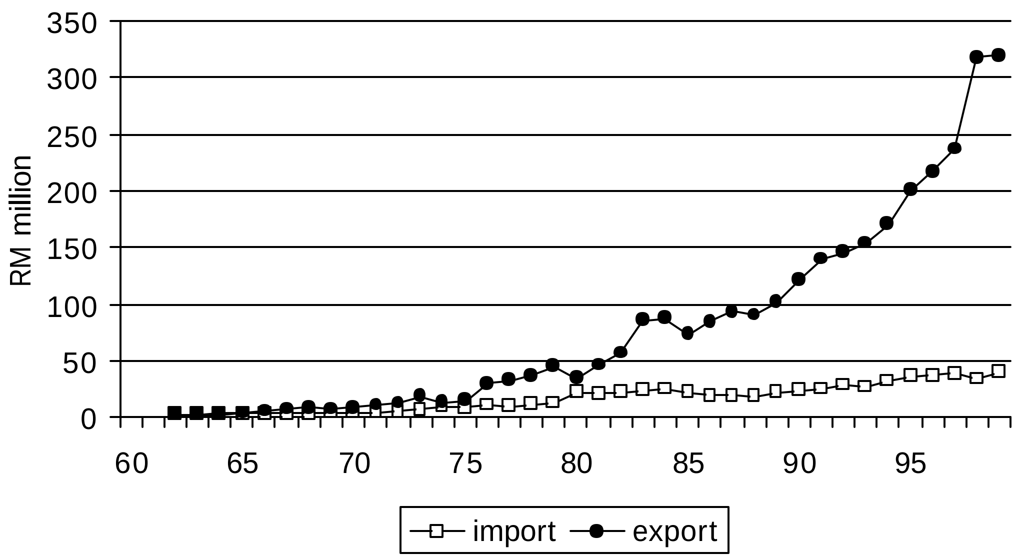


Figure 282c. Temporal fish trade average value per volume trend of fisheries trade, Sabah (1963-1999 period)

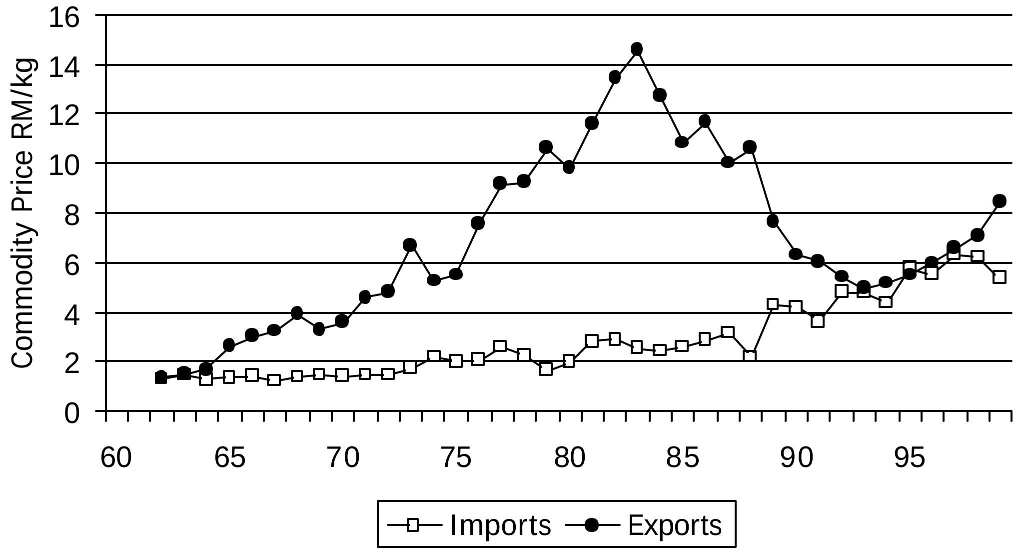


Figure 283a. Annual export volume of fisheries products, Sabah (1991-1999 period)

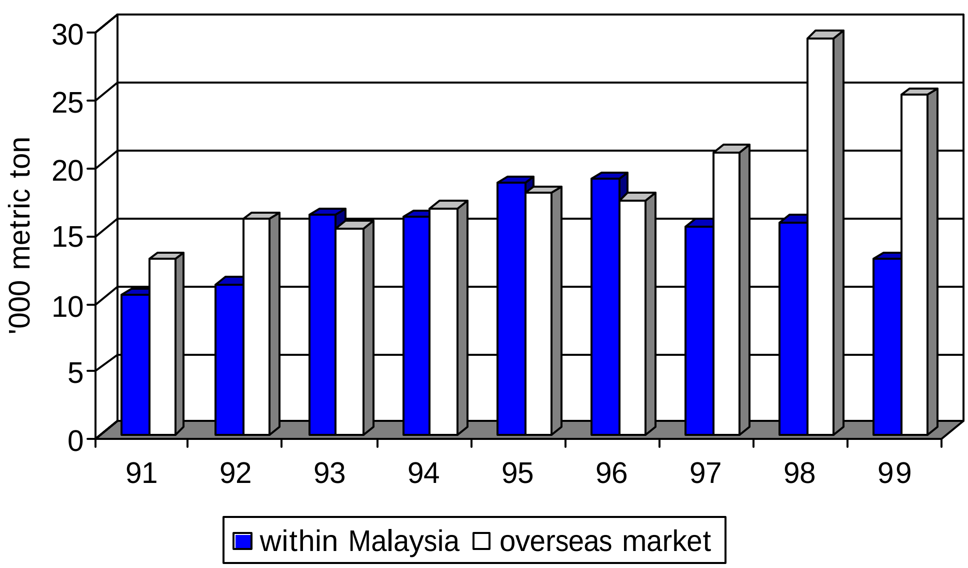


Figure 283b. Annual export volume of fisheries products, Sabah (1991-1999 period) (% annual volume)

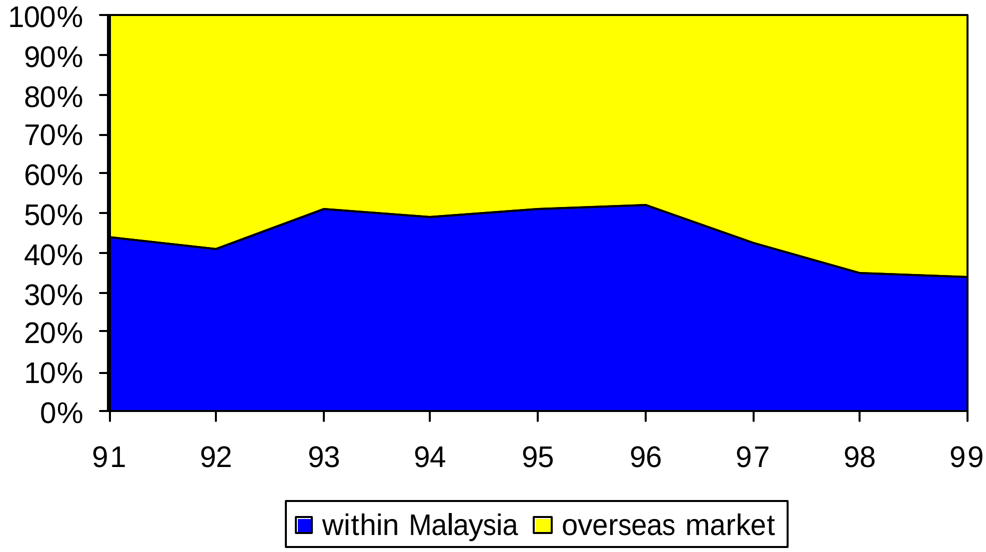


Figure 283c. Annual export value of fisheries products, Sabah (1991-1999 period)

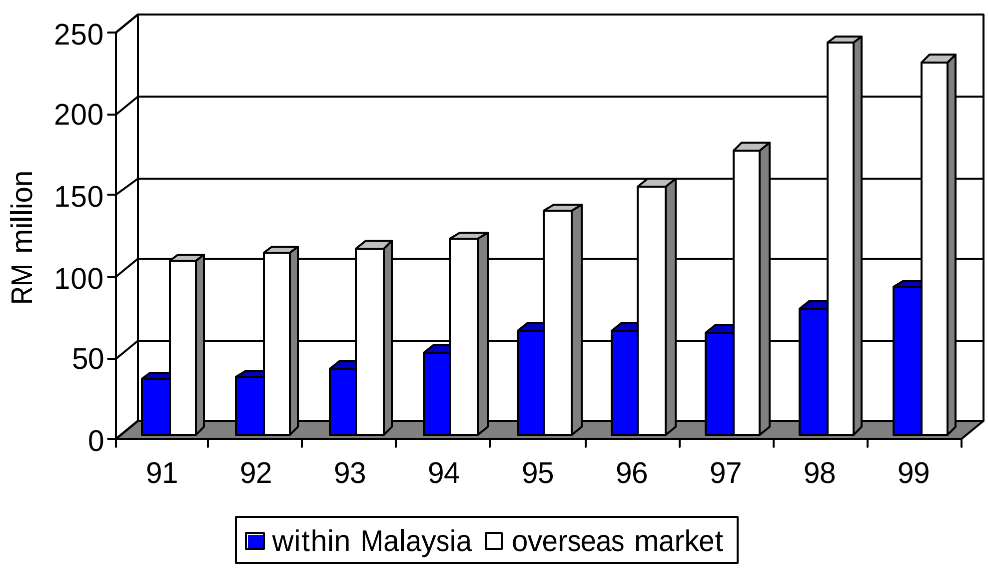


Figure 283d. Annual export value of fisheries products, Sabah (1991-1999 period) (% annual value)

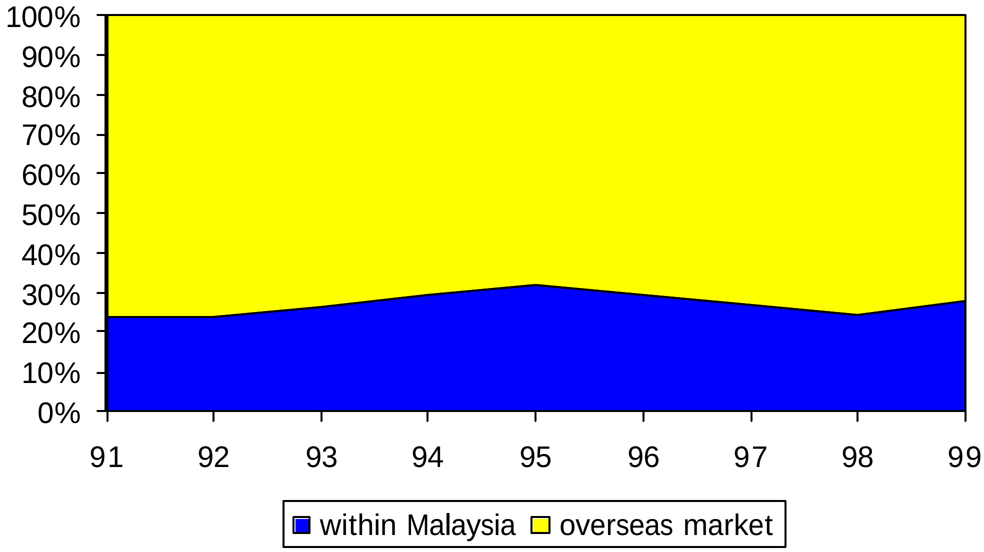


Figure 284a. Export of fisheries products to selected countries, Sabah 1991-1999 (in '000 metric tons)

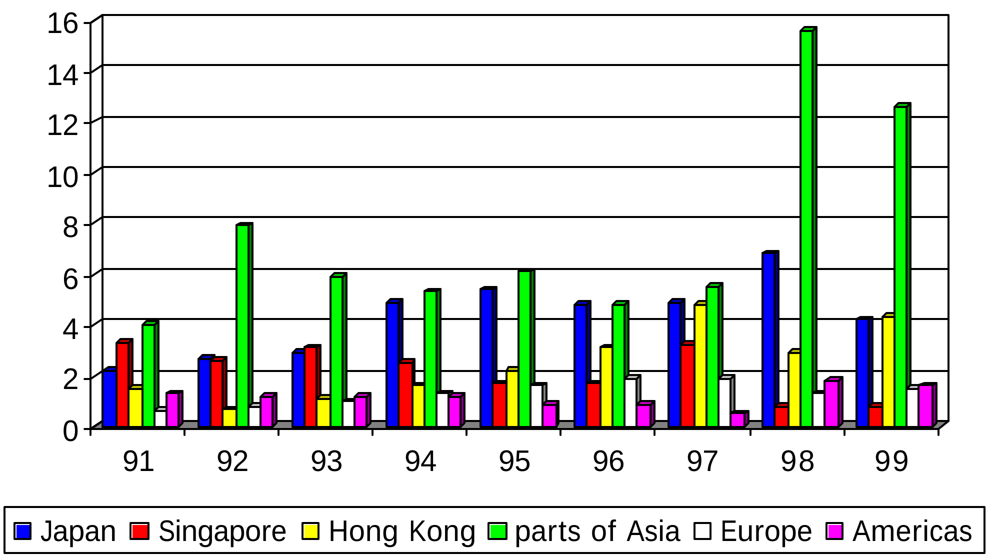


Figure 284b. Export of fisheries products to selected countries, Sabah 1991-1999 (% annual volume)

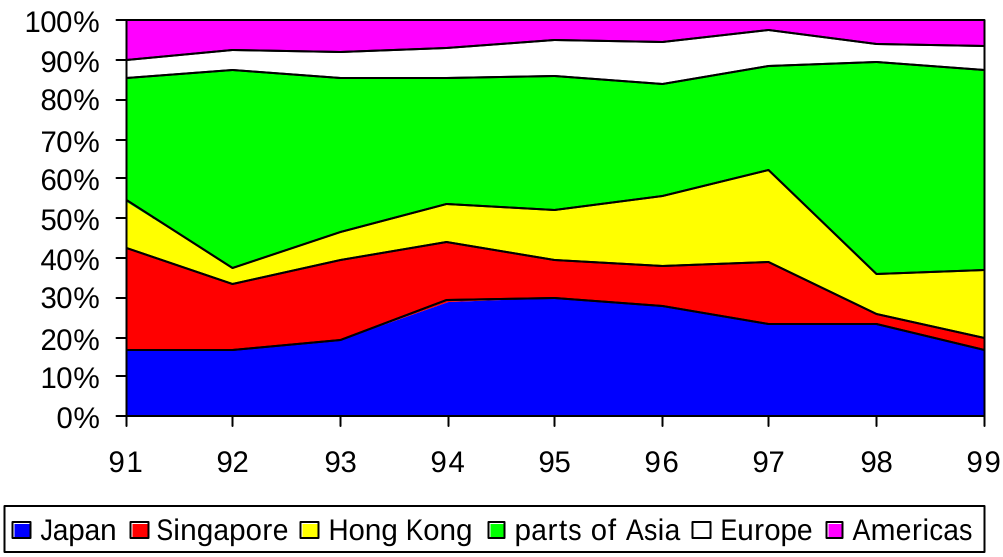


Figure 284c. Export of fisheries products to selected countries, Sabah 1991-1999 (in RM million)

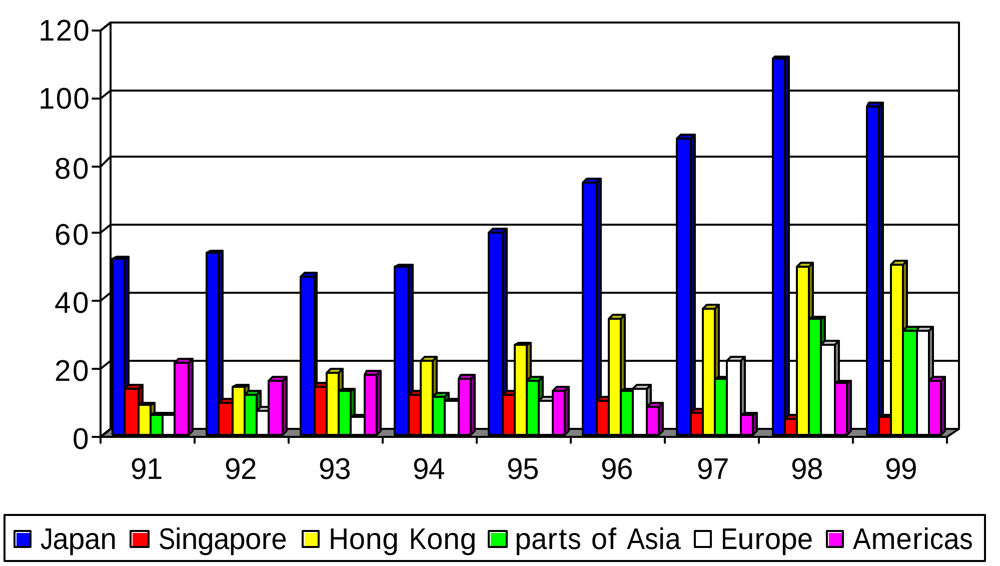


Figure 284d. Export of fisheries products to selected countries, Sabah 1991-1999 (% annual value)

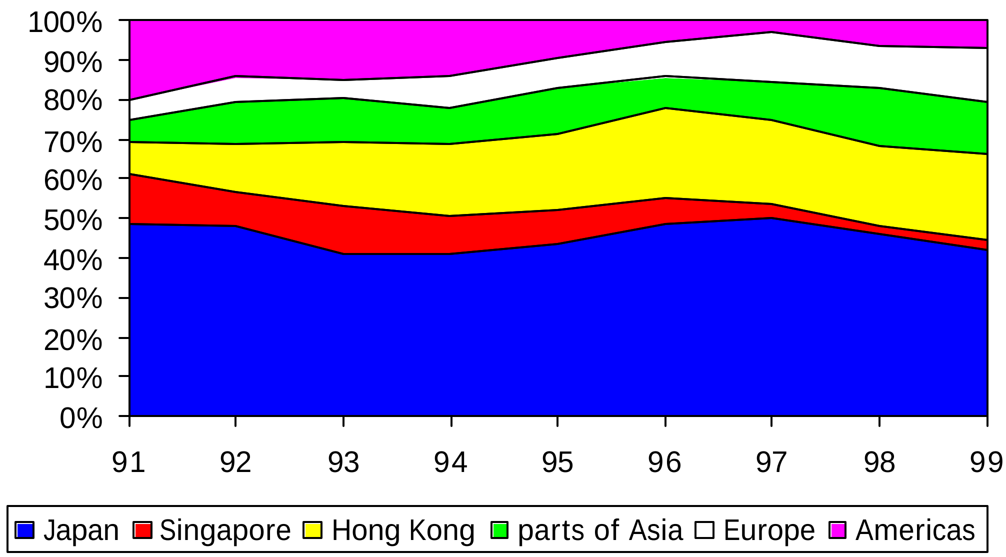


Figure 284e. Temporal fisheries export volume by destination, Sabah, 1991-1999 period

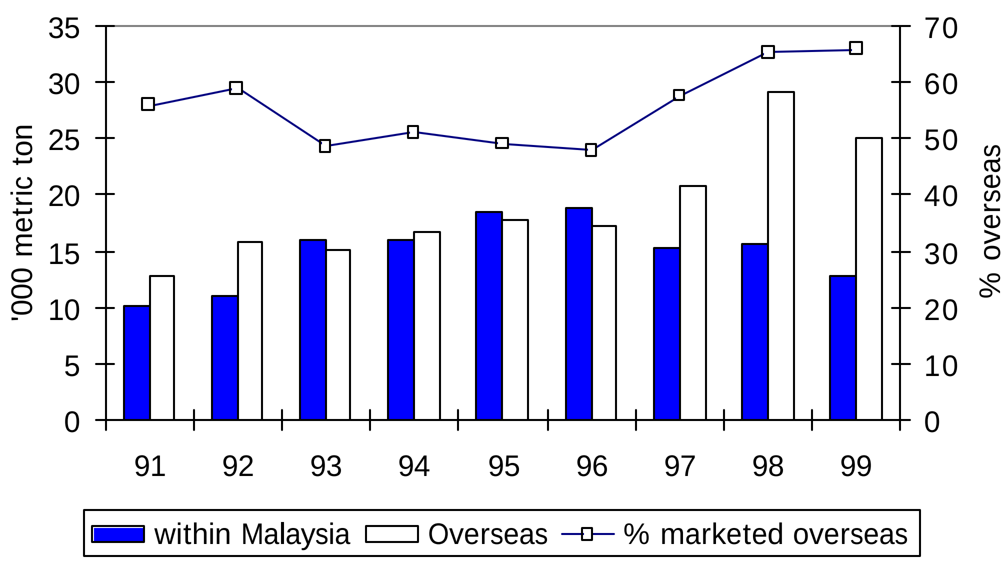


Figure 284f. Temporal fisheries export value by destination, Sabah, 1991-1999 period

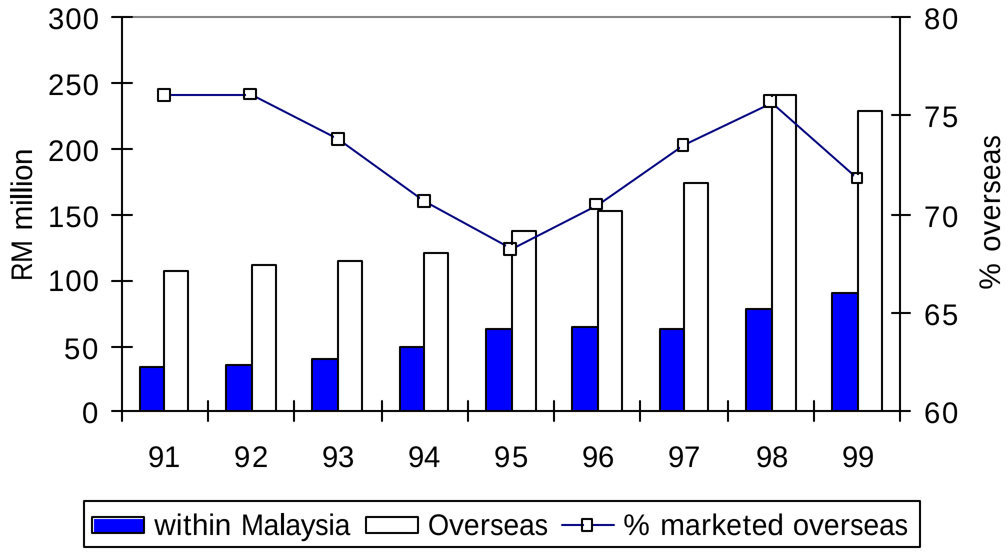
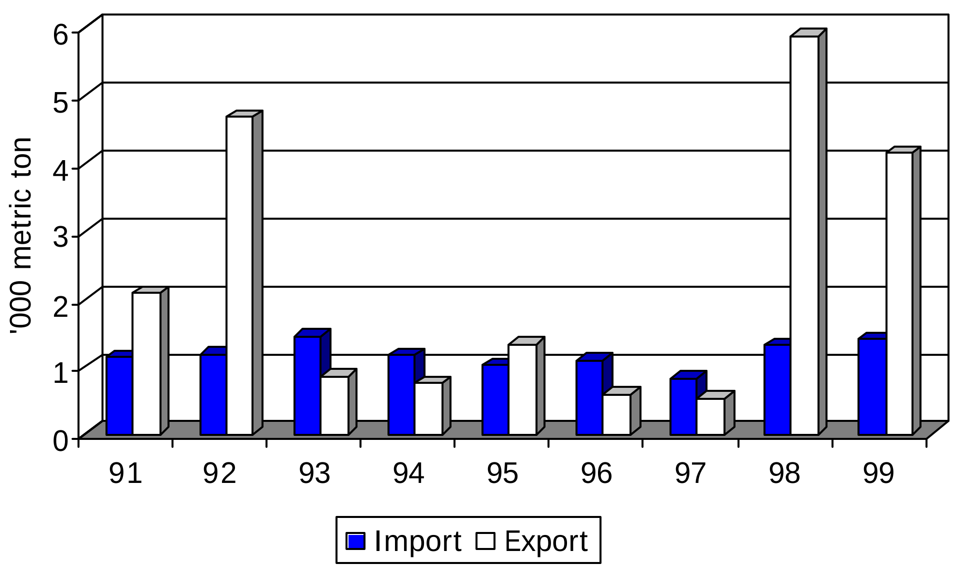


Figure 285a. Fisheries trade volume with Indonesia and Philippines, Sabah (1991-1999 period)



Fisheries Trade in the SSME area

Fisheries trade within the SSME area existed since time immemorial. Fisheries trade statistics obtained from the Royal Custom and Excise Department was used in this study. However, the data only comprised of fisheries products declared to customs, and hence might not reflect the actual flow of fisheries products transacted with Indonesia and the Philippines.

Fisheries trade with Indonesia and the Philippines during the 1991-1999 period is summarized in **Tables A84-A85** and **Figures 285a-285d**. Total imports from both countries amounted to 10,560 metric tons valued at RM 52.4million (RM4.96/kg), which represented 18.2% by volume and 17.5% by value of the state total fisheries imports. During the same period, total exports to both countries amounted to 20,791 metric tons value at RM26.1 million (RM1.26/kg), which represented 6.8% by volume and 1.4% by value of the state total fisheries exports.

<u>Trade with Indonesia</u>

Indonesia is an important fisheries trading partner for Sabah, ranking only second to Peninsular Malaysia in terms of fish imports during the 1991-1999 period. Imports from Indonesia make up 13-23% (mean 16.4%) of the annual fisheries imports. Except for 1998-1999, fish exports to Indonesia is negligible, representing only 0.02-1.41% (mean 0.29%) of the state annual fish imports (**Table A79** & **Figures 286a-286d**).

Fisheries imports from Indonesia can be grouped into four main categories (fish, shrimp, spiny lobster and miscellaneous dried products (**Figures 286e-286h**). Frozen fish comprising of high value species (e.g. pomfret, trevally, threadfin, spanish mackerel, snappers, groupers), make up the bulk of the annual imports, followed by shrimp (frozen or chilled), spiny lobsters and other miscellaneous products (dried or salted forms). The average fisheries import prices fluctuated around RM3.46-7.69/kg during the 1991-1999 period.

During the 1991-1997 period, fisheries exports to Indonesia amounted to 6-380 metric tons annually, which comprised canned fisheries products and other processed fish products that had been imported mainly from Peninsular Malaysia and Thailand. The significant increase in exports in 1998-1999 was attributed by fish meal: 5,252 metric tons (RM8.68 million) in 1998 and 2,460 metric tons (RM0.98 million) in 1999 (**Figure 286a-286d**).

Overall, Sabah imported a total of 9,432 metric tons of fish products worth RM50.7 million from Indonesia during the 1991-1999 period (**Figure 286i**). This represents 16.2% by volume and 16.9% by value of the state fisheries imports. During the same period, exports to Indonesia, comprising mainly of fish meal products, amounted to 8,928 metric tons valued at RM10.3 million (**Figure 286j**). This represents only 2.7% by volume andr 0.5% by value of the state fisheries imports.

The official barter trade based in Tawau is the main focal point of fisheries trade with Kalimantan – Indonesia. Trade statistics reported in the DOF Sabah annual statistics were obtained from the Customs and Excise Department. It is generally believed that the official figures reported might be gross underestimates taking into consideration the flow of fisheries products from Indonesia without going through custom declarations. The prices of fish products were negotiated by fish traders on both sides of the border based on current supply and demand or previous mutual agreement. Prices are fixed in the more stable Malaysian Ringgit with payments made, either in Indonesian Rupiah or US dollars, according the current exchange rates. At the present moment, the Malaysian Ringgit is pegged at a stable RM3.80 to the US dollar.

This study also includes interviews with some of the local fish traders based in Tawau. Results from these discussions revealed that the survival of major fish processing plants in Tawau is dependent on the volume and quality of raw materials from Indonesia. A large portion of these raw materials imported officially or otherwise from Indonesia consisted mainly of highly value species targeted for both domestic and international markets including Japan, Hong Kong, Singapore, Taiwan, China, USA and Europe. To ensure regular supply of raw materials from Indonesia, a number of the fish processing plants in Tawau had established sister plants or trading houses with their Indonesian partners in Eastern Kalimantan. Raw materials are obtained from Kalimantan and Sulawesi.

Trade with Philippines

Cummulative fish imports from the Philippines amounted to 1,128 metric tons valued at RM1.7 million during the 1991-1999 period. The annual import price fluctuated around RM0.58-5.74/kg (mean RM1.53/kg). On the other hand, cumulative fish exports to the Philippines amounted to 12,493 metric tons valued at RM15.8 million, with annual export price fluctuating around RM0.97-1.69/kg (mean RM1.26/kg). Based on available statistics, Sabah is considered as a net importer of fisheries products to the Philippines (**Figures 287a**-**287d**).

Products imported from the Philippines comprised mainly consisted of dried fish products, with annual imports fluctuating between 6-370 metric tons valued at RM0.03-0.39 million. On the other hand, exports to the Philippines comprised mainly of dried anchovies (*ikan bilis*), which represents 5-82% (mean 39%) by volume and 6-86% (mean 38%) by value of the annual fish exports in 1991-1999 (**Figures 287e**-**287h**). In 1996-1997, dried anchovies make up 68-82% by volume and 76-86% by value of annual fisheries imports to the Philippines. Most of Sabah dried anchovy exports were destined for the Filipino market (**Table A85** & **Figure 287i**). In 1997-1999, about 96.9-99.7% (mean 98.2%) by volume and 80.3-95.8% (mean 90.1%) of the state dried anchovy exports were exported to the Philippines. These dried anchovies are the main products from the SSME-based *bagang* fishery sub sector. Overall, dried anchovies make up 31.6% by volume and 34.3% by value of the 9-year cumulative fish exports to the Philippines.

The Philippines is the main market for dried anchovies exported from Sabah. During the 1991-1999 period, Sabah exported a total of 3,000 metric tons (RM4.03 million) of dried anchovies to the Philippines, which represented about 75% (18-99%) by volume or 58% (6-97%) by value of its total dried anchovies exports annually. Tunas (mainly yellow fin and skipjack) targeted for the tuna canneries in the Philippines attributed for the high export volumes in 1991 (1,470 metric tons) and 1992 (3,699 metric tons). Tuna exports to the Philippines had declined since 1993 due to the establishment of tuna canneries in Penang and Thailand. It cannot be accertain for the decline in tuna exports to the Philippines and might have been due to better prices being offered by the tuna canneries in Penang and Thailand.

Figure 285b. Fisheries trade volume with Indonesia and Philippines, Sabah (1991-1999 period) (% annual volume)

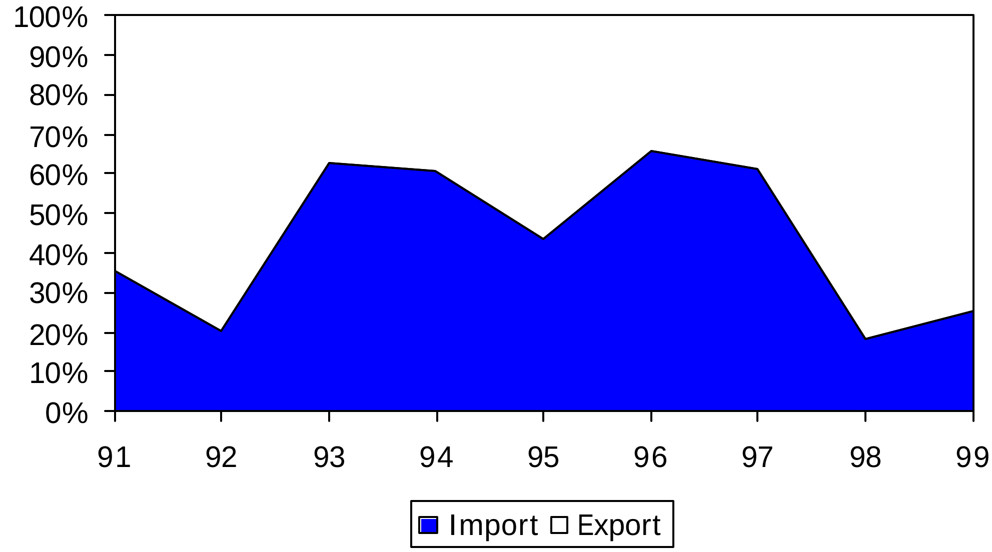


Figure 285c. Fisheries trade value with Indonesia and Philippines, Sabah (1991-1999 period)

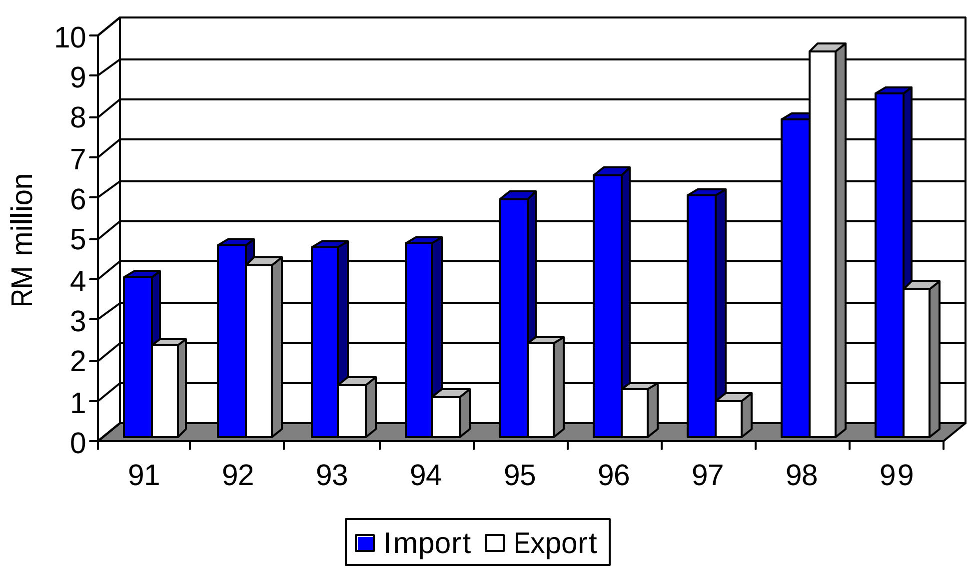


Figure 285d. Fisheries trade value with Indonesia and Philippines, Sabah (1991-1999 period) (% annual value)

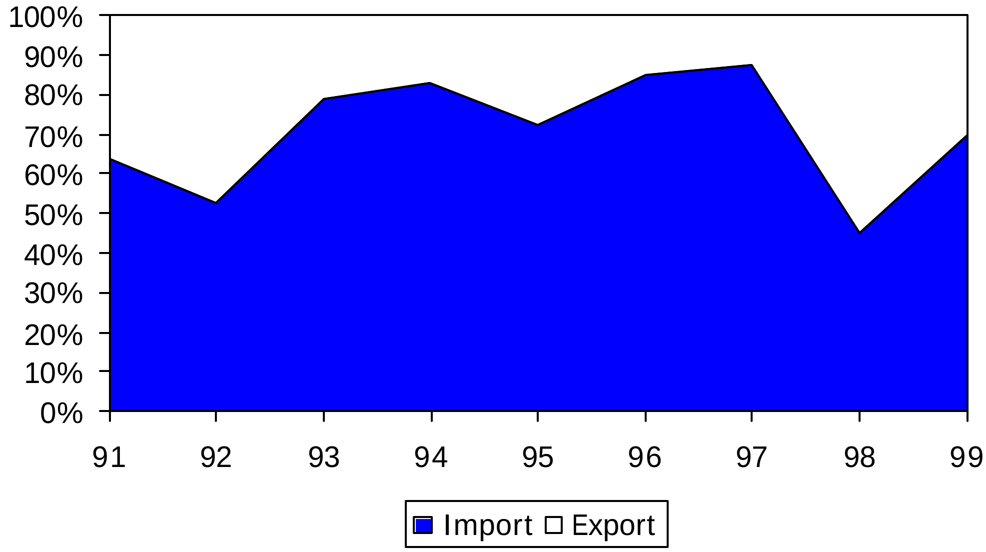


Figure 286a. Annual fisheries trade volume with Indonesia, Sabah (1991-1999 period)

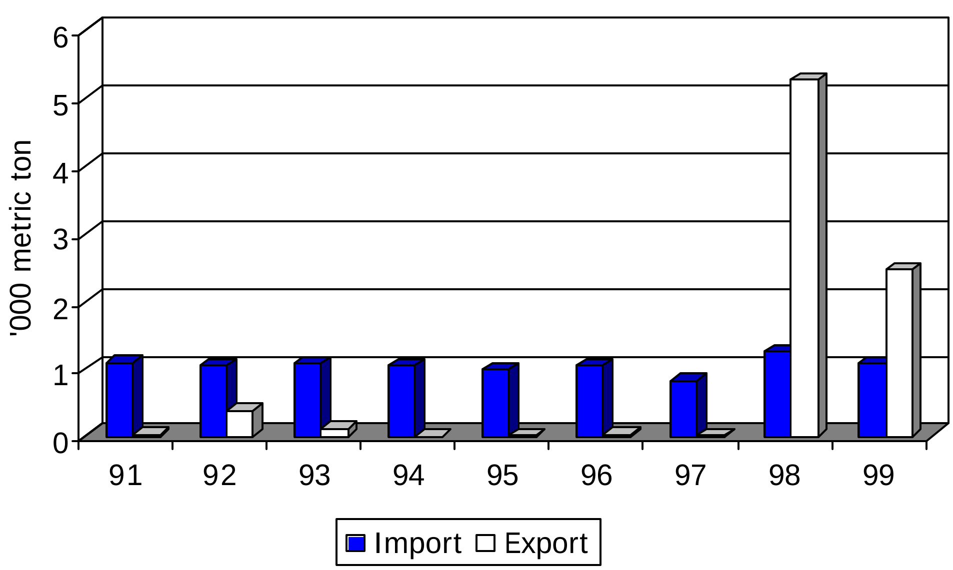


Figure 286b. Annual fisheries trade volume with Indonesia, Sabah (1991-1999 period) (% annual volume)

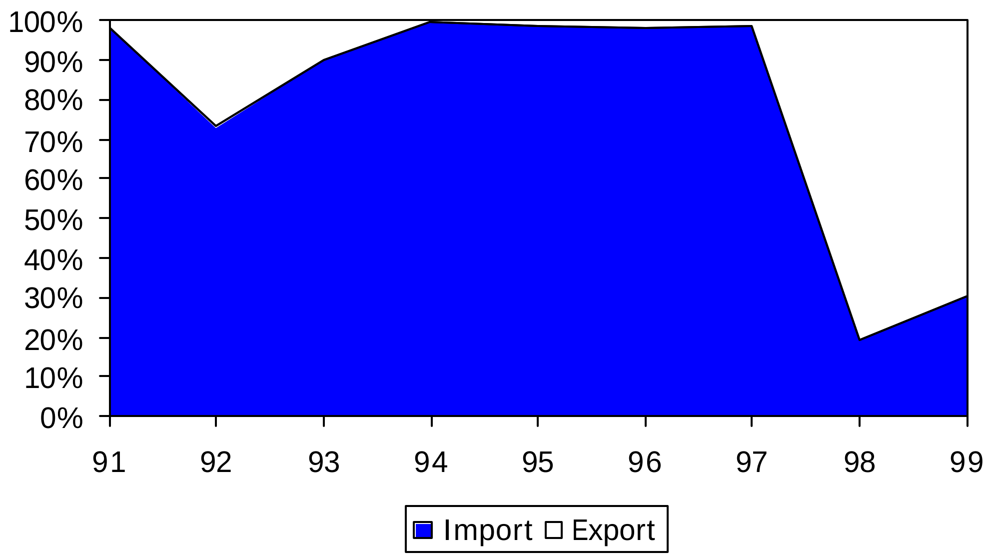


Figure 286c. Annual fisheries trade value with Indonesia, Sabah (1991-1999 period)

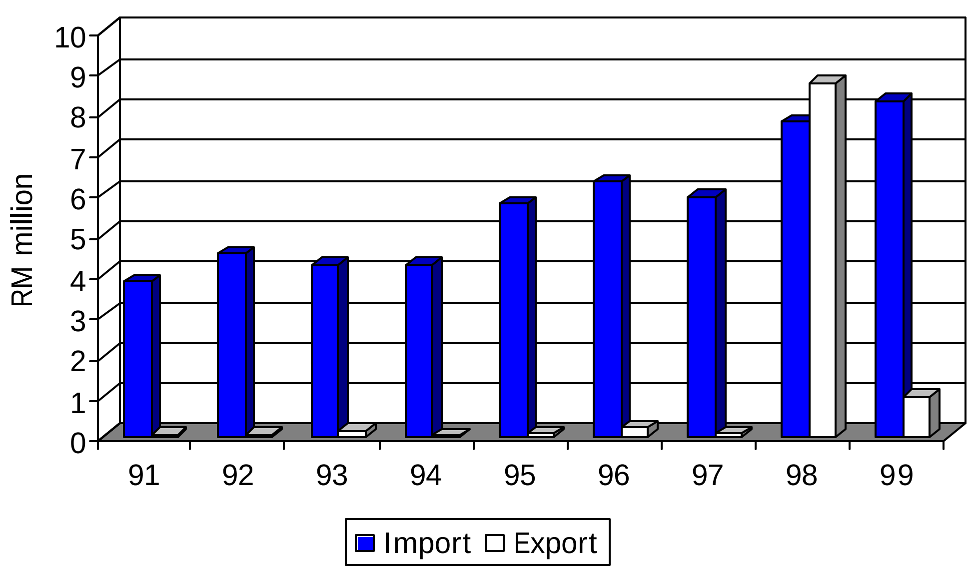


Figure 286d. Annual fisheries trade value with Indonesia, Sabah (1991-1999 period) (% annual value)

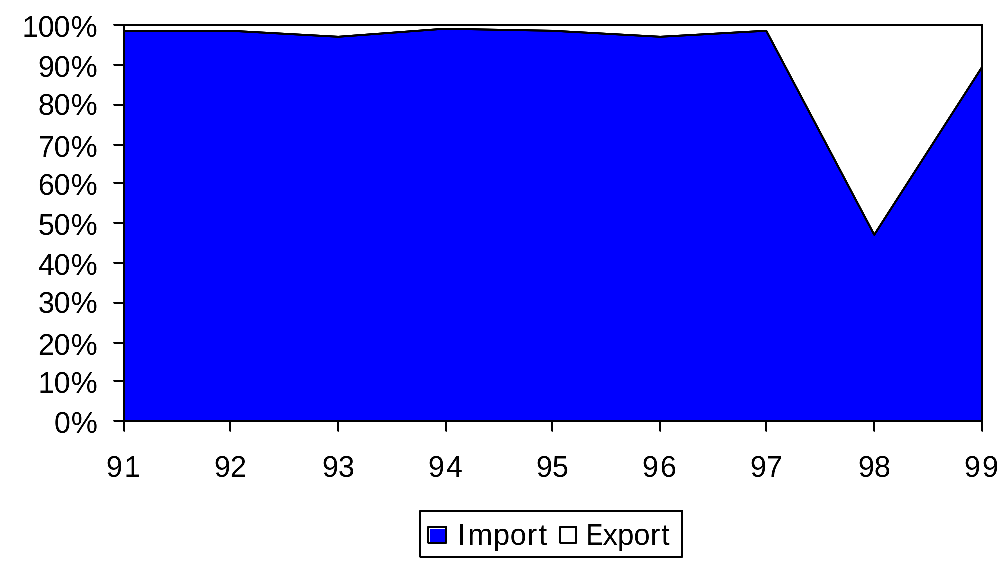


Figure 286e. Breakdown of fisheries import volume from Indonesia, Sabah (1991-1999 period)

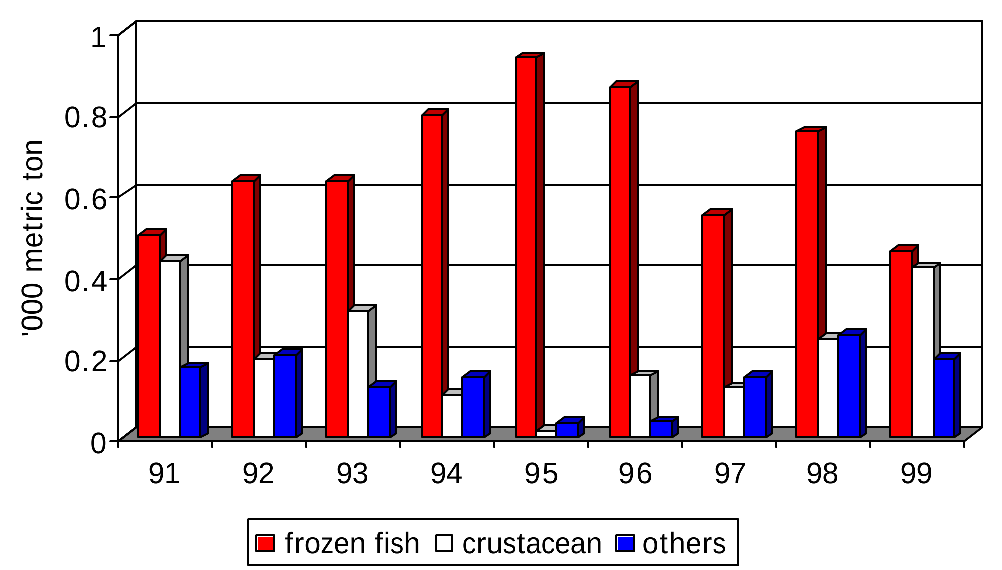


Figure 286f. Breakdown of fisheries import volume from Indonesia, Sabah (1991-1999 period) (% annual volume)

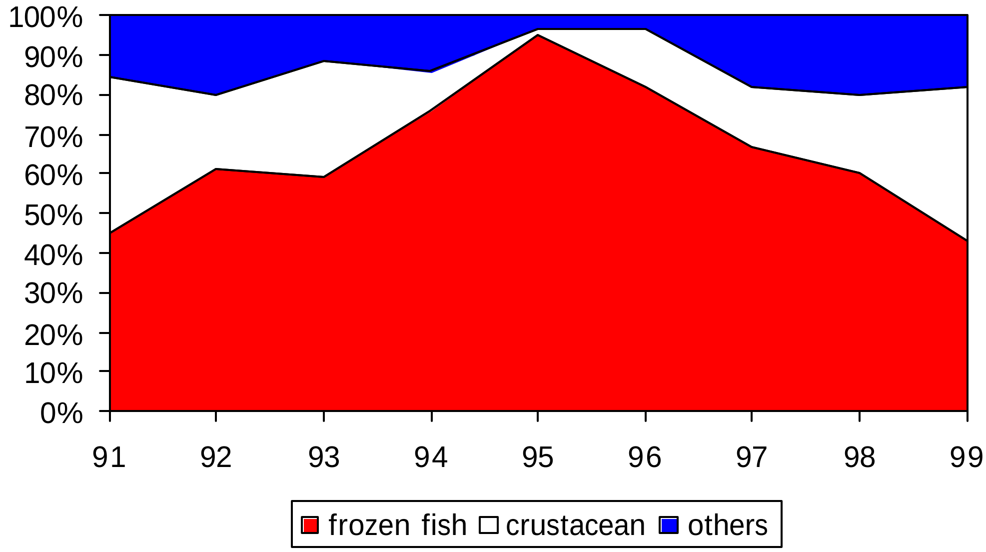


Figure 286g. Breakdown of fisheries import value from Indonesia, Sabah (1991-1999 period)

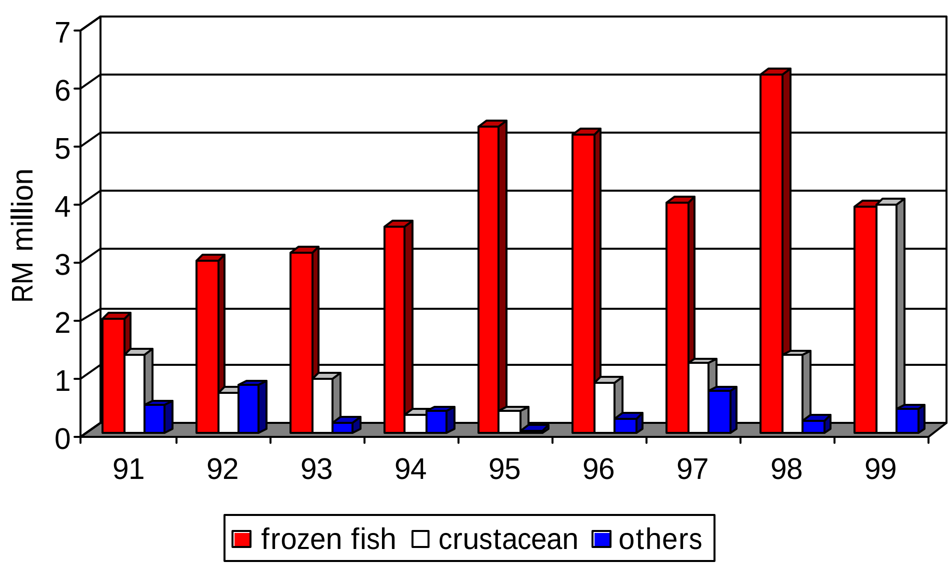


Figure 286h. Breakdown of fisheries import value from Indonesia, Sabah (1991-1999 period) (% annual value)

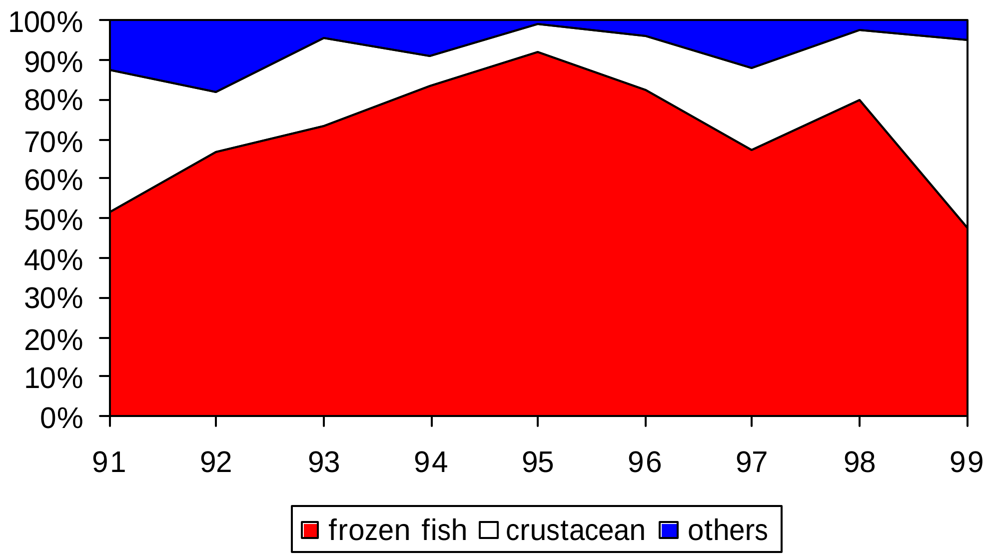


Figure 286i. Breakdown of cummulative fisheries import from Indonesia, 1991-1999 period (9,432 metric ton)

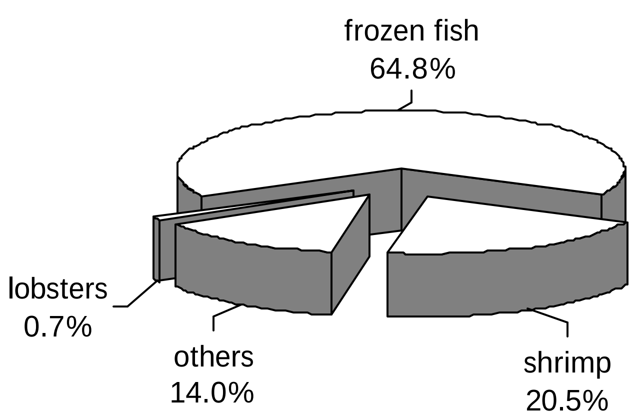


Figure 286j. Breakdown of cummulative fisheries import from Indonesia, 1991-1999 period (RM 50.66 million)

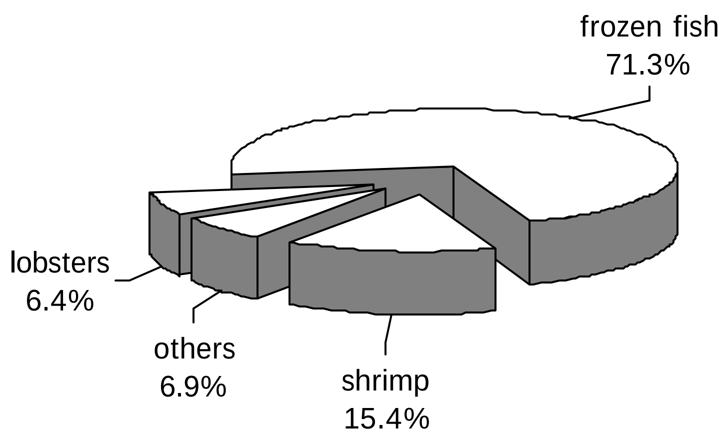


Figure 287a. Annual fisheries trade volume with the Philippines, Sabah (1991-1999 period)

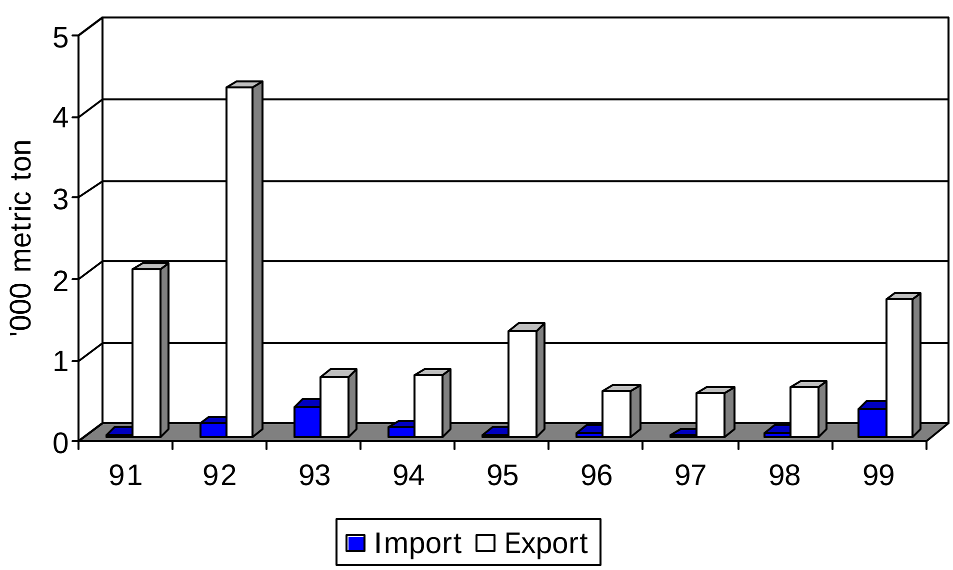


Figure 287b. Annual fisheries trade volume with the Philippines, Sabah (1991-1999 period) (% annual volume)

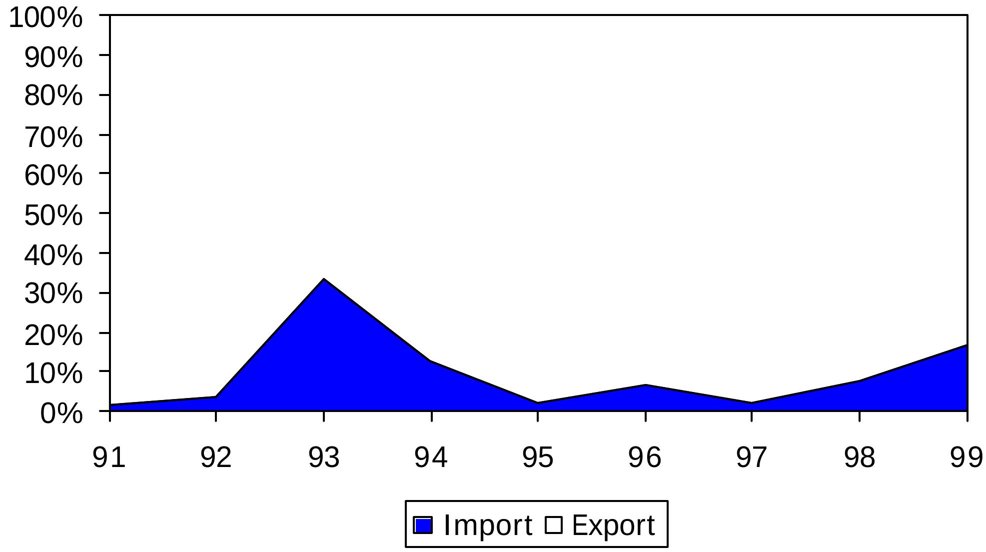


Figure 287c. Annual fisheries trade value with the Philippines, Sabah (1991-1999 period)

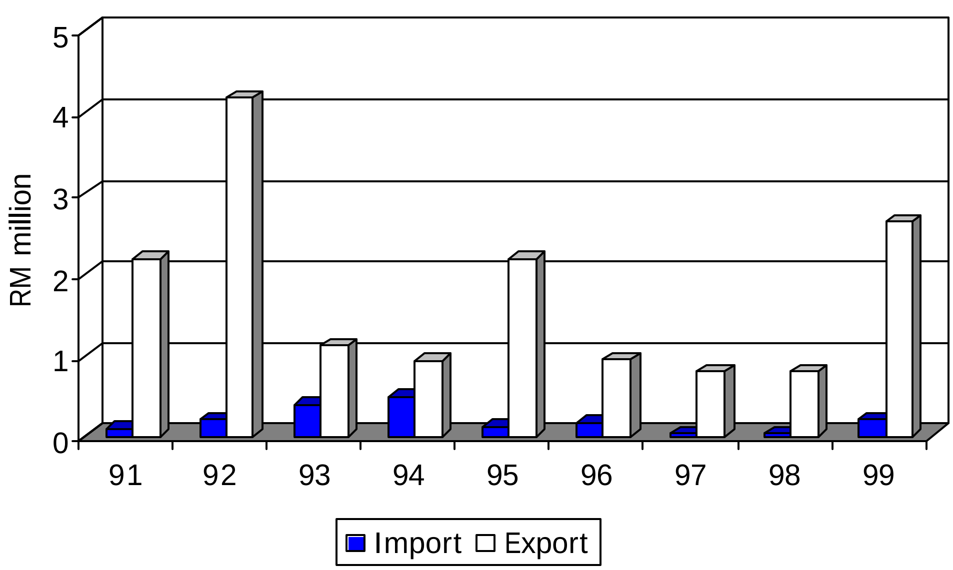


Figure 287d. Annual fisheries trade value with the Philippines, Sabah (1991-1999 period) (% annual value)

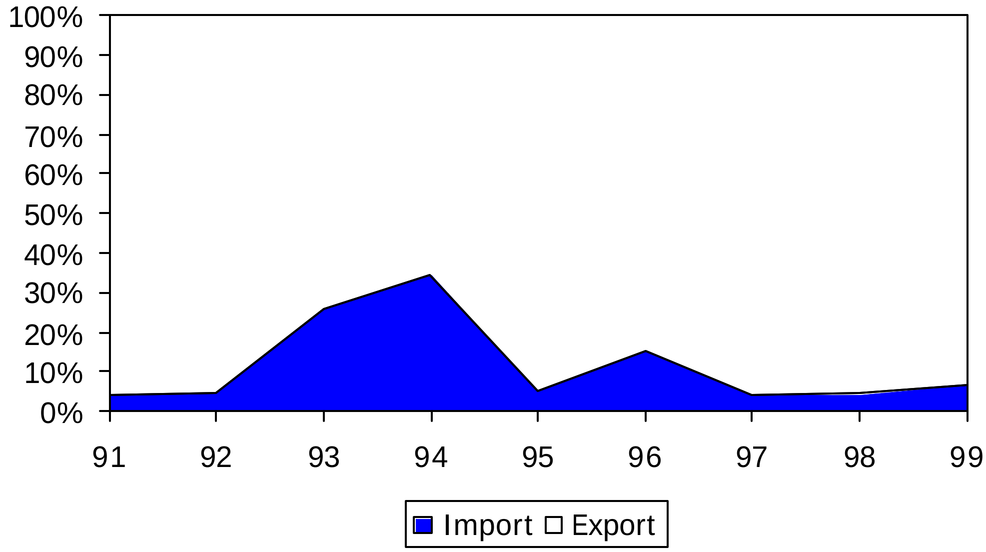


Figure 287e. Annual breakdown of fisheries export volume to the Philippines, Sabah (1991-1999 period)

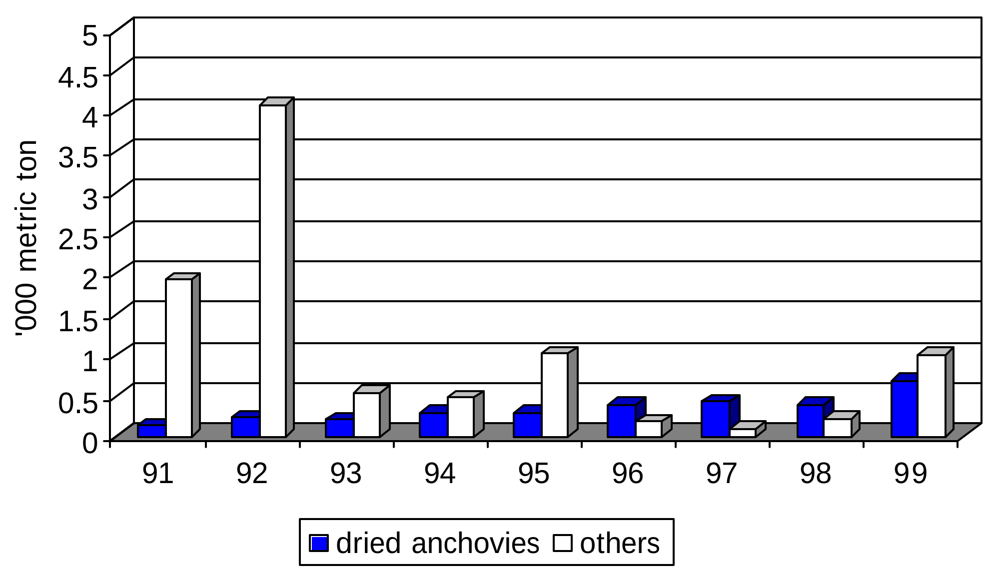


Figure 287f. Breakdown of fisheries export volume to the Philippines, Sabah (1991-1999 period) (% annual volume)

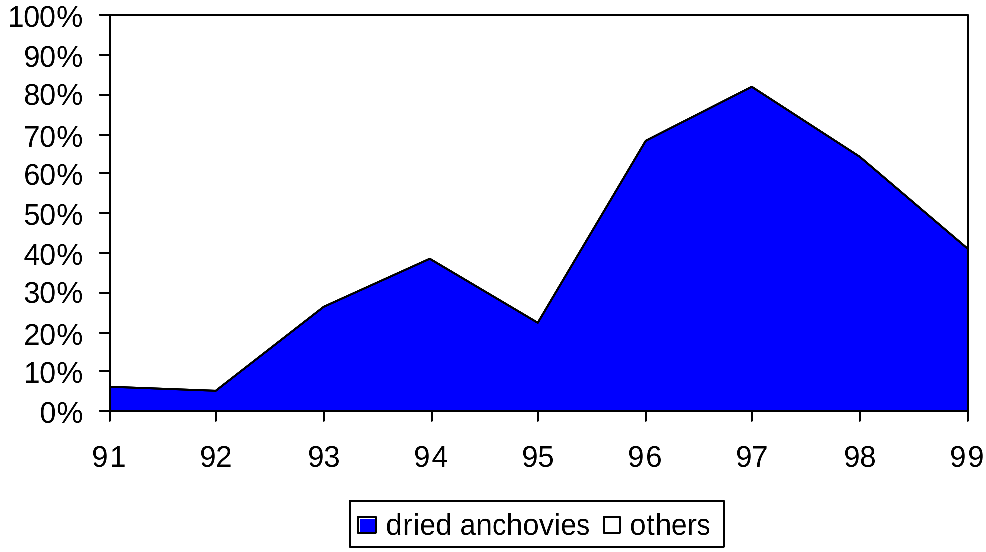


Figure 287g. Breakdown of fisheries export value to the Philippines, Sabah (1991-1999 period)

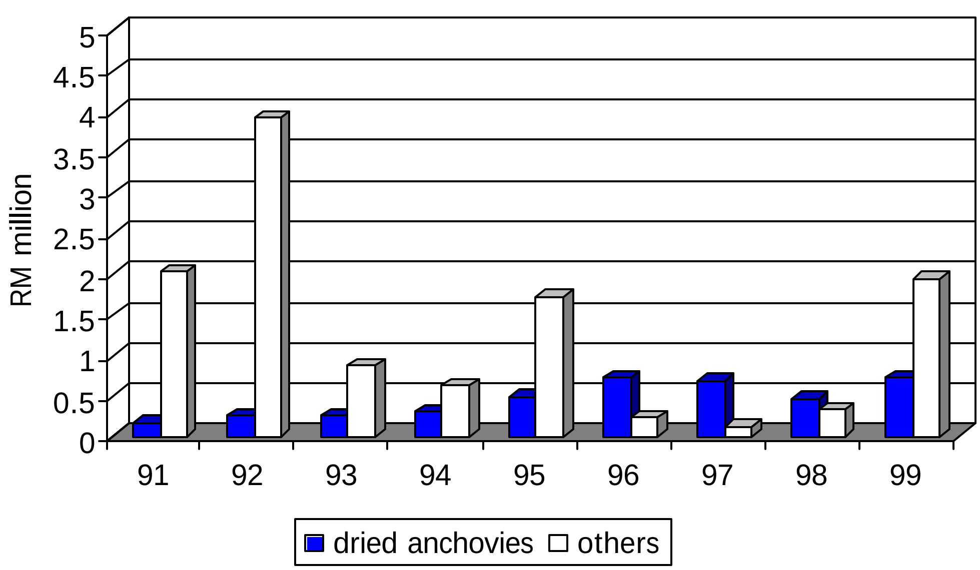


Figure 287h. Breakdown of fisheries export value to the Philippines, Sabah (1991-1999 period) (% annual value)

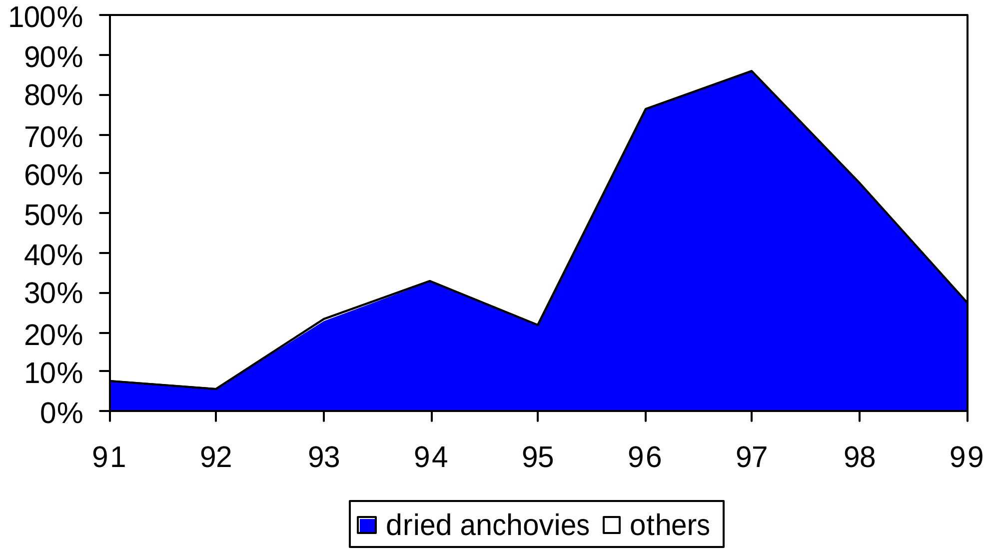


Figure 287i. Annual breakdown of dried anchovy exports to the Philippines, 1991-1999 (% annual)

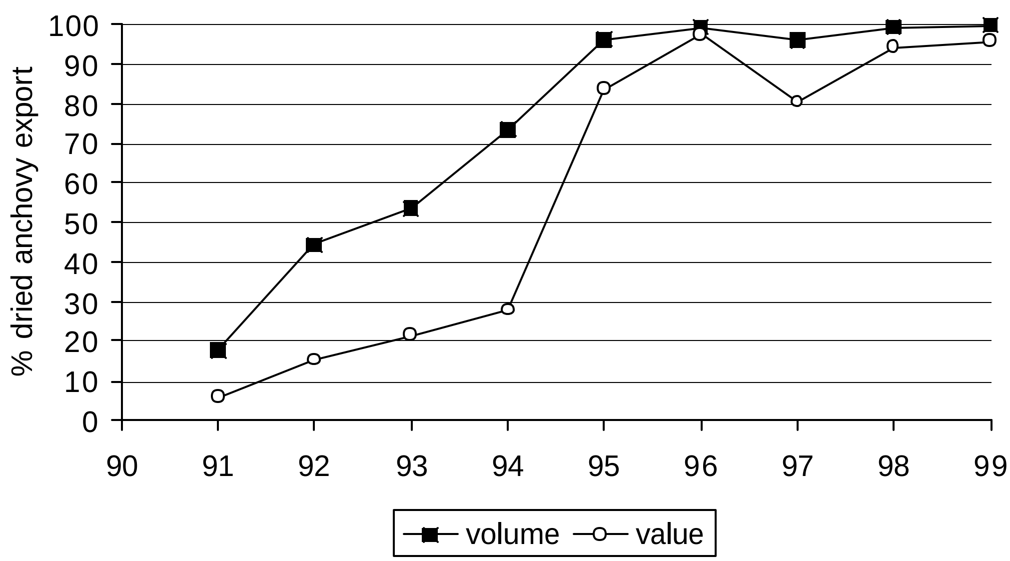


Figure 288a. Live Reef Fish Trade destination breakdown, Sabah (1990-1999 period) (volume)

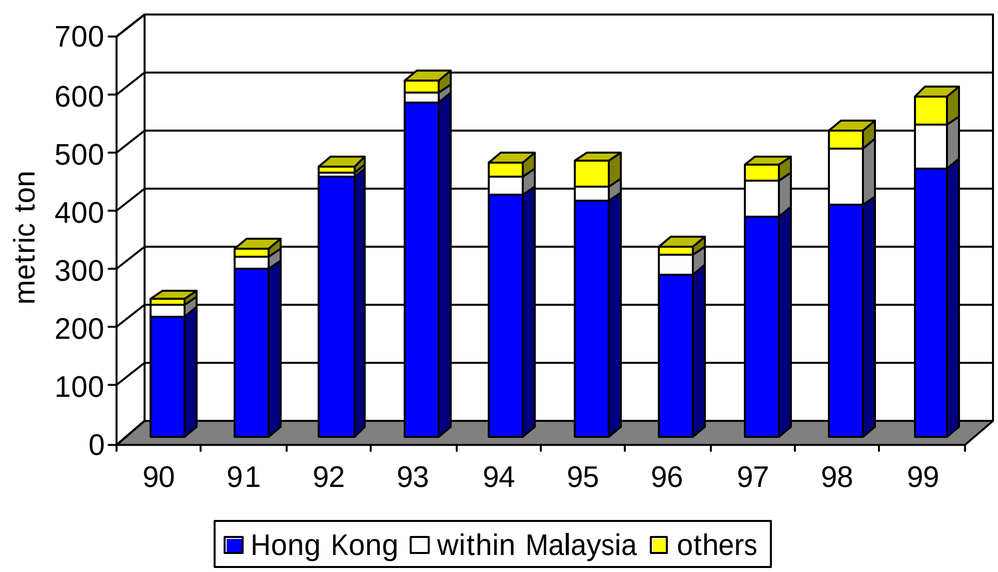


Figure 288b. Live Reef Fish Trade destination breakdown, Sabah (1990-1999 period) (% annual volume)

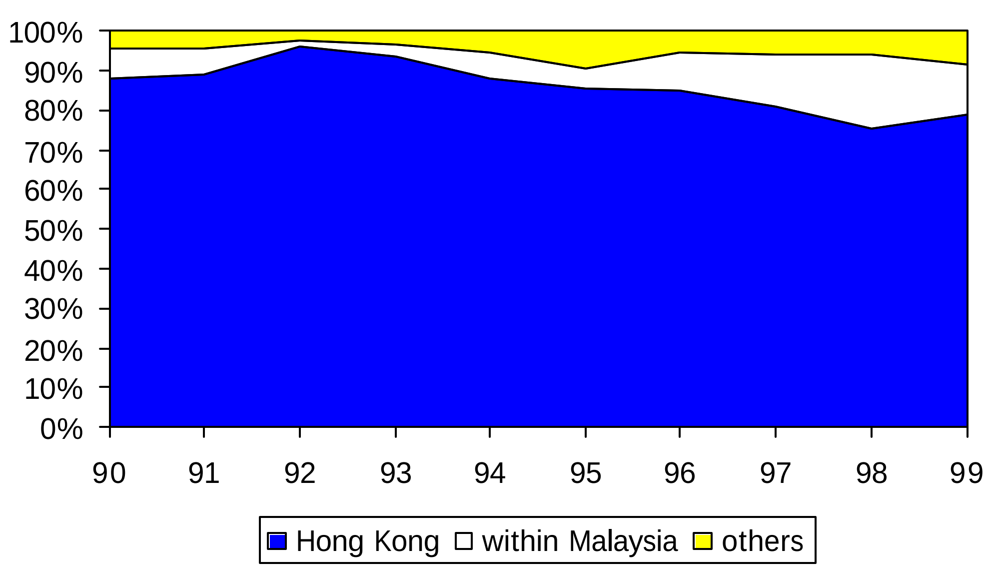


Figure 288c. Live Reef Fish Trade destination breakdown, Sabah (1990-1999 period) (value)

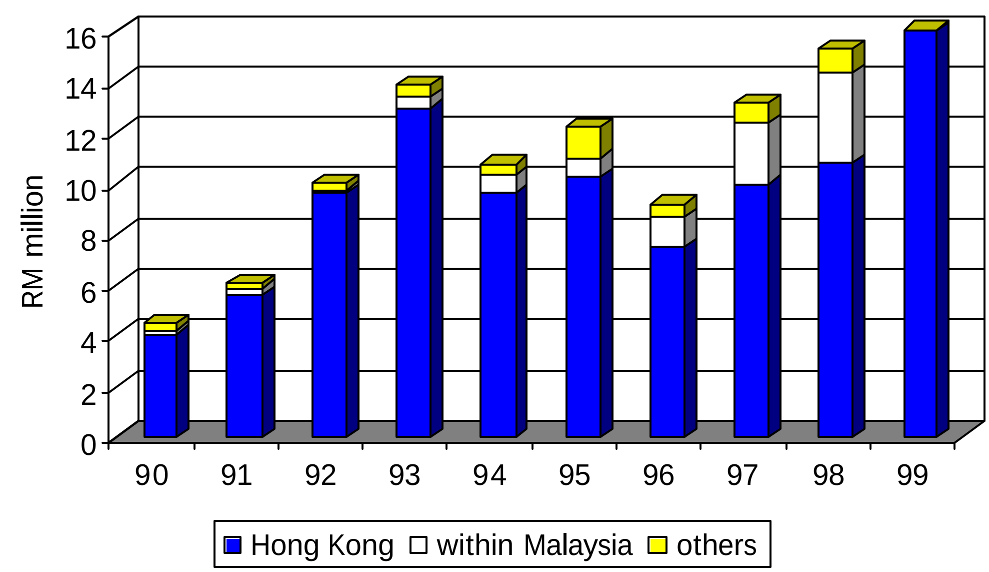


Figure 288d. Average export value of marine live fish by destination, Sabah, 1990-1999 (RM/kg)

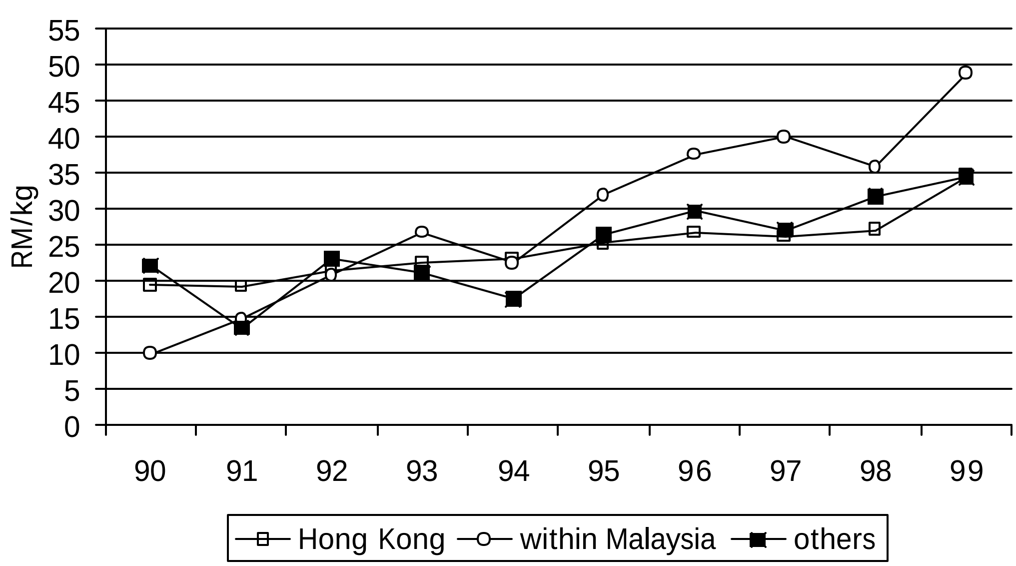


Figure 288e. Adjusted average export value of marine live fish by destination, Sabah, 1990-1999 (refer to text)

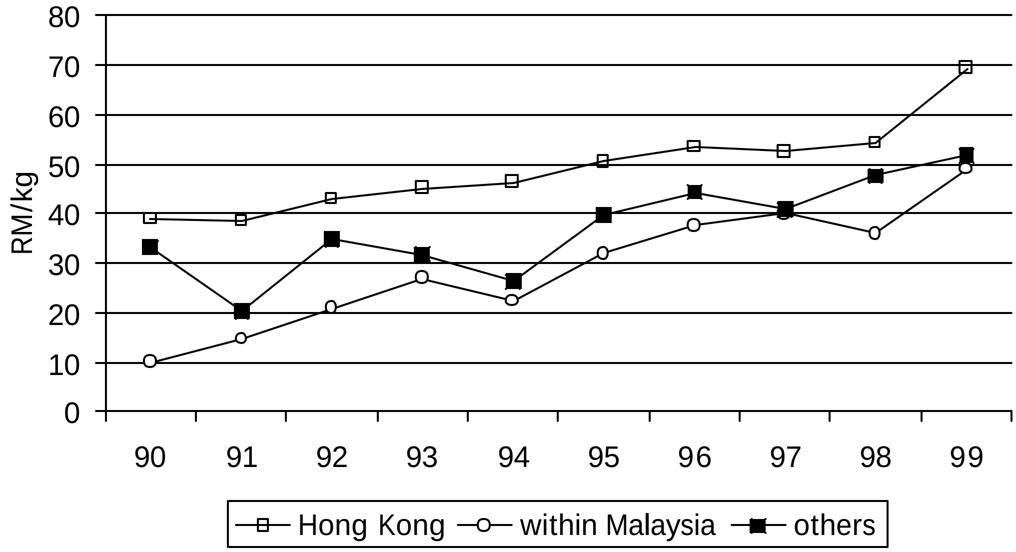


Figure 288f. Live Reef Fish Trade destination breakdown, Sabah (refer to Figure 288e)

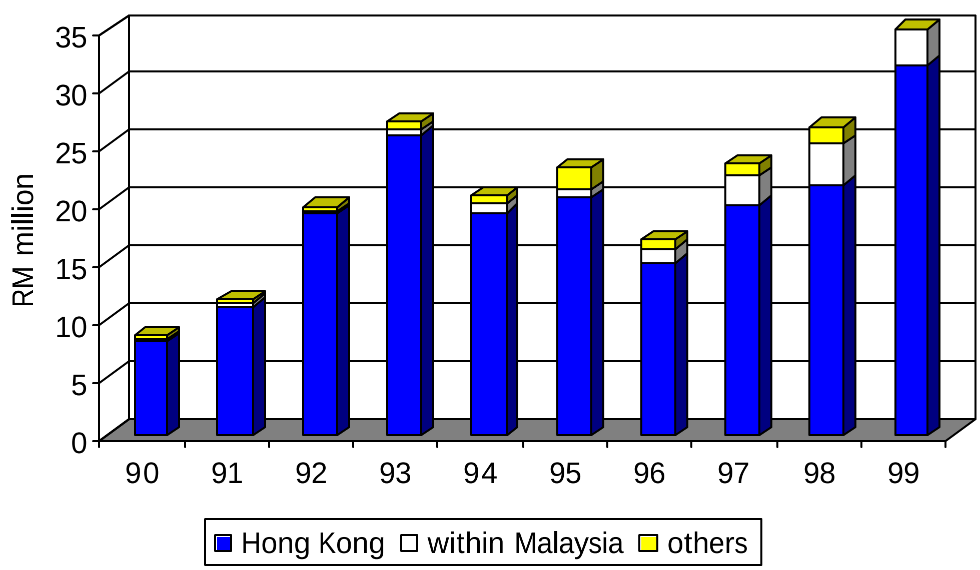


Figure 288g. Live Reef Fish Trade destination breakdown, Sabah (refer to Figure 288e)

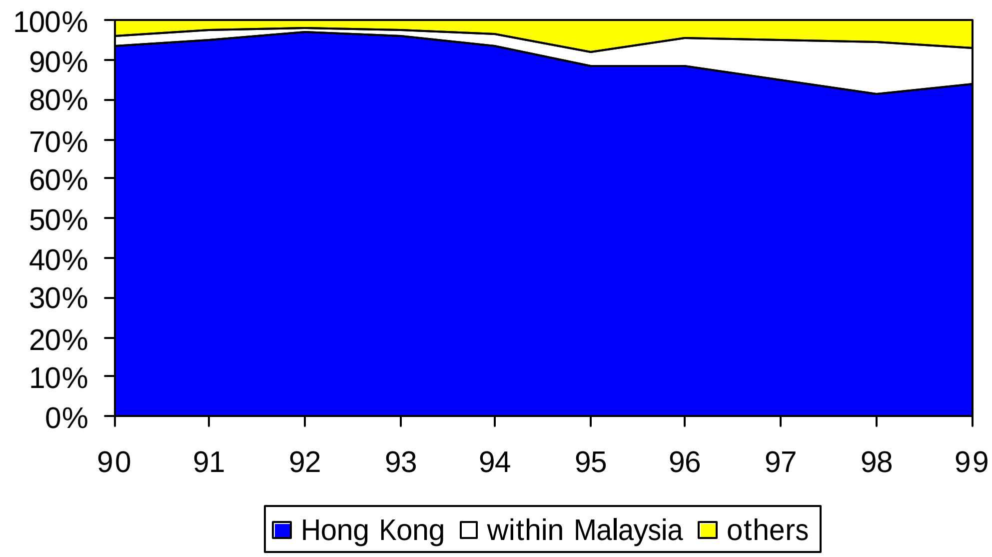


Figure 289a. Dried seaweed export destination breakdown, Sabah (1990-1999 period) (volume)

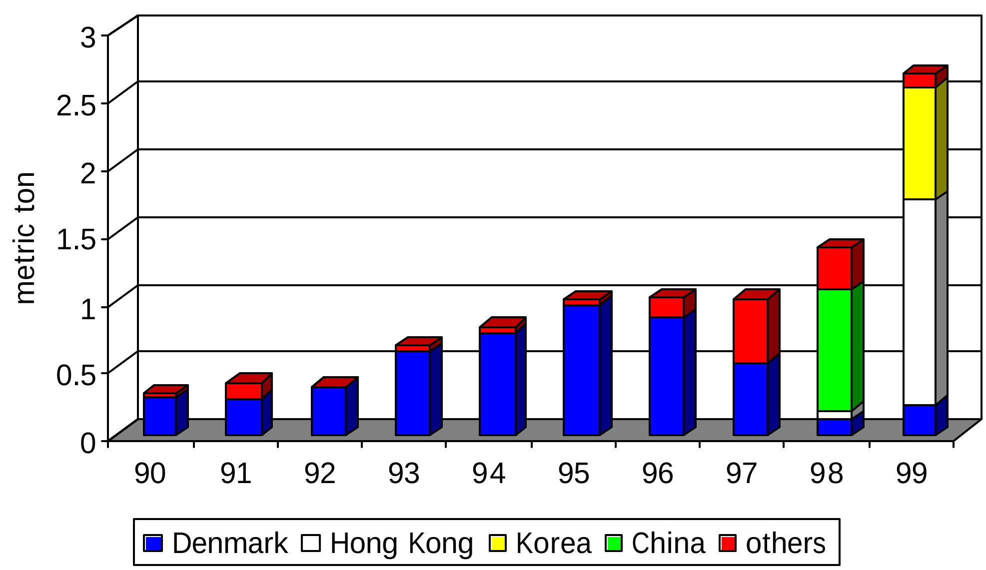


Figure 289b. Dried seaweed export destination breakdown, Sabah (1990-1999 period) (% annual volume)

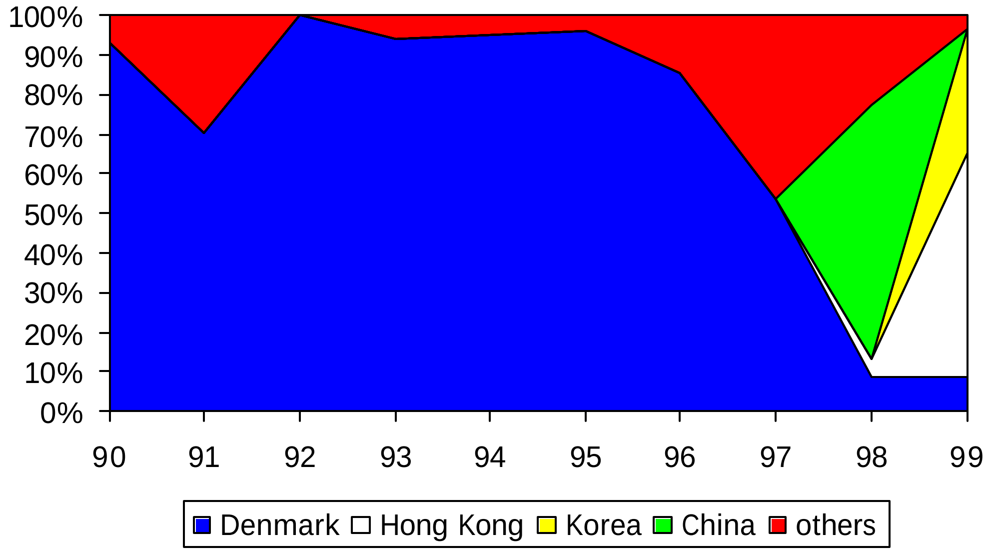


Figure 289c. Dried seaweed export destination breakdown, Sabah (1990-1999 period) (value)

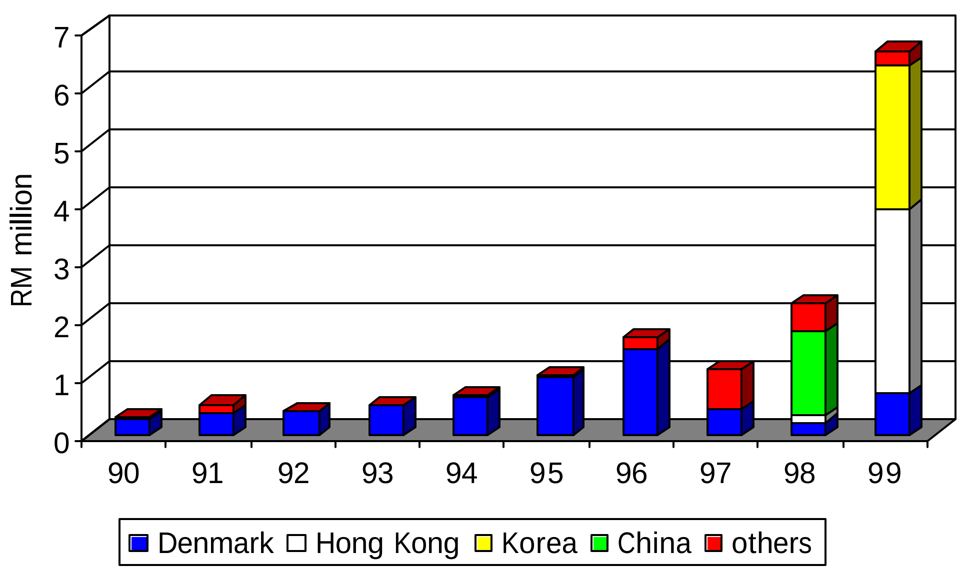


Figure 290a. Average fisheries import volume breakdown, Sabah (1997-1999 period) (6,386 metric tons)

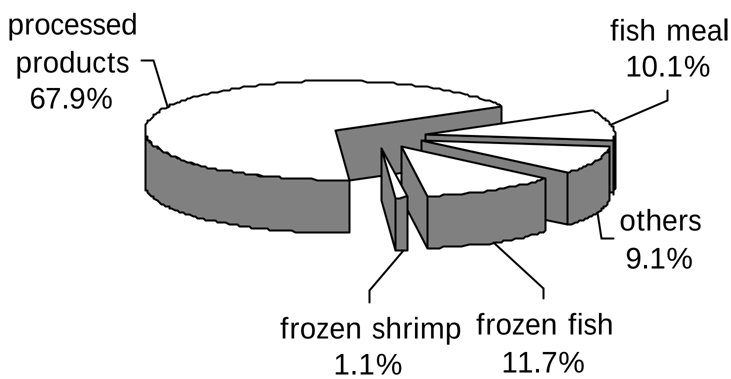


Figure 290b. Average fisheries import value breakdown, Sabah (1997-1999 period) (RM 37.66 million)

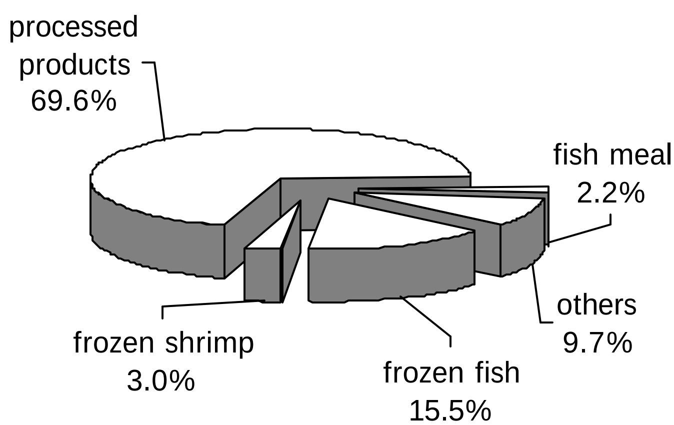


Figure 290c. Average fisheries export volume breakdown, Sabah (1997-1999 period) (39,592 metric tons)

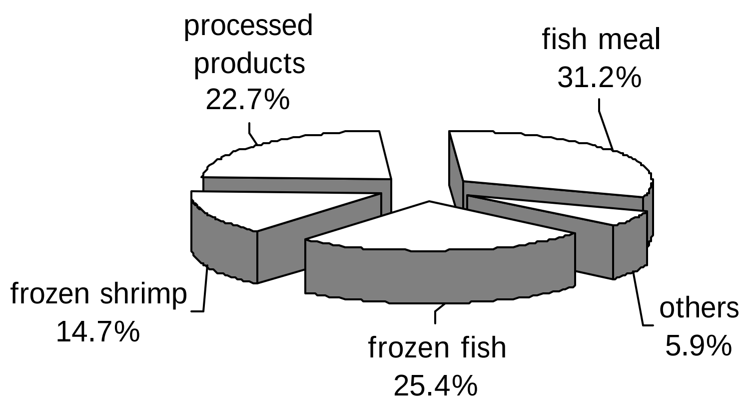
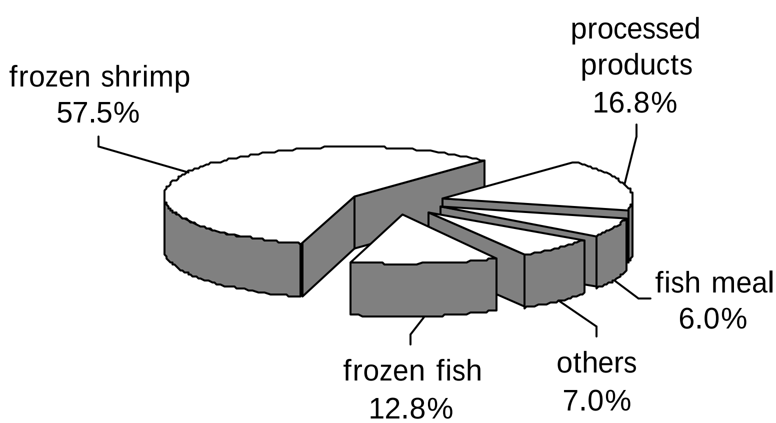


Figure 290d. Average fisheries export value breakdown, Sabah (1997-1999 period) (RM 291.29 million)



VI. FISHERIES MANAGEMENT STRATEGIES

Marine Capture Fisheries

At present, the major fishing grounds in both SSME and non-SSME areas are much confined to the inshore portion of the continental shelf. In some areas, further development can still be considered, particularly in non-trawler areas in offshore waters in the non-SSME area, EEZ waters along the Palawan Trench and around the disputed Islands of Ligitan and Sipadan, which by current estimates are still underexploited. In the SSME area, only SSME-3 particularly Semporna had further potential for development, where landing in the SSME-1 and SSME-2 seems to be saturated during the past few years.

Fishing gears that contributed significantly to the development of the marine capture fisheries sector in Sabah, in order of landing contribution, are trawl net, seine net, gill net, hook & line, lift net and miscellaneous traditional gears. Trawl nets contributed the bulk of the landings in the non-SSME and SSME-1 areas, gill nets in SSME-2 and seine net in SSME-3. Trawl net attributed to the gradual "pseudo" increase in landings during the past few years, which include by-catch and trash fish landings as well. Landings from other fishing gears had declined throughout the years with trawl net contribution becoming more significant. The increasing dependency on trawl net landings is of primary concern because of its non-selective mode of catching fish. Impacts of trawl gears on the demersal fish assemblage and food web in Sabah are unknown but lessons from the Gulf of Thailand and other areas in the region had clearly shown the negative impacts of non-selective gears (Pauly, 1979). Phasing out small trawlers from the present fishery sector is a major step forward to address the negative impacts of these gears on depleting inshore fish resources. New selective and environmentally friendly gears might need to be introduced into the fishery, particularly in under-exploited areas. In the future, purse seines and long lines may become more important particularly if efforts are made to further develop the offshore resources in the non-SSME and SSME-3 areas. Other feasible fishing methods that can be considered in these offshore areas are mid water trawling and pair trawling. Except for *bagang* lift net and hook & line, other traditional gears do not hold much development potential. To a certain extent, R&D can be used to improve their fishing efficiency and gear selectivity to ensure sustainable exploitation.

<u>Pelagic Resources</u>

The pelagic stocks in Sabah are migratory in nature, which are also being shared among coastal states in the Southeast Asian region. Any management measures and policies pertaining to the future development of the pelagic fisheries in Sabah can only be implemented effectively by considering the management of the regional fisheries sector in as a whole. With respect to this, regional collaborative research on the biological aspects, resource assessment and migratory patterns of common shared stocks need to be carried out. At present, SEAFDEC had already identified mackerel (*Rastrelliger* spp.), round scad (*Decapterus* spp.) and tuna being the most common trans-boundary stocks in the region including in the SSME area, and various kinds of collaborative research programs on these species had been identified with some of them already in various stages of implementation by SEAFDEC member countries. The above species formed the backbone of the pelagic fisheries in Sabah, especially in the SSME-3 area.

Large pelagics refers mainly to oceanic tunas and oceanic sharks. In this context, the "large pelagic" fishery refers only to tunas which formed the bulk of the pelagic landings in Sabah. Available data suggested that the small pelagic stocks in the inshore waters are moderately to highly exploited, and resources in the outer shelf area and offshore waters to be lightly exploited.

At present, the current pelagic landings of 100,000-odd metric tons are still below the combined MSY of 190,000 metric tons. The current tuna landings amounting to 10,000 metric tons, which include both coastal and oceanic tunas, can be increased significantly if appropriate gears and fishing techniques are used. In particular, the use of FADs in conjunction with purse seining, usage of mid water trawling and the expansion of both hand line and long line operations could enhance future production. However, since the above estimates of resource availability are still preliminary in nature, more rigorous resource assessment will therefore be needed. No information is available on the species breakdown of tuna landings but a substantial portion is believed to comprise mainly of coastal species.

There appears to be some development potential, particularly with respect to the small pelagics scattered over the outer continental shelf of the non-SSME area and in the offshore waters along the Palawan Trench, north of Kudat, and off Semporna. Despite the apparent potential for the further exploitation and pelagic resources on both coastal and EEZ waters, there are certain limitations relating to the relatively low density of these resources and also the longer travelling times required to reach these fishing grounds especially along the Palawan Trench and around Layang-Layang Island. Both these factors may affect the overall viability of exploiting the offshore small pelagic resources. The most abundant small pelagics found in these areas are mainly sardines, small scombrids (e.g. mackerels), neritic tunas and carangids (mainly round scads, hardtail scads and selar scads). Furthermore, the domestic market prices for these species are generally low (wholesale price range: RM 0.50-2.00/kg) and the local market potential is rather small. The use of appropriate gears (e.g. purse seiners with the aid of FADs or *fish aggregating devices*, mid water trawlers, pair trawlers) and larger vessels can improve the economic viability of the fishery, and the development of related processing and canning operations can enhance market potential if sufficient resources are available.

Since the available information on small pelagics in both coastal and offshore waters are rather inconclusive, the most effective management approaches that can be applied at this present moment are as follows:

- Carry out biological studies, resource assessment and stock differentiation of key pelagic species. Since most pelagic species also being shared by other countries in the region, this study should be carried out on a collaborative basis with relevant counterpart researchers in the SSME area.

- Maintain the commercial fishing fleet in the coastal zone at its present fishing effort level until more concrete and rigorous assessment studies can be carried out.

- Encourage/promote a limited entry fishery for the offshore pelagic sector which appears to have the greatest potential for development (e.g. Semporna, Kudat and along the Palawan Trench). This fishery, which could include joint operations with foreign fishing companies, with priority for technology transfer to the local industry, must be strictly controlled and comprehensively monitored for catch per unit (CPUE) data. The CPUE data can be used to assess and estimate the actual potential yield of fisheries resources found in these areas.

From past resource surveys carried out, the most common oceanic tunas found off Semporna and along the Palawan Trench and other offshore waters are yellowfin and bigeye tunas. These species formed the backbone of the *sashimi* fishery in the Indo Pacific region. Since these species fetch a relatively low price on the domestic market, the future development of the tuna fishery in Sabah will therefore depend on the current situation of the international market, particularly with respect to the *sashimi* market in Japan. SAFMA Sdn. Bhd., a local fishing company with state interests, which was actively involved in the exploitation of oceanic tunas in Sabah a few years ago, was forced out of the international *sashimi* market due to high operating costs (incl. high air freight charges) and very stiff competition from other neighboring countries in the region. At present, with the opportunities available under the BIMP-EAGA, this fishery has high potential for further development. It may be necessary to provide certain incentives to both foreign and local fishing ventures to enter the fishery, particularly to exploit the offshore waters in the Malaysian EEZ around Sabah and in the international waters as joint fishing ventures under the BIMP-EAGA.

With regards to the future development of the large pelagic fisheries in Sabah, the following facts should be considered:

- Until now, the deepsea fishing grounds in the Sabah portion of the Malaysian EEZ still remain to be explored. Although data from past resource surveys and oceanographic studies carried out by DOF Malaysia were found to be still insufficient for the thorough evaluation of fisheries resources found in the area, it is generally believed that these areas holds some significant potential for development, particularly for large oceanic tunas and other small pelagics;

- Most of the tunas landed in Sabah, which consisted mainly of coastal species with some oceanic tunas in Semporna, composed primarily of juvenile or immature individuals, where a significantly higher yield on the long run may not be possible with any substantial increase in fishing effort. Therefore, the fishery should concentrate on the exploitation of bigeye and yellowfin tunas found in the offshore waters; and

- In general, tuna resources widely scattered within the coastal and offshore waters of Sabah would limit the overall productivity of these fishing grounds. The wider use of FADs would facilitate fishing efforts by concentrating the resources.

<u>Demersal Resources</u>

In general, the demersal resources in Sabah are subjected to moderate to heavy exploitation, particularly by trawlers in most coastal areas. The exploitation rate of demersal resources is estimated around 70% based on current landings of 110,000-odd metric tons and combined MSY of 160,000 metric tons. However, this estimate should be taken with great caution pending on more rigorous assessment. However, some areas can still be further exploited using non-trawl gears. A substantial portion of the continental shelf in the non-SSME area is untrawlable because of the presence of rocky obstacles, coral reefs and industrial installation (e.g. oil rigs and pipe lines). Due to fishing technology constraints, the trawlable portion of the outer continental shelf on the west coast is also underexploited. Therefore, it appears that there is still further development potential in these areas provided appropriate fishing gears and techniques are used. In particular, increased hand line and long lining activities in reef-associated and rocky areas may increase the demersal production of high value species (e.g. snapper, grouper, wrasse, trevally) considerably. These species are the preferred targets in the LRFT sector, which had exploited by destructive fishing practices including cyanide fishing. The increase in the supply of these highly value fishes to a certain extent will meet some of the demand from the LRFT sector, thus can reduce pressure from cyanide fishing.

In most areas, the trash component and by-catch of trawlers are presently underutilized, with only a small portion being processed for human consumption. A large portion of the trawl net landings had been used as raw materials for fish meal production, which on the long run is unsustainable and uneconomical. As shown earlier, about 40% of the annual fish landings had been used as raw materials by the fish meal processing sector. Appropriate R&D is therefore needed on downstream processing to utilize this wasted component for other higher value products, thus can further enhance the development of the demersal fisheries sector in the state.

Based on the temporal trends and subsequent analysis of the shrimp-trawler fishery CPUE data during the last 30-odd years, suggested that shrimp resources in Sabah are intensively exploited beyond the upper limits of sustainable production, and therefore there will be no further more development opportunities in this sector. Discussions made with trawl operators confirmed the significant reduction in catch returns for the last 10-odd years. The future of many shrimp and fish processing plants in Tawau and Sandakan depends on the imports of raw materials from Indonesia. Some processing plants in Sandakan are now sourcing raw materials from Tawau in view of serious decline in shrimp landings during the last 5-odd years. Within BIMP-EAGA, sustainable trade opportunities may be available on joint-venture downstream processing activities with Indonesia. There is compelling evidence to support a further reduction in the fishing effort that could not only enhance the present catch per unit effort but could also resulted in modest increase in the future shrimp landings. It is therefore pertinent to suggest that steps should be made to limit the number of small shrimp trawlers in operation, particularly trawler of less than 40 GRT in size, until more comprehensive and rigorous assessment studies can be carried out to estimate current shrimp stock sizes and determine the optimum fishing effort. One best option to increase shrimp production in Sabah is through the development of more culture areas. However, there are a number of issues that need to be addressed, including earmarking suitable idle non-mangrove areas into ADAs (aquaculture development area), supply of quality fries, high production costs, institutional and marketing constraints, environmental issues and establishing appropriate code of farming practices based on the FAO CCRF (code of conduct for responsible fisheries). Sabah used to be one of the very few areas in the region that had been free from any harmful shrimp diseases, until in 1999 when shrimp farms in Tawau had been seriously devastated by white spot outbreaks that had resulted in high shrimp mortalities. It is estimated that about RM42 million had been lost in foreign exchange earnings through exports based on the 1,200 metric tons decline in production.

Blood cockles (*Anadara granosa*) formed the bulk of the wild bivalve production in the state, with most of the landings from Tawau in the SSME-3 area. Landings of other bivalves may have been substantial but no information is presently available on their actual contribution to this fishery. Most seafood restaurants served varieties of these bivalves and gastropods at current prices at RM15/kg shell-on upwards. Middlemen purchased these bivalves including selected gastropods from fishermen at cheap prices from as low as RM0.50/kg in the case for Semporna. One of the possible coastal community-based resource management programs can include the development of grow out and holding culture of these shellfish, targeting both domestic and overseas markets. The artificial propagation and sea ranching of giant clams (*Tricdana* spp.), abalone (*Haliotis* spp.) and pearl oyster is another area that needs to be explored further.

Cephalopods formed a significant portion of the trawl net landings in Sabah. More resource assessment, work and research into the distribution, abundance and general biology of major cephalopod species is needed before decisions can be made concerning the future development of this fishery. The intensive use of more species-specific gear types and techniques (e.g. light attractants, jigging gear) may result in substantial increases in landings.

The jellyfish fishery in Sabah is still in its initial development phase compared to neighboring Sarawak, where jellyfish landings make up about 10% of the annual fish landings. At present, the fishery is concentrated in Kota Marudu involving a few seasonal operators. In 1991, Sarawak had exported about 1,254 metric tons of processed jellyfish valued at RM14.2 million. Little is known of jellyfish population dynamics, distribution, abundance and general biology in Sabah waters. Past surveys had indicated that the offshore waters along the west coast holds some development potential prospects. Overall, the jellyfish fishery has ample potential for investment in the sub sector.

It is generally believed that a substantial portion of the lobster landings in Sabah originated from neighboring countries. This fishery is mainly concentrated in areas with extensive coral reefs and rocky shoals, with most the lobster production coming in from Semporna, Lahad Datu Kudat and certain districts in the non-SSME area. In view of the fact that a significant portion of the reefs in Sabah is severely damaged due to destructive fishing practices, particularly dynamite and cyanide fishing, it is unlikely that there is any substantial development of this fishery. The establishment of both MPA (marine protected area) or MMA (managed marine area) including habitat creation and enhancement through the development of artificial reefs in suitable areas, followed with the artificial propagation of spiny lobsters and subsequent releases in these areas may result in some minor increase in production.

The main components of the crab fishery in Sabah are mangrove crab (*Scylla serrata*) and pelagic crab (*Portunus pelagicus*). Overall, mangrove crabs fetches better prices (RM 4-6/kg) compared to pelagic crabs (RM 2-3/kg). Most of the mangrove crab production comes from the SSME-2 area. The crab fishery in Sabah is targeted for both domestic and export markets. Pelagic crabs are mainly caught by trawlers, while mangrove crabs are caught using static traps in mangrove and estuarine areas. The US-based Philips Seafood (East Malaysia) Sdn. Bhd.[173] had established a pelagic crabmeat canning plant in Tawau, with raw materials sourced from nearby districts and perhaps Indonesia as well. This plant has cold storage facilities of 200 metric tons. At least 40 metric tons of canned crabmeat had been sent to USA since it started operations in late 2000.

Juvenile or unmarketable mangrove crabs are also reared in ponds for fattening and grow-out purposes prior being sold to local seafood restaurants or exported out of the state. At present, crab landings are relatively stable and to a certain extent reflect the level of fishing effort exerted. In view of the saturation of trawler effort and also the gradual destruction of mangroves, no further development potential is to be seen for this fishery.

In conclusion, the most appropriate strategies in the management of the demersal resources in Sabah may include the following:

- Carry out biological studies and resource assessment of key finfish, shrimp and other invertebrate species;
- Maintain or reduce the commercial fishing effort level, trawlers in particular, until more concrete and rigorous assessment studies can be carried out;
- R&D on downstream m and value-added processing of demersal by-catch including trash fish from trawl landings;
- Discourage the establishment of new fish meal processing plants, including the gradual phasing out existing plants;
- Establishment of MMA, MPA and artificial reefs in critical areas including habitat and stock enhancement/rehabilitation programs;
- Awareness and public education programs to combat destructive fishing practices; and
- Develop community-based integrated marine aquaculture projects as alternative or supplementary livelihoods for coastal communities – including those involved in destructive fishing practices.

[173] http://www.phillipsfood.com

Marine Aquaculture

Present State and Federal government development policies are favorable to the development of coastal aquaculture in Sabah. These policies give high priority to alleviating poverty among the coastal communities and an emphasis on the development of coastal aquaculture as a means of income generating activity, employment and for generating foreign exchange through exports. Coastal aquaculture is a recent development in Sabah, and whilst growth over the past 5 years has been quite rapid (average increase in production of 24 percent per annum), there are a number of constraints to the development of the industry that need to be addressed.

Environmental conditions along the coastline are generally favourable for coastal aquaculture development, however, there are a number of issues that need to be considered in the development of an environmentally sound industry including:

- Risks to aquaculture from harmful algal blooms and water pollution in areas;
- Site selection to avoid impacts on coastal mangroves;
- Need to treat shrimp pond effluent; and
- Need for sustainable harvesting and management for wild marine fishes.

Until today, coastal aquaculture has not given rise to significant environmental impacts, and any future problems can be mitigated through appropriate technology and farming system, good site selection and zoning, and the development of optimum management practices. There is growing competition with other coastal resource ‘users’ and integrated approaches to coastal resource management need to be adopted.

There is good potential for expansion of coastal aquaculture to meet export and domestic demand. However there are a number of constraints to be addressed:

- Shrimp processors, suffering from declining raw material availability and plant over-capacity, need to implement effective quality control measures;
- Live marine fish trade is constrained by limited wild stock availability that had been further depleted due to destructive fishing practices;
- Heavy reliance on one market in Hong Kong, with high fluctuation in prices determined by current supply and demand; and
- Fluctuating prices for seaweed.

Mollusc farming faces few marketing constraints at present, although attention to the impact of harmful algal blooms (red tide) and product quality will be essential for future expansion. Sabah aquaculture marketing strategy requires attention to quality and diversification of markets and products.

Economic returns from shrimp culture are highly favourable and there are still some investment opportunities available in the sector. However, the future expansion and sustainable development of this sector need to address various certain issues:

- Hatchery management to supply high quality healthy shrimp post-larvae;
- Water quality and environmental management in pond farms;
- Supporting infrastructure (electricity, roads and water supplies);
- Code of Practices;
- Zoning of shrimp culture areas to allow development to proceed in harmony with other coastal resource users; and institutional support; and
- Institutional support (financing, technical services & R&D).

Marine fish culture (mainly cage culture) in Sabah comprises a mixture of larger scale farming operations which are primarily for holding live marine fish before export, and small-scale cage farms involved in both culture and holding operations. The attractive prices offered for high value reef fishes in the LRFT offers wide investment opportunities. However, at present marine fish culture is severely constrained by the shortage of fish fingerlings, where virtually almost all marine finfish farming relies on capture of wild fingerlings. There is an urgent need for:

- Zoning of suitable culture areas in lagoons and sheltered areas including ADAs;
- Development of hatchery sourced fish fingerlings;
- R&D on suitable culture systems including offshore cage culture farming;
- Improving disease & fish health management;
- Improving feed and feeding strategies which are less reliant on trash fish; and
- Implementation of effective resource management measures for the sustainable exploitation of wild fishery resources of high value marine fish species.

Mollusc culture in Sabah is still in its infancy. Government efforts to enhance production from this sector include the provision of training, extension and incentives in the form of seeds and farm materials. The target species are mussels (*Perna viridis*) and oysters (*Crassostrea* spp.). It is expected that molluscs culture will play important roles in the development of the aquaculture sector in the near future including supplementing the incomes of coastal communities. In order to enhance production, there are certain issues that need to be addressed:

- Zoning of suitable culture areas including ADAs in the SSME area;
- Development of hatchery sourced seed supply;
- Code of Practice;
- Presence of HABs (harmful algal blooms);
- Marketing and downstream processing; and
- Investment

Seaweed farming (*Eucheuma* spp.) has grown rapidly during the 10-odd years and is currently providing profitable and significant socio-economic benefits to some 600 small-scale coastal households in Semporna. Coastal communities in Banggi Island are also expected to benefit from seaweed farming in the near future. Seaweed farming is a simple low investment culture method with few constraints. The establishment of two SRC plants in Semporna and Tawau is expected to encourage more investment in this sub sector. However, there are certain issues that need to be addressed:

- Zoning of suitable culture areas including ADAs
- Cyclical global market demand leading to fluctuating prices;
- Need for farming systems diversification;
- Improved farm management to optimize farm output and productivity;
- Disease and predator control;
- Labour constraints;
- Investment

Among major issues and challenges faced by the aquaculture in Malaysia and Sabah in general include the following:

- *Economic*: In aquaculture, limited accessibility to suitable land and water bodies, competition from alternative land use and pollution are major constraints to further development of the industry. In addition, heavy dependence of the aquaculture industry on imported fish fry and feed may threaten the long-term viability of the industry.

- *Technology*: The industry relies on labor-intensive technology for most operations from farm preparation, culture activity, harvesting and post-harvest. There are limited R&D activities to develop appropriate aquaculture technologies to exploit resources. Furthermore, there is inadequate research on nutrition and genetic manipulation for fast growth and disease resistant species, seed and fry production, hatchery, feed and post-harvest technology for aquaculture. In addition, inadequate and lack of coordination of R&D activities restrict the exploitation of the vast marine biodiversity for development of new products.

- *Infrastructure and institutional support*: At the present moment, existing infrastructure and supporting facilities are inadequate and not integrated to meet the present needs of the industry. Aquaculture ventures need high capital investment. Financial institutions perceive aquaculture as high risk and are reluctant to finance such investments. In addition, the lack of basic infrastructure and public facilities have also led to higher investment which affect the overall competitiveness of the industry.

- *Marketing*: In marketing, stringent international food quality standards pose an additional challenge to expand and diversify markets. The undeveloped market as well as inadequate networking for freshwater fish limits consumer demand and reduce the overall efficiency of fish marketing.

- *Skilled workers*: There is acute shortage of specialized, skilled and semi-skilled workers for aquaculture. Insufficient expertise coupled with poor adoption of sustainable aquaculture practices has affected the development of aquaculture.

Downstream Processing

At present there are several constraints faced by the downstream processing sector in Sabah that need to be addressed before any significant development can be be seriously considered:

- Raw material shortage: This had lead to unhealthy competition between fish processing plants. Uncertainty in supplies resulted in reluctance of processing plants to expand their operations with more modern equipment.

- Low downstream processing technology: At present, only minimum value-added processing of raw materials is involved.

- Inadequate sea and air linkages: This lead to lower profits due to higher freight charges and handling costs involved.

- Limited local marketing potentials. The population in Sabah is low and widely dispersed.
- Poor road network system: Coast to coast transportation of raw materials is time-consuming which attributed to quality deterioration.

- High operation costs: This involved packaging materials sourced only from Peninsular Malaysia, freight charges, handling costs, etc.

- Poor utilities services: Including ffrequent electricity blackouts and cut in water supplies.

- Poor implementation or non-existence of standard food handling: This include FIQC (*Fish Inspection and Quality Control*) or HACCP (*Hazard Analysis Critical Control Point*);

- Poor post harvest handling: Usage of ice in long fishing trips coupled with usage of unhygienic storage facilities resulted in poor quality of raw materials upon arrival at port.

Resource Management Issues

Among common key issues faced in the management of fisheries in the SSME area include the following:

- Destructive Fishing Practices and Live Reef Fish Trade

Destructive fishing practices are among the main cause of coral reef and marinelife degradation in the SSME area. Destructive fishing activities include blast fishing, poison fishing (cyanide and plant poisons), muro ami, trawling and coral mining. In the case of Sabah, destructive fishing practices involves blast fishing and cyanide fishing, and to a certain extent non-selective using using trawl nets. However, trawling is the most important component of the coastal fisheries in Sabah, contributing more than 40% to the annual fish landings. Blast fishing is primarily driven by the subsistence needs of small-scale transient fishermen. Financiers or taukehs in the fishing business are also involved in blast fishing activities. Cyanide fishing is driven by the lucrative but unregulated LRFT with most supplies of high value reef fishes mainly destined for the Hong Kong, China and Taiwan markets. It had been reported that cyanide fishing is now widespread causing severe damages to coral reefs in the Philippines, Indonesia, Papua New Guinea, Vietnam, Thailand, Malaysia, Maldives and in most of the Pacific Islands.

- Overfishing and Food Security

The coastal fisheries in the SSME area is very complexed and difficult to manage because of its multi-gear cum multi-species capture fishery characteristics. In most cases, fishing activities are carried out in limited inshore coastal waters, with both traditional and commercial fishermen competiting with each other for the same resources. In the case of Sabah, trawling in particular formed the backbone of the coastal fisheries industry contributing more than 40 per cent to the annual landings. In many cases, the decline in catches had also lead to trawlers encroaching into restricted fishing grounds of traditional fishermen. The use of non-selective gears coupled with destructive fishing practices had lead to overfishing and severe toll on aquatic ecosystems critical to fisheries productivity. Coral reefs, sea grass communities and mangrove habitats provide fishery resources that represent a critical source of food and income for both traditional and commercial fishermen.

- Land-based Pollution

Land-based sources of marine pollution pose some of the greatest threats to marinelife including mangroves, coral reefs and sea grass beds. In Sabah, land-based sources of pollution include run-off from coastal development, agricultural activities mainly from palm oil cultivation in the SSME area, industrial activities and forest deforestation.

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Table A1: *Fisheries production and population statistics in the Southeast Asian region*

COUNTRY	Population[a] 1998	% SE Asia	Area (km^2)	Coastline (km)	Number of Fishing Boats	Fisheries GDP[b] 1995	Per Capita Supply[c]	Fish for Human consumption[d]
Malaysia	20.93	4.52	329,733	4,800	31,575	694	34	679.17
Philippines	77.73	16.79	299,404	17,460	375,673	2,731	42	2,871.07
Indonesia	212.94	45.99	1,900,000	81,000	389,498	3,382	16	3,370.30
Thailand	60.04	12.97	513,115	2,614	18,146	3,082	52	3,088.70
Singapore	3.49	0.75	NA	NA	276	NA	NA	NA
Vietnam	76.24	16.46	325,360	3,260	NA	NA	12	1,373.55
Cambodia	11.34	2.45	NA	NA	NA	NA	NA	NA
Brunei	0.32	0.07	5,765	130	1,208	25	48	6.21
SE Asia (sub total)	463.02	100%	3,373,377	109,264				11,389.00
World Population	7,222.89	6.41%						

Note: a – population in million; b – in US$ million; c – in $kg.yr^{-1}$; d – in '000 metric ton

Source**:**

Website: http://www.census.gov/ipc/www/wp98.html

Website: http://www.seafdec.org

COUNTRY 1993 period	Total		Marine Fishery		Inland Fishery		Aquaculture	
	Q	V	Q	V	Q	V	Q	V
Total	13,024,935	9,054,231	9,727,634	4,889,953	1,065,788	257,147	2,231,513	3,907,131
Brunei	5,532	15,059	5,485	14,713	NA	NA	47	346
Taiwan	589,008	1,915,545	302,044	780,118	1,688	3,892	285,276	1,131,535
Hong Kong	227,042	343,055	218,176	304,148	NA	NA	8,866	38,907
Indonesia	3,795,322	NA	2,886,289	NA	308,649	NA	600,384	NA
Kampuchea	108,900	NA	33,100	NA	75,800	NA	NA	NA
Malaysia	1,154,557	1,039,314	1,047,350	925,530	1,971	NA	105,236	113,784
Philippines	2,647,787	2,623,046	1,648,625	1,420,594	227,080	76,294	772,082	1,126,158
Singapore	11,629	27,683	9,279	17,017	NA	NA	2,350	10,666
Thailand	3,385,158	3,090,529	2,752,486	1,427,833	175,400	176,961	457,272	1,485,735
Vietnam	1,100,000	NA	824,800	NA	275,200	NA	NA	NA

Note: Q – quantity in metric tons; V– value in USD$

Source: SEAFDEC Fishery Statistical Bulletin for the South China Sea Area 1993

Table A2: *Profile of countries in the SSME Area*

	MALAYSIA	INDONESIA	PHILIPPINES
Total Area (square km)	329,750	1,919,000	300,000
Land Area (square km)	328,550	1,826,000	298,170
Economy GDP (1993, million $US)	85,311	198,079	74,180
Per Capita	4,236	1,002	1,098
Social Population ('000)	20,581	200,596	68,976
% urban	53.7	35.4	54.2
% rural	46.3	64.6	45.8
Marine and Coastal Resources			
Coastline (km)	4,675	54,716	22,540
EEZ (square km)	476	5,419	1,786
Total Mangrove Area ('000 ha)	731	2,101	140
Marine Fish Catch*	651,480	2,719,100	1,685,139
Per Capita Food Supply (fish) – kg	44.7	14.7	36.2

Note: * - wild catch and aquaculture
URL Source: http://www.wri.org/facts/country-data.html

Table A3: *Economic performance Indicators, Malaysia – 1993-1998*

	1993	1994	1995	1996	1997	1998
Population (million)	19.6	20.1	20.7	21.2	21.7	22.2
Labor Force (million)	7.627	7.834	8.257	8.641	9.038	9.007
Employment (million)	7.498	7.603	8.024	8.417	8.805	8.540
Per Capita Income (RM)[1]	8,024	8,996	10,068	11,228	12,051	11,626
Gross National Savings (RM billion)	54.53	62.13	73.45	91.57	102.81	103.87
% GDP	34.7	34.2	35.3	38.6	39.4	40.2
Gross Domestic Product (RM billion)	165.21	190.27	218.67	249.50	275.37	279.82
Growth Rate (%) GDP	8.3	9.3	9.4	8.6	7.7	-6.3
Agriculture, forestry and fishing	4.5	-1.0	1.1	2.2	1.3	-4.9
Manufacturing	12.9	14.9	14.2	12.3	12.5	-9.5
Mining and Quarrying	-0.4	2.5	8.9	4.5	1.0	-0.2
Construction	11.2	14.1	17.3	14.2	9.5	-23.9
Services	9.8	9.7	9.4	9.7	8.0	1.8
Gross National Product (RM billion)	156.94	180.86	208.29	237.69	261.09	257.87
Growth Rate (%) GNP	8.7	9.1	9.3	8.3	7.8	-6.8
Public Consumption	10.7	9.9	7.3	1.4	5.3	1.1
Private Consumption	4.6	9.9	9.3	6.0	4.7	-9.3
Public Investment	8.4	-0.6	8.7	1.1	8.6	-11.4
Private Investment	19.1	27.9	25.3	13.4	8.4	-58.8
Exports	17.2	22.5	17.6	7.2	10.8	1.5
Imports	19.1	27.7	21.4	4.2	10.2	-16.0
External Trade (RM billion)						
Total Exports (f.o.b.)	121.24	153.92	184.99	197.03	221.41	287.16
Total Imports (c.i.f.)	117.41	155.92	194.35	197.28	220.98	232.21
Balance of Trade	3.83	-2.00	-9.36	-0.25	0.42	54.94
Consumer Price Index (%)	3.5	3.7	3.4	3.5	3.2	5.3
External Debt (RM billion)	51.86	59.15	68.81	73.18	125.67	150.34
Debt Service Ratio (% export)	6.2	4.9	6.0	5.7	5.1	NA
% GDP	31.4	31.1	31.5	29.3	45.6	57.4
Net BN Reserves (RM billion)	76.44	68.17	63.77	70.02	59.12	93.85
Months of Retained Imports	8.3	5.5	4.1	4.4	3.4	4.7

Note: 1 – at current prices; 2 – at 1978 prices
Source: National Economic Action Council of Malaysia
Website: http://vs02.tvsecure.com/~vs021b5/figures/epi.shtml

Table A4: *Population parameters, labour force and employment by state, Malaysia*

State	State Area (km^2)	1991		2000		AAGR % 1991-2000	Gross Domestic Product RM	in '000		% UER
		Population 1991	pop.density ind/km^2	Population 2000	pop.density ind/km^2			Labour Force	Employment	
Johore	18,986	2,069,740	109.01	2,565,701	135.14	2.39	16,416	1,139.0	1,114.3	2.2
Kedah	9,426	1,302,241	138.15	1,572,107	166.78	2.09	6,803	620.2	605.7	2.3
Kelantan	14,920	1,181,315	79.18	1,289,199	86.41	0.97	3,087	561.9	533.9	5
Malacca	1,651	506,321	306.68	602,867	365.15	1.94	3,599	259.4	254.6	1.9
Negeri Sembilan	6,643	692,897	104.30	830,080	124.96	2.01	4,792	352.7	344.3	2.4
Pahang	35,964	1,045,003	29.06	1,231,176	34.23	1.82	6,516	510.6	492.0	3.6
Perak	21,005	1,877,471	89.38	2,030,382	96.66	0.87	11,678	873.6	852.1	2.5
Perlis	795	183,824	231.23	198,335	249.48	0.84	926	84.3	81.9	2.8
Pulau Pinang	1,030	1,064,166	1033.17	1,225,501	1,189.81	1.57	10,234	565.1	560.1	0.9
Sabah	73,619	1,734,685	23.56	2,449,389	33.27	3.83	10,026a	1,007.8a	950.6a	5.7
Sarawak	124,449	1,642,771	13.20	2,012,616	16.17	2.26	10,719	945.6	907.3	4.1
Selangor	7,955	2,297,159	288.77	3,947,527	496.23	6.02	27,019	1,306.8	1,291.3	1.2
Terengganu	12,955	766,244	59.15	879,691	67.90	1.53	9,899	400.6	382.0	4.6
FT Kuala Lumpur	243	1,145,342	4713.34	1,297,526	5,339.61	1.39	17,431	699.5	696.1	0.5
FT Labuan	92	54,241	589.58	70,517	766.49	2.92	na	na	na	na
TOTAL	329,733	17,563,420	53.27	22,202,614	67.34	2.60	139,145	9,327.1	9,066.2	2.8

Note: non-Malaysian citizens is estimated at 1.23 million making up a total population of 23.3 million (preliminary count of the Malaysia Population and Housing Census 2000)

KEY POPULATION PARAMETERS	1998	1999	2000
Mid year population (million)	22.18	22.71	23.26
Crude Birth Rate (thousand)	25.0	24.4	24.5
Crude Death Rate (thousand)	4.5	4.4	4.4
Crude Rate of Natural Increase	20.5	20.0	20.1
Infant Mortality Rate	8.3	7.9	7.9
Live Expectancy – males (years)	69.6	69.9	70.2
Live Expectancy – females (years)	74.6	74.9	75.0

Note: FT – Federal Territory; a – including FT Labuan; na – not available; AAGR – average annual growth rate (%); UER – unemployment rate

Sources: Yearbook of Statistics Malaysia 1997, 7th Malaysian Plan (Midterm Review), Preliminary estimates of Malaysia Population and Housing Census 2000, Economic Report 1999/2000, Ministry of Finance Malaysia, Annual Report 1998, Bank Negara Malaysia

Table A5: *Mean monthly gross household income by ethnic group, Malaysia 1997*

Ethnic Group	*In Current Prices (RM)*		ANVR	*In 1995 prices (RM)*		ANVR
	1995	*1997*	(%)	*1995*	*1997*	(%)
Malaysia	2,008	2,607	13.9	2,008	2,453	10.5
Citizens	2,020	2,606	13.6	2,020	2,452	10.2
Bumiputera	1,604	2,038	12.7	1,604	1,917	*9.3*
Chinese	2,890	3,737	13.7	2,890	3,516	*10.3*
Indians	2,140	2,896	16.3	2,140	2,725	*12.8*
Others	1,284	1,680	14.4	1,284	1,581	*11.0*
Non-Citizens	1,744	2,625	22.7	1,744	2,470	19.0
a. URBAN	2,593	3,406	14.6	2,593	3,205	11.2
Citizens	2,589	3,357	13.9	2,589	3,158	10.5
Bumiputera	2,159	2,769	13.2	2,159	2,605	9.8
Chinese	3,147	4,071	13.7	3,147	3,830	10.3
Indians	2,429	3,289	16.4	2,429	3,094	12.9
Others	1,615	2,225	17.4	1,615	2,093	13.9
Non-Citizens	2,711	4,403	27.4	2,711	4,143	23.6
b. RURAL	1,307	1,669	13.0	1,307	1,570	9.6
Citizens	1,326	1,704	13.4	1,326	1,603	10.0
Bumiputera	1,189	1,498	12.2	1,189	1,409	8.9
Chinese	2,018	2,668	15.0	2,018	2,510	11.5
Indians	1,488	2,019	16.5	1,488	1,900	13.0
Others	1,066	1,261	8.8	1,066	1,186	5.5
Non-Citizens	995	1,195	9.6	995	1,124	6.3

Note: ANVR – average annual growth rate (1995-1997)
Source: Mid Term Review of the Seventh Malaysian Plan, 1996-2000

Table A6: *Incidence of poverty by state, Malaysia 1995-1997 period*

State	Malaysian Citizens		Overall	
	1995	1997	1995	1997
Terengganu	23.4	17.3	23.4	17.3
Kelantan	22.9	19.2	23.4	19.5
Sabah[1]	22.6	16.5	26.2	22.1
Kedah	12.2	11.5	12.1	11.5
Perlis	11.8	10.7	12.7	10.6
Sarawak	10.0	7.3	10.0	7.5
Perak	9.1	4.5	9.1	4.5
Pahang	6.8	4.4	6.8	4.1
Malacca	5.3	3.5	5.2	3.6
Negeri Sembilan	4.9	4.7	4.8	4.5
Pulau Pinang	4.0	1.7	4.1	1.6
Johore	3.1	1.6	3.2	1.6
Selangor	2.2	1.3	2.5	1.3
WP Kuala Lumpur	0.5	0.1	0.7	0.1
MALAYSIA	8.9	6.1	9.6	6.8

Note: 1 – includes WP Labuan
Source: Seventh Malaysia Plan (Mid-Term Review)

Table A7: *Key economic indicators, Malaysia 1995-1999*

Key Economic Indicators	1995	1999
Gross Domestic Products (*in 1978 prices*)	120,272	132,569
Agriculture, forestry and fishing	16,321	16,932
Mining and quarrying	8,979	9,510
Manufacturing	39,790	45,493
Construction	5,385	4,678
Electricity, gas & water	2,797	3,817
Transport, storage & communications	8,852	10,806
Wholesale & retail trade, hotels & restaurants	14,781	17,097
Finance, real estate & business services	12,937	17,733
Government services	11,454	13,270
Other services	2,478	3,026
Less : Imputed bank service charges	8,503	13,442
Plus : Import duties	5,090	3,649

Source: *Economic Planning Unit, Prime Minister Department Malaysia*
Website: http://www.epu.jpm.my/eif99/eif_toc.html

Table A8: *Per capita protein consumption in Malaysia, 1990-2010*

Commodity (kg)	1990	1995	2000	2005	2010
Beef	3.2	4.3	5.3	6.7	8.8
Mutton	0.4	0.6	0.6	0.7	0.7
Chicken	19.0	30.0	35.3	35.9	36.8
Pork	12.0	13.2	8.1	9.3	9.2
Egg	15.7	16.4	16.8	17.2	17.3
Milk (in liters)	37.7	51.5	53.0	56.0	60.6
Fish	34.8	39.1	49.0	53.0	56.0
% Fish*	*40.9*	*37.7*	*42.6*	*43.2*	*43.5*

Note: * excluding milk in total per capita protein consumption

Source: Third National Agriculture Policy (1999-2010)

Table A9: *Projected production and demand for fish in Malaysia, 1995-2010*

Year	1995*	2000**	2005**	2010**
Population (in millions)	20.69	23.27	25.84	28.41
Consumption Per Capita (kg)	39	45	50	55
Demand (‘000 metric ton)	810	1,047	1,292	1,563
Aquaculture (‘000 metric ton)	133	250	400	600
Capture Fisheries (‘000 metric ton)	1,108	1,230	1,306	1,332
Total Fish Supply (‘000 metric ton)	1,241	1,480	1,706	1,932
Trash fish (‘000 metric ton – minus)	476	499	481	433
Total Food Fish Supply (‘000 metric ton)	765	989	1,225	1,499
Per Capita Consumption (kg)	34.8	45.0	50.0	55.0
Self-Sufficiency Level (%)	94	94	95	96
Export Food-Fish Items (‘000 metric ton)	185	206	235	282
Import Food-Fish Items (‘000 metric ton)	230	264	302	346

Note: * actual figures; ** projected
Source: Ministry of Agriculture Malaysia 1996

Table A10: *Spatial distribution of fishermen by ethnic group and fishing gear, Malaysia 1998*

ETHNIC BREAKDOWN								
Region	BUM	CHN	IND	POR	THA	INDO	OTR	Total
Pen. West	10,894	14,856	236	52	3,554	27	146	29,765
Pen. East	14,644	1,964	3	0	3,656	2	4	20,273
Sarawak	8,678	1,598	0	0	0	0		10,287
FT Labuan	112	10	0	0	0	52	203	377
Sabah	14,835	243	0	0	0	0	5,767	20,845
Total	49,163	18,671	239	52	7,210	81	6,131	81,547

GEAR TYPE BREAKDOWN							
Region	TN	PS	GN	LN	HL	OT	Total
Pen. West	8,813	7,187	12,124	0	337	1,304	29,765
Pen. East	3,618	8,412	4,556	218	2,502	967	20,273
Sarawak	4,364	360	3,602	0	0	1,961	10,287
FT Labuan	70	193	0	0	102	12	377
Sabah	5,123	1,497	6,134	1,394	4,806	1,891	20,845
Total	21,988	17,649	26,416	1,612	7,747	6,135	81,547

GEAR CATEGORY BREAKDOWN					
Region	Commercial	Traditional	Sub Total	% Com	% Trad
Pen. West	28,124	1,641	29,765	94.49	5.51
Pen. East	16,586	3,687	20,273	81.81	18.19
Sarawak	8,326	1,961	10,287	80.94	19.06
FT Labuan	263	114	377	69.76	30.24
Sabah	12,754	8,091	20,845	61.18	38.82
Total	66,053	15,494	81,547	81.00	19.00

Note: BUM – Bumiputera; CHN – Chinese; IND – Indian; POR – Portuguese; THA – Thai; INDO – Indonesia; OTR – others; Transient population (Indonesians and Filipinos) in Sabah is categorized under the OTR group
TN – trawl net; PS – seine net; GN – gill net; LN – lift net; HL – hook & line; OT – others
Source: DOF Malaysia annual fisheries statistics 1998

Table A11: *Spatial breakdown of fishing vessels by type and tonnage class, Malaysia 1998*

Fishing Zone	State	Total	NB	OE	Inboard Engine Fishing Vessels by Gross Tonnage (GRT)**								
					IE	< 5	5-10	10-15	15-20	20-25	25-40	40-70	>70
Peninsular West Coast	Perlis	644	0	72	572	59	110	30	58	39	130	105	41
	Kedah	1709	0	651	1,058	220	225	97	72	67	201	128	48
	Penang	1,367	15	818	534	70	335	7	2	2	80	36	2
	Perak	4,326	75	981	3,270	623	1,045	480	464	109	145	331	73
	Selangor	2,381	88	445	1,848	52	1,017	194	198	101	172	114	0
	Negeri Sembilan	193	2	151	40	0	37	3	0	0	0	0	0
	Malacca	659	8	531	120	1	110	9	0	0	0	0	0
	West Johore	2,933	110	2,131	692	110	351	71	120	31	9	0	0
	Sub Total	*14,212*	*298*	*5,780*	*8,134*	*1,135*	*3,230*	*891*	*914*	*349*	*737*	*714*	*164*
Peninsular East Coast	Kelantan	963	0	239	724	263	114	128	77	15	35	37	55
	Terengganu	2,199	3	236	1,960	303	613	390	306	111	127	67	43
	Pahang	1,100	3	260	837	40	272	154	38	40	80	137	76
	East Johore	1,497	26	715	756	82	226	130	45	12	102	129	30
	Sub Total	*5,759*	*32*	*1,450*	*4,277*	*688*	*1,225*	*802*	*466*	*178*	*344*	*370*	*204*
East Malaysia	Sarawak	2,338	2	777	1,559	217	458	307	103	88	133	131	122
	FT Labuan	81	0	58	23	0	0	0	0	0	8	4	11
	Sabah**	10,456	2,524	4,653	3,279	555	749	383	231	220	402	52	1
	Sub Total	*12,875*	*2,526*	*5,488*	*4,901*	*772*	*1,207*	*690*	*334*	*308*	*543*	*187*	*134*
GRAND TOTAL		32,846	2,856	12,718	17,272	2,595	5,662	2,383	1,714	835	1,624	1,271	502

Note: ** 681 inboard engine vessels in Sabah of unknown GRT (inshore fishing vessels); NB - non-motorized boats; OE – outboard engine fishing vessels
Traditional fishing fleet – non motorized boats; inshore fishing fleet – OE vessels and IE vessels less than 40 GRT
Source: Adapted from DOF Malaysia annual fisheries statistics 1998

Fishing Zone	Fishing Fleet Size (units)				Fishing Fleet Breakdown (%)			
	Traditional	Inshore	Offshore	Total	Traditional	Inshore	Offshore	Total
Peninsular Malaysia West Coast	298	13,036	878	14,212	2.10	91.73	6.18	100%
Peninsular Malaysia East Coast	32	5,153	574	5,759	0.56	89.48	9.97	100%
Sarawak	2	1,409	927	2,338	0.09	60.27	39.65	100%
FT Labuan	0	58	23	81	0.00	71.60	28.40	100%
Sabah	2,524	7,874	58	10,456	24.14	75.31	0.55	100%
Total	2,856	27,530	2,460	32,846	8.70	83.82	7.49	100%

Table A12: *Spatial breakdown of motorized fishing vessels by engine horsepower, Malaysia 1998*

Vessel Type	Horsepower HP Class	Peninsular West	% TOTAL	Peninsular East	% TOTAL	Sarawak	% TOTAL	Labuan	% TOTAL	Sabah	% TOTAL	TOTAL	% TOTAL
Inboard Engine Fishing Vessels	< 5 HP	35	0.43	44	1.03	9	0.58	0	0.00	122	3.72	210	1.22
	5-9 HP	161	1.98	307	7.18	152	9.75	0	0.00	301	9.18	921	5.33
	10-19 HP	704	8.66	669	15.64	346	22.19	0	0.00	245	7.47	1,964	11.37
	20-39 HP	1,656	20.36	1,535	35.89	457	29.31	4	17.39	163	4.97	3,815	22.09
	40-59 HP	1,898	23.33	178	4.16	68	4.36	2	8.70	603	18.39	2,749	15.92
	60-99 HP	676	8.31	337	7.88	120	7.70	2	8.70	275	8.39	1,410	8.16
	100-149 HP	627	7.71	265	6.20	78	5.00	0	0.00	296	9.03	1,266	7.33
	150-249 HP	1,234	15.17	261	6.10	153	9.81	4	17.39	750	22.87	2,402	13.91
	> 250 HP	1,143	14.05	681	15.92	176	11.29	11	47.83	524	15.98	2,535	14.68
	TOTAL	8,134	100.00	4,277	100.00	1,559	100.00	23	100.00	3,279	100.00	17,272	100.00
Outboard Engine Fishing Vessels	< 5 HP	1,078	18.65	381	26.28	194	24.97	0	0.00	252	5.42	1,905	14.98
	5-9 HP	1,893	32.75	393	27.10	52	6.69	2	3.45	378	8.12	2,718	21.37
	10-19 HP	1,551	26.83	385	26.55	63	8.11	5	8.62	1,746	37.52	3,750	29.49
	20-39 HP	901	15.59	211	14.55	103	13.26	10	17.24	1,854	39.85	3,079	24.21
	40-59 HP	290	5.02	79	5.45	311	40.03	30	51.72	361	7.76	1,071	8.42
	60-99 HP	64	1.11	1	0.07	54	6.95	10	17.24	62	1.33	191	1.50
	100-149 HP	3	0.05	0	0.00	0	0.00	1	1.72	0	0.00	4	0.03
	150-249 HP	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
	> 250 HP	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
	TOTAL	5,780	100.00	1,450	100.00	777	100.00	58	100.00	4,653	100.00	12,718	100.00
GRAND TOTAL		13,914		5,727		2,336		81		7,932		29,990	

Source: DOF Malaysia annual fisheries statistics 1998

Table A13: *Spatial breakdown of fishing vessels by gear type, Malaysia 1998*

GEAR TYPE	Sub Total	NB	OE	Sarawak	Sabah	Labuan	Peninsular Malaysia (Inboard Engine Boats) by GRT Class						
							IE	< 5	5-15	15-25	25-40	40-70	>70
Trawl Net	5,928	0	0	579	1,422	7	3,918	15	665	1,352	915	774	197
Purse Seine	862	0	0	19	124	7	707	3	84	123	105	266	126
Anchovy Purse Seine	150	0	0	0	42	0	108	0	22	13	2	28	43
Other Seine Nets	836	11	96	0	56	3	670	168	498	2	0	2	0
Gill Net	17,299	240	6,565	1,417	4,356	17	4,704	1,102	3,398	151	42	11	0
Lift Net	436	0	21	0	356	6	53	6	41	6	0	0	0
Hook and Line	4,421	10	250	50	2,734	35	1,342	280	856	196	10	0	0
Bag Net	523	1	30	193	0	0	299	125	171	1	2	0	0
Fish Carriers	58	25	2	0	0	0	31	0	27	0	0	2	2
Traps	868	11	110	10	423	6	308	23	219	61	4	1	0
Shellfish Collector	258	9	19	0	134	0	96	83	13	0	0	0	0
Barrier Net	92	5	16	51	5	0	15	0	15	0	0	0	0
Scoop Net	25	0	6	19	0	0	0	0	0	0	0	0	0
Others	1,092	18	110	0	804	0	160	18	139	2	1	0	0
TOTAL	32,846	330	7,230	2,338	10,456	81	12,411	1,823	6,148	1,907	1,081	1,084	368

Note: NB - non-motorized boats; OE – outboard engine fishing vessels; IE – onboard engine fishing vessels
Source: Adapted from DOF Malaysia annual fisheries statistics 1998

Table A14: *Spatial breakdown of licensed fishing gears, Malaysia 1998*

GEAR GROUP / STATE	Trawl net	Seine Nets: Purse seine	Seine Nets: Anchovy purse seine	Seine Nets: Other seine net	Drift & gill net	Lift net	Traps	Hook & line	Bag Net	Barrier net	Push scoop net	Shellfish collector	Misc. gears	TOTAL
Peninsular West Coast														
Perlis	222	116	0	0	306	0	0	0	0	0	0	0	0	64
Kedah	509	19	54	0	1,127	0	0	0	0	0	0	0	0	1,709
Penang	95	7	0	111	1,018	0	36	55	0	0	2	1	42	1,367
Perak	1,370	59	13	340	1,819	0	76	88	85	0	0	202	89	4,041
Selangor	665	20	0	0	1,379	0	2	46	152	16	0	5	84	2,369
Negeri Sembilan	0	0	0	1	177	0	5	10	0	0	0	0	0	193
Malacca	0	0	0	3	615	0	0	37	0	3	0	0	1	659
West Johore	176	0	0	6	2,367	0	64	36	24	21	0	17	14	2,725
TOTAL	3,037	221	67	461	8,808	0	183	272	261	40	2	125	230	13,707
Peninsular East Coast														
Kelantan	83	1	8	63	567	27	0	162	0	0	0	0	1	912
Terengganu	222	312	22	3	597	36	123	847	0	0	0	0	30	2,192
Pahang	338	49	11	0	411	0	291	0	0	0	0	0	0	1,100
East Johore	235	1	0	49	999	0	22	133	0	14	0	0	3	1,456
TOTAL	878	363	41	115	2,574	63	436	1,142	0	14	0	0	34	5,660
East Malaysia														
Sarawak	570	21	0	1	1,308	0	5	128	217	72	12	0	6	2,340
FT Labuan	7	7	0	3	17	6	6	35	0	0	0	0	0	81
Sabah	1,210	171	6	7	1,171	188	206	473	0	4	0	0	227	3,663
TOTAL	1,787	199	6	11	2,496	194	217	636	217	76	12	0	233	6,084
Grand Total	5,702	783	114	587	13,878	257	836	2,050	478	130	14	125	497	25,451

Source: DOF Malaysia annual fisheries statistics 1998

Table A15: *Fisheries production, Malaysia 1993-1998*

a. Production (metric ton)												
Region	Marine Capture Fisheries Sector						Aquaculture Sector**					
	1993	1994	1995	1996	1997	1998	1993	1994	1995	1996	1997	1998
Peninsular	791,618	785,079	819,464	807,657	837,574	901,933	94,912	103,802	113,586	98,702	97,011	122,272
Sarawak	81,924	95,624	99,255	100,744	128,193	103,213	861	1,428	1,314	1,254	680	1,499
Sabah[1]	173,808	184,882	189,717	218,288	203,206	210,060	9,464	8,884	9,349	9,106	10,293	9,875
Sabah %	16.6	17.4	17.1	19.4	17.4	17.3	9.0	7.8	7.5	8.3	9.5	7.4
Total	1,047,350	1,065,585	1,108,436	1,126,689	1,168,973	1,215,060	105,237	114,114	124,249	109,062	107,984	133,647
b. Wholesale Value (RM million)												
Region	Marine Capture Fisheries Sector						Aquaculture Sector					
	1993	1994	1995	1996	1997	1998	1993	1994	1995	1996	1997	1998
Peninsular	1,721.27	1,865.37	1,947.90	2,440.13	2,596.00	2,761.25	215.85	272.97	206.61	332.88	449.17	471.29
Sarawak	233.75	276.95	242.77	300.08	408.05	338.61	5.36	7.75	3.76	12.39	12.26	25.34
Sabah[1]	423.59	450.97	520.23	581.95	671.19	717.36	71.22	84.32	52.30	117.13	147.61	157.66
Sabah %	17.8	17.4	19.2	17.5	18.3	18.8	24.4	23.1	19.9	25.3	24.2	24.1
Total	2,378.61	2,593.29	2,710.91	3,322.16	3,675.23	3,817.22	292.43	365.04	262.67	462.40	609.04	654.29

Note: 1 – Sabah including FT Labuan; Sabah (%) – Sabah's contribution to national output; ** Aquaculture - excluding seaweed production (Sabah)
Website: http://agrolink.moa.my/dof/Statistics/statistics.html

Marine Capture Fisheries 1998												
Resource Group	Peninsular West		Peninsular East		Sarawak		FT Labuan		Sabah		TOTAL	
	Q	%	Q	%	Q	%	Q	%	Q	%	Q	%
DEMERSAL FINFISH	275,982	50.07	172,008	49.04	54,487	52.79	3,718	26.88	79,500	40.51	585,695	48.20
Pelagic Fish	174,731	31.70	148,579	42.36	22,528	21.83	8,967	64.82	91,332	46.54	446,137	36.71
Crustaceans	62,721	11.38	7,873	2.24	13,227	12.82	803	5.80	14,719	7.50	99,343	8.17
Cephalopods	31,387	5.69	22,285	6.35	2,537	2.46	345	2.49	9,671	4.93	66,225	5.45
Others	6,361	1.15	6	0.00	10,434	10.11	0	0.00	1,005	0.51	17,806	1.47
TOTAL	551,182	100%	350,751	100%	103,213	100%	13,833	100%	196,227	100%	1,215,206	100%

Source: adapted from DOF Malaysia annual fisheries statistics 1998

Table A16: *Spatial breakdown of marine fish landings by gear group, Malaysia 1998 (in metric ton)*

GEAR GROUP / STATE	Trawl net	Seine Nets			Drift & gill net	Lift net	Traps	Hook & line	Bag Net	Barrier net	Push scoop net	Shellfish collector	Misc. gears	TOTAL
		Purse seine	Anchovy purse seine	Other seine net										
Peninsular West Coast														
Perlis	27,147	35,414	0	0	10,773	0	0	0	0	0	205	0	242	73,781
Kedah	59,014	8,800	13,561	149	9,763	0	27	227	501	73	323	790	133	93,361
Penang	22,354	2,379	0	2,263	7,115	0	96	240	699	163	99	2	66	35,476
Perak	152,878	12,024	1,135	11,145	28,121	0	78	806	1,403	191	5,428	483	292	213,944
Selangor	78,930	5,185	0	336	11,100	0	406	4,072	12,073	1,200	374	3,823	164	117,663
Negeri Sembilan	0	0	0	0	289	0	28	59	0	0	0	0	0	376
Malacca	0	0	0	6	1,594	0	2	208	0	0	62	23	0	1,895
West Johore	7,069	0	0	0	5,193	0	551	81	1,473	83	92	0	104	14,646
TOTAL	347,392	63,802	14,696	13,899	73,948	0	1,188	5,693	16,149	1,710	6,583	5,121	1,001	551,182
Peninsular East Coast														
Kelantan	9,446	18,867	402	0	4,313	5,419	81	2,991	0	0	0	0	27	41,546
Terengganu	50,145	57,910	2,485	0	4,239	3,584	6,992	18,339	0	0	0	0	0	143,694
Pahang	81,616	17,967	1,765	0	3,070	457	2,176	1,910	0	0	0	0	0	108,961
East Johore	46,723	6,123	0	0	827	0	67	1,430	1,354	0	0	0	26	56,550
TOTAL	187,930	100,867	4,652	0	12,449	9,460	9,316	24,670	1,354	0	0	0	53	350,751
East Malaysia														
Sarawak	63,029	3,391	0	0	19,455	0	740	3,887	3,681	247	8,775	1	7	103,213
FT Labuan	4,972	7,980	0	4	172	49	4	652	0	0	0	0	0	13,833
Sabah	77,900	41,904	0	2,513	24,305	12,721	3,493	28,005	0	3	0	275	5,108	196,227
TOTAL	145,901	53,275	0	2,517	43,932	12,770	4,237	32,544	3,681	250	8,775	276	5,115	313,273
Grand Total	681,223	217,944	19,348	16,416	130,329	22,230	14,741	62,907	21,184	1,960	15,358	5,397	6,169	1,215,206

Source: DOF Malaysia annual fisheries statistics 1998

Table A17: *Fish landing composition by gear group, Malaysia 1998 (in metric ton)*

GEAR GROUP / ISSCAAP GROUP	Trawl net	Seine Nets: Purse seine	Seine Nets: Anchovy purse seine	Seine Nets: Other seine net	Drift & gill net	Lift net	Traps	Hook & line	Bag Net	Barrier net	Push scoop net	Shellfish collector	Misc. gears	TOTAL
24	5,594	370	4	20	7,082		75	12	0	1	0		0	13,158
25	65				1,017		144	327	0	10	315		2	1,880
31	4,321			74	964		101	0	1	11	0		0	5,472
33	97,025	3,214	211	627	18,511	90	10,015	28,261	87	636	39		1,031	159,747
34	42,367	85,181	5	123	16,960	10,162	808	12,202	71	114	93		598	168,684
35	4,138	38,577	18,832	759	3,941	9,704	140	245	0	0	0		65	76,401
36	96	38,444		775	4,912		0	8,613	0	0	0		0	52,840
37	50,325	39,276	3	357	45,642	780	80	5,795	4	0	15		24	142,301
38	15,188	544		13	3,763		191	4,222	3	16	3			23,943
39	347,397	11,070	293	6,017	9,652	297	1,157	1,563	4,003	752	2,373			384,574
42	7,204	90		20	2,308		690	0	15	200	27		3,689	14,243
45	46,670	271		7,487	14,738	64	689	0	13,765	154	3,705		389	87,932
56	454	52					0	0	0	0	0	5397	101	6,004
67	60,336	855		144	839	1,133	651	1,667	428	0	149		23	66,225
76	43								2,807	66	8,639		247	11,802
TOTAL	681,223	217,944	19,348	16,416	130,329	22,230	14,741	62,907	21,184	1,960	15,358	5,397	6,169	1,215,206

ISSCAAP (*International Standard Statistical Classification Of Aquatic Animals and Plants*)
24 *Shads, milkfishes etc* (Chacunda shad, slender shad, longtail shad); **25** Barramundi (giant sea perch); **31** *Flounders, halibuts, soles etc.* (Tonguefish, sole, flatfish); **33** *Red fishes, basses, congers, etc.* (Parrotfish, croaker, wrass, goatfish, spotted sicklefish, fusilier, rabbit fish, catfish, jewfish, grunter, triggerfish, mangrove snapper, sweetlip, silver biddy, grouper, threadfin bream, sharptoothed bass, ponyfish, bombay-duck, conger eel, red snapper, lizard fish, sillago-whitings, monocle bream, emperors, spadefish, snapper, eel, false trevally); **34** *Jacks, mullets, sauries, etc.* (Amberjack, barracuda, black kingfish, pomfret, mullet, hardtail scad, horse mackerel, golden trevally, threadfin, ox-eye scad, big-eye scad, rainbow runner, selar scad, yellow striped scad, round scad, queenfish); **35** *Herrings, sardines, anchovies, etc.* (Rainbow sardine, anchovy, dorab wolf-herring, indo-pacific tarpon); **36** *Tunas, bonitos, billfishes, etc.* (Longtail tuna, kawakawa (little eastern tuna), frigate tuna, sailfish, marlin, spanish mackerel); **37** *Mackerels, snoeks, cutlass fishes, etc.* (Indian mackerel, ribbon fish, japanese mackerel); **38** *Sharks and rays*; **39** *Misc. marine fishes* (Trash fishes, mixed unidentified fishes); **42** *Sea spiders, crabs, etc.* (Mud crab, pelagic crab, horse shoe crab); **45** *Shrimps, prawns, etc.* (Small shrimps, banana prawns, king prawns, giant tiger prawn, green tiger prawn, sand prawn, white prawn, yellow prawn, pink prawn, greasy back prawn, rainbow prawn, sharp-rostrum prawn, red prawn); **56** *Clams, cockles, ark shells, etc.* (Blood cockle, carpet clam, other clams/snails); **57** *Cephalopods* (Common squid, cuttlefish, octopus); **76** *Misc. Invertebrates* (Sea cucumbers, jellyfish)

Source: adapted from DOF Malaysia annual fisheries statistics 1998

Table A18: *Fisheries production performance by sector, Malaysia 1993-1998*

Marine Fisheries Sector																
Region	Inshore Fisheries Sub Sector								Deep Sea Fisheries Sub Sector							
	Q				V				Q				V			
	1993	%	1998	%	1993	%	1998	%	1993	%	1998	%	1993	%	1998	%
West Pen.	415,335	46.1	508,464	47.1	1,002.10	47.5	1,664.23	48.2	31,180	21.4	42,718	31.6	56.59	21.0	113.06	30.9
East Pen.	269,126	29.8	294,352	27.3	517.92	24.6	828.35	24.0	75,977	52.2	56,399	41.7	144.66	53.7	155.61	42.5
Sarawak	52,486	5.8	81,874	7.6	185.38	8.8	286.74	8.3	29,438	20.2	21,339	15.8	48.37	18.0	51.87	14.2
Sabah	148,552	16.5	190,992	17.7	360.33	17.1	642.83	18.6	6,115	4.2	5,235	3.9	14.01	5.2	17.25	4.7
Labuan	16,302	1.8	4,271	0.4	43.47	2.1	29.05	0.8	2,839	2.0	9,562	7.1	5.77	2.1	28.23	7.7
Total	901,810	100.0	1,079,953	100.0	2,109.21	100.0	3,451.20	100.0	145,549	100.0	135,253	100.0	269.40	100.0	366.02	100.0

Aquaculture Sector																
Region	Freshwater Aquaculture				Brackishwater Pond Culture				Marine Cage Culture				Marine Mollusks Culture			
	Q		V		Q		V		Q		V		Q		V	
	1993	1998	1993	1998	1993	1998	1993	1998	1993	1998	1993	1998	1993	1998	1993	1998
Peninsular	8,947	25,565	66.63	141.94	3,654	8,208	59.59	192.84	5,451	5,769	63.25	72.11	76,952	82,731	26.40	64.40
Sarawak	811	768	4.92	4.36	47	675	0.40	20.54	3	56	0.03	0.44	0	0	0	0
Sabah	5,800	6,850	40.98	48.99	900	2,717	12.60	95.10	740	198	16.42	11.03	2,022	110	1.21	2.55
Total	15,558	33,183	112.53	195.29	4,601	11,600	72.59	308.48	6,194	6,023	79.70	83.58	78,974	82,841	27.61	66.95

Note: ** Aquaculture - excluding seaweed production (Sabah); Q = metric ton; V = million
Website: http://agrolink.moa.my/dof/Statistics/statistics.html

Performance Indicator (1993 – 1998) % change (growth)												
SECTOR	Capture Fishery Sector				Freshwater Aquaculture		Brackishwater Aquaculture		Marine Cage Culture		Marine Mollusk Culture	
	Inshore		Deep Sea									
STATE	Q	V	Q	V	Q	V	Q	V	Q	V	Q	V
Peninsular	17.29	63.98	-7.50	33.50	185.75	113.03	124.63	223.61	5.83	14.01	7.51	143.94
Sarawak	55.99	54.68	-27.51	7.24	-5.30	-11.38	1,336.17	5,035.00	1,766.67	1,366.67	-	-
Sabah	18.45	66.39	65.26	129.93	18.10	19.55	201.89	654.76	-73.24	-32.83	-94.56	110.74
Malaysia	19.75	63.63	-7.07	35.86	113.29	73.54	152.12	324.96	-2.76	4.87	4.90	142.48

Table A19: *Ice factories and refrigeration facilities in Malaysia, 1998*

STATE	No. Ice Plants	% Total	Daily Production Capacity						Storage Capacity					
			Metric Ton	%	Average Price per Ice Block (RM)				No. Cold Rooms	Metric Ton				
					0-50 kg	51-100 kg	101-150 kg	151-200 kg		%	Ice	%	Fish	%
Perlis	1	0.63	70	1.44	-	5.50	8.30	-	13	1.89	135	1.61	414	1.60
Kedah	2	1.27	120	2.48	-	7.00	8.30	-	40	5.81	455	5.42	389	1.51
Pulau Pinang	5	3.16	693	14.30	-	-	9.00	-	118	17.15	1,114	13.27	11,623	45.05
Perak	7	4.43	275	5.67	-	7.19	10.10	-	16	2.33	321	3.83	560	2.17
Selangor	5	3.16	402	8.30	8.00	-	6.00-9.00	-	62	9.01	572	6.82	485	1.88
Malacca	2	1.27	60	1.24	-	-	12.00	-	45	6.54	58	0.69	430	1.67
Negeri Sembilan	-	0.00	-	0.00	-	-	-	-	-	0.00	-	0.00	-	0.00
West Johore	5	3.16	258	5.32	3.00-9.00	6.00-10.00	-	-	8	1.16	195	2.32	466	1.81
East Johore	2	1.27	120	2.48	2.80-3.60	7.00-9.60	-	-	15	2.18	333	3.97	5	0.02
Kelantan	10	6.33	491	10.13	3.00	-	6.00-9.70	-	19	2.76	532	6.34	114	0.44
Terengganu	6	3.80	456	9.41	-	6.00	7.00	10.00	41	5.96	742	8.84	692	2.68
Pahang	6	3.80	598	12.34	-	-	8.00	8.50	41	5.96	495	5.90	125	0.48
Sarawak	45	28.48	500	10.32	7.00	3.60-9.00	10.00	-	121	17.59	1,804	21.50	6,519	25.27
FT Labuan	4	2.53	204	4.21	5.00	5.00	16.00	12.00	3	0.44	148	1.76	280	1.09
Sabah	58	36.71	599	12.36	3.90	5.50	11.00	-	146	21.22	1,488	17.73	3,697	14.33
TOTAL	158	100	4,846	100					688	100	8,392	100	25,799	100

Source: DOF Malaysia annual fisheries statistics

Table A20: *Disposition of marine fish landings, Peninsular Malaysia 1998 (in metric tons)*

DISPOSITION CHANNEL	West Coast	% Sub Total	East Coast	% Sub Total	Grand Total	% Grand Total
Disposed Fresh	339,447	61.59	301,049	85.83	640,496	71.01
Disposed for Freezing	2,420	0.44	0	0.00	2,420	0.27
Disposed for Canning	NA		NA	NA	NA	NA
Disposed for Curing						
Smoked, Salted or Smoked	29,111	5.28	4,105	1.17	33,216	3.68
Steamed or Boiled	2,070	0.38	0	0.00	2,070	0.23
FERMENTED	28,838	5.23	2,696	0.77	31,534	3.50
OTHERS	859	0.16	12,344	3.52	13,203	1.46
Disposed for Reduction	128,374	23.29	23,763	6.77	152,137	16.87
Disposed for Others	4,077	0.74	6,794	1.94	10,871	1.21
TOTAL	551,182	100%	350,751	100%	901,933	100%
Source: adapted from DOF Malaysia annual fisheries statistics						

Table A21: *Processed fish products, Peninsular Malaysia 1998 (in metric tons)*

PROCESSED PRODUCTS	West Coast	% Sub Total	East Coast	% Sub Total	Grand Total	% Grand Total
Salted and Dried Fish	2,931.61	3.81	1,725.58	6.72	4,657.19	4.53
Dried Anchovies	4,949.52	6.43	275.50	1.07	5,225.02	5.09
Dried Shrimp	294.32	0.38	0.00	0.00	294.32	0.29
Dried Cuttle Fish	10.29	0.01	93.79	0.37	104.08	0.10
Dried Jellyfish	140.20	0.18	0.00	0.00	140.20	0.14
Dried Shellfish	114.12	0.15	0.00	0.00	114.12	0.11
Smoked Fish	0.00	0.00	1.50	0.01	1.50	0.00
Manure Fish	20,986.36	27.25	3,110.62	12.12	24,096.98	23.46
Fish Meal	33,073.40	42.94	6,695.25	26.08	39,768.65	38.72
Shrimp Paste	41.40	0.05	0.00	0.00	41.40	0.04
Prawn/Cuttlefish Paste	3,166.49	4.11	362.70	1.41	3,529.19	3.44
Pickled Shrimp	25.00	0.03	0.00	0.00	25.00	0.02
Ferment Anchovies	0.00	0.00	113.20	0.44	113.20	0.11
Fish Ball	6,554.69	8.51	254.25	0.99	6,808.94	6.63
CuttleFish Ball	30.75	0.04	172.60	0.67	203.35	0.20
Fish Cake	158.38	0.21	226.36	0.88	384.74	0.37
Fish Paste	20.59	0.03	0.00	0.00	20.58	0.02
Surimi	974.25	1.26	24.89	0.10	999.14	0.97
Fish Cracker	188.10	0.24	12,613.33	49.14	12,801.43	12.47
Shrimp Cracker	14.70	0.02	0.00	0.00	14.70	0.01
Satay Fish	71.81	0.09	0.00	0.00	71.81	0.07
Frozen CuttleFish	2,121.00	2.75	0.00	0.00	2,121.00	2.07
Frozen Shrimp	666.09	0.86	0.00	0.00	666.09	0.65
Boiled Fish	493.64	0.64	0.00	0.00	493.64	0.48
Total	77,026.72	100.00	25,669.57	100.00	102,696.29	100.00
Source: adapted from DOF Malaysia annual fisheries statistics						

Table A22: *Number and area, number of culturists by culture system and state, Malaysia 1998*

FRESHWATER AQUACULTURE

State	Earthen Pond Culture			Ex-Mining Pool			Cage Culture			Cement Tank Culture			Pen Culture		
	units	area (ha)	no. of culturist	units	area (ha)	no. of culturist	units	area (m^2)	no. of culturist	units	area (m^2)	no. of culturist	units	area (ha)	no. of culturist
Perlis	147	28.85	100	0	0.00	0	36	625.00	6	0	0.00	0	0	0.00	0
Kedah	1,391	180.75	564	0	0.00	0	9	222.33	1	5	245.62	3	14	1.40	14
Penang	127	17.92	60	0	0.00	0	0	0.00	0	0	0.00	0	0	0.00	0
Perak	2,246	627.19	1,300	233	889.72	146	724	11,045.15	61	53	10,000.00	11	206	31.51	72
Selangor	1,806	458.66	625	106	194.18	53	737	13,223.46	12	97	18,329.34	22	0	0.00	0
N.Sembilan	1,633	301.52	1,050	9	14.75	9	912	13,506.63	7	165	6,731.64	32	0	0.00	0
Melaka	509	102.16	299	0	0.00	0	11	99.00	1	28	1,376.87	15	0	0.00	0
Johor	1,489	199.26	431	0	0.00	0	166	1,725.45	5	220	5,091.37	60	0	0.00	0
Pahang	2,732	985.95	2,832	3	64.00	60	2,762	39,642.16	592	51	686.78	25	0	0.00	0
Terengganu	1,300	111.94	706	0	0.00	0	1,381	24,610.44	170	188	3,223.86	75	60	3.60	60
Kelantan	2,006	202.27	1,077	0	0.00	0	191	4,366.08	49	100	3,809.92	52	655	185.63	655
Sarawak	1,708	156.80	1,235	0	0.00	0	895	21,480.00	372	25	624.00	8	47	1.13	37
Sabah	14,012	1,385.70	4,920	0	0.00	0	0	0.00	0	0	0.00	0	0	0.00	0
TOTAL	31,106	4,758.97	15,199	351	1162.65	268	7,824	130,545.7	1,276	932	50,119.40	303	982	223.27	838

BRACKISH WATER AQUACULTURE

State	Earthen Pond Culture			Cage Culture			Cockle Culture			Mussel Culture			Oyster Culture		
	units	area (ha)	no. of culturist	units	area (m^2)	no. of culturist	units	area (m^2)	no. of culturist	units	area (m^2)	no. of culturist	units	area (ha)	no. of culturist
Perlis	52	35.73	8	100	250.00	2	0	0.00	0	0	0.00	0	0	0.00	0
Kedah	885	676.10	144	2,916	31,693.22	110	2	39.29	2	5	761.07	3	22	1,460.10	2
Penang	325	192.31	139	23,300	209,633.00	319	63	768.00	51	0	0.00	0	20	153.00	2
Perak	1,138	708.82	148	20,185	159,129.00	207	206	2,377.86	203	0	0.00	0	0	0.00	0
Selangor	715	370.69	134	6,479	111,523.44	31	26	1,036.07	26	5	561.00	4	0	0.00	0
N.Sembilan	68	59.00	4	0	0.00	0	0	0.00	0	25	4,339.00	25	0	0.00	0
Melaka	76	44.23	20	184	3,132.57	3	3	50.79	3	48	6,317.14	37	0	0.00	0
Johor	692	669.44	95	5,375	122,896.68	169	0	0.00	0	332	51,593.57	77	7	7,000.00	10
Pahang	189	134.51	18	29	263.00	8	0	0.00	0	0	0.00	0	0	0.00	0
Terengganu	219	109.87	49	781	7,764.04	63	0	0.00	0	0	0.00	0	19	16,887.00	27
Kelantan	157	75.37	131	1,056	21,812.00	131	0	0.00	0	0	0.00	0	33	1,391.46	12
Sarawak	403	126.08	162	860	8,061.62	629	0	0.00	0	0	0.00	0	0	0.00	0
Sabah	1,463	2,646.33	122	1,202	31,071.00	278	0	0.00	0	109	1,930.00	108	103	50,350.20	100
TOTAL	6,382	5,848.48	1,174	62,467	707,229.57	1,950	300	4,272.01	285	524	65,501.78	254	204	77,241.76	153

Source: DOF Malaysia annual fisheries statistics

Table A23: *Estimated fish production by culture system, Malaysia 1998*

QUANTITY (metric ton)											
STATE	FRESHWATER AQUACULTURE					BRACKISH WATER AQCAULTURE					TOTAL
	Pond Culture	Ex-Mining Pool	Cage Culture	Cement Tank Culture	Pen Culture	Pond Culture	Cage Culture	Cockle Culture	Mussel Culture	Oyster Culture	
Perlis	54.76	0.00	2.80	0.00	0.00	154.67	25.98	0.00	0.00	0.00	238.21
Kedah	324.13	0.00	4.25	2.68	3.32	529.93	63.52	175.05	6.84	5.32	1,115.04
Penang	106.96	0.00	0.00	0.00	0.00	957.12	1,836.16	13,167.08	0.00	3.24	16,070.56
Perak	2,158.89	3,357.64	61.61	267.23	133.82	2,579.77	1,386.92	54,506.52	0.00	0.00	64,452.40
Selangor	4,481.99	233.72	123.28	413.86	0.00	1,453.74	1,194.03	13,787.63	0.67	0.00	21,688.92
N. Sembilan	1,043.88	19.41	264.77	19.84	0.00	122.80	0.00	0.00	43.93	0.00	1,514.63
Melaka	616.33	0.00	6.80	0.00	0.00	83.20	5.69	80.50	190.89	0.00	983.41
Johor	1,878.68	0.00	7.26	33.89	0.00	1,357.52	1,188.59	0.00	716.90	5.68	5,188.52
Pahang	7,582.14	7.03	716.10	1.20	0.00	825.08	1.48	0.00	0.00	0.00	9,133.03
Terengganu	179.20	0.00	843.96	23.07	0.00	99.42	36.89	0.00	0.00	39.98	1,222.52
Kelantan	420.12	0.00	8.99	1.52	159.14	44.73	30.06	0.00	0.00	0.33	664.89
Sarawak	768.30	0.00	0.00	0.00	0.00	675.12	55.80	0.00	0.00	0.00	1,499.22
Sabah	6,850.00	0.00	0.00	0.00	0.00	2,717.00	198.00	0.00	27.14	83.15	9,875.29
TOTAL	26,465.38	3,617.80	2,039.82	763.29	296.28	11,600.10	6,023.12	81,716.78	986.37	137.70	133,646.64
WHOLESALE VALUE ('000 RM)											
STATE	FRESHWATER AQUACULTURE					BRACKISH WATER AQCAULTURE					TOTAL
	Pond Culture	Ex-Mining Pool	Cage Culture	Cement Tank Culture	Pen Culture	Pond Culture	Cage Culture	Cockle Culture	Mussel Culture	Oyster Culture	
Perlis	182.25	0.00	9.49	0.00	0.00	3,085.66	311.76	0.00	0.00	0.00	3,589.16
Kedah	1,196.32	0.00	17.72	9.84	13.84	11,918.31	966.51	131.29	7.11	53.20	14,314.14
Penang	409.82	0.00	0.00	0.00	0.00	15,072.61	17,746.27	9,216.96	0.00	46.98	42,492.64
Perak	8,829.70	11,286.28	372.48	1,019.91	508.99	71,989.70	19,084.27	43,605.22	0.00	0.00	156,696.55
Selangor	16,302.44	958.75	600.36	1,995.76	0.00	33,944.94	16,256.07	10,064.97	0.65	0.00	80,123.94
N. Sembilan	4,341.69	70.90	1,005.41	64.33	0.00	3,396.40	0.00	0.00	57.11	0.00	8,935.84
Melaka	2,258.16	0.00	21.37	0.00	0.00	2,328.35	60.71	80.50	156.53	0.00	4,905.62
Johor	9,381.98	0.00	34.21	123.20	0.00	31,716.64	17,041.19	0.00	315.44	154.33	58,766.99
Pahang	67,840.24	29.12	4,727.52	4.84	0.00	16,326.82	17.28	0.00	0.00	0.00	88,945.82
Terengganu	834.34	0.00	4,319.84	95.26	0.00	2,077.60	364.29	0.00	0.00	502.95	8,194.28
Kelantan	2,256.47	0.00	44.15	6.77	768.99	988.45	261.08	0.00	0.00	3.71	4,329.62
Sarawak	4,359.35	0.00	0.00	0.00	0.00	20,542.52	435.52	0.00	0.00	0.00	25,337.39
Sabah	48,985.00	0.00	0.00	0.00	0.00	95,095.00	11,034.00	0.00	54.28	2,494.50	157,662.78
TOTAL	167,177.76	12,345.05	11,152.55	3,319.91	1,291.82	308,483.00	83,578.95	63,098.94	591.12	3,255.67	654,294.77

Source: DOF Malaysia annual fisheries statistics

Table A24: *Estimated output (metric ton) per unit aquaculture production by culture system and state, Malaysia 1998*

FRESHWATER AQUACULTURE

State	Earthen Pond Culture			Ex-Mining Pool			Cage Culture			Cement Tank Culture			Pen Culture		
	mt/unit	mt/ha	mt per farm	mt/unit	mt/ha	mt per farm	mt/unit	kg/m^3	mt per farm	mt/unit	kg/m^3	mt per farm	mt/unit	mt/ha	mt per farm
Perlis	0.373	1.898	0.548				0.078	4.48	0.467						
Kedah	0.233	1.793	0.575				0.472	19.12	4.250	0.536	10.91	0.893	0.237	2.371	0.237
Penang	0.842	5.969	1.783												
Perak	0.961	3.442	1.661	14.410	3.774	22.998	0.085	5.58	1.010	5.042	26.72	24.294	0.650	4.247	1.859
Selangor	2.482	9.772	7.171	2.205	1.204	4.410	0.167	9.32	10.273	4.267	22.58	18.812			
N.Sembilan	0.639	3.462	0.994	2.157	1.316	2.157	0.290	19.60	37.824	0.120	2.95	0.620			
Melaka	1.211	6.033	2.061				0.618	68.69	6.800		0.00				
Johor	1.262	9.428	4.359				0.044	4.21	1.452	0.154	6.66	0.565			
Pahang	2.775	7.690	2.677	2.343	0.110	0.117	0.259	18.06	1.210	0.024	1.75	0.048			
Terengganu	0.138	1.601	0.254				0.611	34.29	4.964	0.123	7.16	0.308			
Kelantan	0.209	2.077	0.390				0.047	2.06	0.183	0.015	0.40	0.029	0.243	0.857	0.243
Sarawak	0.450	4.900	0.622												
Sabah	0.489	4.943	1.392												
TOTAL	0.851	5.561	1.741	10.307	3.112	13.499	0.294	18.70	2.256	0.841	15.42	2.587	0.317	1.334	0.370

BRACKISH WATER AQUACULTURE

State	Earthen Pond Culture			Cage Culture			Cockle Culture			Mussel Culture			Oyster Culture		
	mt/unit	mt/ha	mt per farm	kg/unit	Kg/m^3	mt per farm	mt/unit	mt/m^3	mt per farm	mt/unit	kg/m^3	mt per farm	mt/unit	kg/m^3	mt per farm
Perlis	2.974	4.329	19.334	259.80	103.92	12.990									
Kedah	0.599	0.784	3.680	21.78	2.00	0.577	87.525	4.455	87.525	1.422	9.34	2.37	2.418	36.44	26.600
Penang	2.945	4.977	6.886	78.81	8.76	5.756	209.001	17.145	258.178				2.349	307.06	23.490
Perak	2.267	3.640	17.431	68.71	8.72	6.700	264.595	22.923	268.505						
Selangor	2.033	3.922	10.849	184.29	10.71	38.517	530.293	13.308	530.293	0.130	1.16	0.163			
N.Sembilan	1.806	2.081	30.700							2.284	13.16	2.284			
Melaka	1.095	1.881	4.160	30.92	1.82	1.897	26.833	1.585	26.833	3.261	24.78	4.231			
Johor	1.962	2.028	14.290	221.13	9.67	7.033				0.950	6.11	4.097	22.05	22.05	15.433
Pahang	4.366	6.134	45.838	51.03	5.63	0.185									
Terengganu	0.454	0.905	2.029	47.23	4.75	0.586							26.47	29.78	18.628
Kelantan	0.285	0.593	0.341	28.47	1.38	0.229							0.11	2.67	0.309
Sarawak	1.675	5.355	4.167	64.88	6.92	0.089									
Sabah	1.857	1.027	22.270	164.73	6.37	0.712				0.498	28.12	0.503	24.22	49.54	24.945
TOTAL	1.818	1.983	9.881	96.42	8.52	3.089	272.389	19.128	286.726	1.128	9.02	2.327	15.96	42.15	21.279

Source: DOF Malaysia annual fisheries statistics (refer to Tables 16-17)

Table A25: *Trade of fisheries products statistics for Malaysia, 1994-1998 per iod*

FISHERIES EXPORTS															
DESTINATION	1994			1995			1996			1997			1998		
	Q	V	RM/KG	Q	V	RM/KG	Q	V	RM/KG	Q	V	RM/KG	Q	V	RM/KG
Japan	55.32	269.27	4.87	17.23	258.42	15.00	31.16	241.44	7.75	13.20	247.54	18.75	18.31	280.43	15.31
Singapore	54.11	124.84	2.31	32.75	94.99	2.90	31.23	113.18	3.62	22.38	103.11	4.61	20.39	114.10	5.60
Italy	17.81	40.51	2.27	5.08	68.76	13.54	4.98	64.58	12.97	5.72	78.69	13.76	6.06	111.20	18.35
Netherlands	2.26	26.77	11.85	2.57	33.89	13.19	3.04	38.49	12.66	3.67	60.41	16.46	5.32	100.33	18.84
Hong Kong	4.75	54.48	11.47	6.14	64.38	10.49	6.13	69.31	11.31	7.21	75.06	10.41	6.77	91.44	13.50
China	0.06	0.86	14.33	0.31	2.33	7.52	2.07	19.33	9.34	4.79	35.51	7.41	23.55	78.46	3.33
USA	5.29	65.80	12.44	4.15	48.76	11.75	4.23	40.75	9.63	3.47	43.73	12.60	4.93	67.42	13.68
Australia	7.65	73.89	9.66	6.24	57.02	9.14	5.45	49.07	9.00	4.59	53.41	11.64	4.21	62.49	14.83
U Kingdom	3.61	34.47	9.55	2.88	30.71	10.66	3.21	33.70	10.50	2.71	46.92	17.31	2.63	52.44	19.90
Belgium	1.22	18.52	15.18	1.05	16.75	15.95	1.28	16.92	13.22	1.47	30.70	20.88	1.54	43.91	28.55
Spain	2.38	35.47	14.90	2.59	42.70	16.49	1.48	21.51	14.53	2.08	29.72	14.29	1.88	33.25	17.72
Thailand	77.53	35.06	0.45	96.65	44.43	0.46	28.35	31.61	1.11	24.25	26.14	1.08	26.54	31.72	1.20
Others	14.74	86.00	5.83	70.21	129.08	1.84	12.34	87.04	7.05	12.07	108.65	9.00	22.40	165.11	7.37
Total	246.72	865.93	3.51	247.84	892.22	3.60	134.94	826.92	6.13	107.62	939.58	8.73	144.54	1,232.27	8.53
FISHERIES IMPORTS															
ORIGIN	1994			1995			1996			1997			1998		
	Q	V	RM/KG	Q	V	RM/KG	Q	V	RM/KG	Q	V	RM/KG	Q	V	RM/KG
Thailand	156.81	263.83	1.68	142.87	261.20	1.83	155.76	281.40	1.81	174.10	307.57	1.77	147.35	271.14	1.84
Indonesia	35.56	163.61	4.60	34.64	175.97	5.08	45.67	180.92	3.96	29.72	143.14	4.82	46.17	237.31	5.14
India	7.98	41.53	5.20	6.62	43.22	6.53	17.97	70.87	3.94	16.13	90.59	5.62	7.43	59.18	7.97
Taiwan	11.98	48.96	4.09	10.27	47.46	4.62	9.07	42.22	4.65	10.90	52.70	4.83	7.26	37.49	5.16
New Zealand	6.25	23.97	3.84	7.27	27.00	3.71	6.77	24.19	3.57	7.93	33.00	4.16	3.35	29.20	8.72
Chile	6.21	13.48	2.17	6.78	18.29	2.70	5.74	15.07	2.63	5.98	14.34	2.40	3.28	14.59	4.45
U Kingdom	3.97	15.45	3.89	7.19	25.47	3.54	8.02	31.33	3.91	5.97	33.37	5.59	4.09	27.82	6.80
Myanmar	0.33	4.62	14.00	0.36	4.69	13.03	2.77	13.51	4.88	4.67	29.37	6.29	2.67	22.55	8.45
Others	46.79	232.69	4.97	44.57	225.13	5.05	48.15	228.02	4.74	42.38	275.15	6.49	28.26	209.1	7.40
Total	275.88	808.14	2.93	260.57	828.43	1.83	299.92	887.53	2.96	297.78	979.23	3.29	249.86	908.38	3.64

Note: Q = '000 mt; V = RM million

Website: http://agrolink.moa.my/dof/Statistics/statistics.html

Table A26: *Breakdown of fisheries trade commodities by type, quantity and value, Malaysia 1996-1998*

EXPORTS								
FISHERIES COMMODITY	1995		1996		1997		1998	
	Q	V	Q	V	Q	V	Q	V
Live Fish	4,683.28	58,284,786	6,578.02	75,733,017	5,196.48	79,281,211	6,109.12	99,275,503
Fish-1	56,922.97	79,764,221	46,688.14	75,484,723	31,849.52	65,075,612	43,751.41	78,237,751
Fish-2	1,049.00	4,812,898	901.53	3,903,550	1,030.82	4,494,238	1,186.13	5,235,932
Invertebrates	99,086.35	408,241,304	35,573.95	379,989,670	44,511.39	490,221,297	47,003.65	669,879,144
Processed Products	23,493.69	284,447,808	39,587.74	270,161,177	20,203.93	287,110,822	20,412.32	328,205,992
Fish Fats and Oils	15.31	124,314	82.77	971,578	71.86	995,800	34.95	675,371
Fish Meals	3,987.84	4,160,385	2,343.72	2,270,116	1,613.35	2,060,486	20,657.72	35,815,579
Miscellaneous	58,600.94	52,387,355	3,185.77	18,404,864	3,144.62	10,336,481	5,384.41	14,948,027
TOTAL	247,839.38	892,223,071	134,941.64	826,918,695	107,621.97	939,575,947	144,539.71	1,232,273,299
IMPORTS								
FISHERIES COMMODITY	1995		1996		1997		1998	
	Q	V	Q	V	Q	V	Q	V
Live Fish	963.63	56,307,993	3,888.16	51,511,089	3,819.06	69,217,138	1,540.82	24,028,222
Fish-1	164,388.58	408,059,326	197,745.35	501,901,715	211,665.91	550,020,374	186,725.69	544,129,910
Fish-2	9,783.02	23,318,281	24,364.52	27,700,952	12,178.59	30,562,531	10,521.20	27,729,997
Invertebrates	38,151.30	199,288,138	36,874.81	178,951,839	33,087.85	188,789,756	29,547.11	203,896,314
Processed Products	16,743.75	83,005,678	15,378.24	73,794,846	13,745.37	77,505,570	11,389.82	64,916,028
Fish Fats and Oils	2,640.29	6,299,469	1,481.78	4,510,368	820.13	2,871,646	548.42	2,720,404
Fish Meals	25,199.93	35,332,326	15,624.70	28,353,211	20,341.29	37,597,406	7,781.69	20,524,684
Miscellaneous	2,697.48	16,814,292	4,560.17	20,802,732	2,117.78	22,669,669	1,801.74	20,430,736
TOTAL	260,567.98	828,425,503	299,917.73	887,526,752	297,775.98	979,234,090	249,856.49	908,376,295

Note: Fish-1 (fresh, chilled or frozen); Fish-2 (dried, salted, in brine, smoked); Invertebrates (crustaceans and mollusks - fresh, chilled, frozen, salted, dried); Processed Products (fish, crustaceans and mollusks - prepared or preserved, N.E.S.); Fish Fats and Oils (fats & oils & their fractions, of fish or marine mammals, not chemically) modified); Fish Meals (flours, meals and pellets, of fish or of crustaceans, mollusks or other aquatic invertebrates, unfit for human consumption); Q – metric tons; V = Ringgit Malaysia

Tables 29-32: In the following figures, **fish products** comprised of Fish-1 and Fish-2; **non-fish products** comprised of invertebrates; **others** comprised of Processed Products, Fish Fats and Oils, Fish Meals and Miscellaneous.

Source: http://agrolink.moa.my/dof/Statistics/statistics.html

Table A27: *Malaysian fisheries trade with Indonesia and Philippines, 1994-1998 period*

Export Quantity (Q)						
Exporting Country		1994	1995	1996	1997	1998
Indonesia	Import	1.97	1.84	0.76	0.66	6.26
	Export	35.56	34.64	45.67	29.72	46.17
	BOT	**-33.59**	**-32.81**	**-44.92**	**-29.06**	**-39.91**
	% Total Exports	14.413	13.977	33.845	27.616	31.943
	% Total Imports	0.714	0.706	0.253	0.222	2.505
Philippines	Import	0.91	1.52	0.81	0.93	0.77
	Export	1.42	0.44	0.32	0.18	0.08
	BOT	**-0.51**	**1.08**	**0.49**	**0.75**	**0.69**
	% Total Exports	0.576	0.178	0.237	0.167	0.055
	% Total Imports	0.330	0.583	0.270	0.312	0.308
Export Value (V)						
Exporting Country		1994	1995	1996	1997	1998
Indonesia	Import	3.24	4.84	1.98	3.48	26.67
	Export	163.61	175.97	180.92	143.14	237.31
	BOT	**-160.37**	**-171.13**	**-178.94**	**-139.66**	**-210.64**
% Total Exports		18.894	19.723	21.879	15.234	19.258
% Total Imports		0.401	0.584	0.223	0.355	2.936
Philippines	Import	1.12	2.43	1.29	1.58	1.66
	Export	4.86	1.49	1.65	0.87	0.36
	BOT	**-3.74**	**0.94**	**-0.36**	**0.71**	**1.30**
	% Total Exports	0.561	0.167	0.200	0.093	0.029
	% Total Imports	0.139	0.293	0.145	0.161	0.183
Note: Q = '000 metric ton; V = RM million; BOT – balance of trade Website: http://agrolink.moa.my/dof/Statistics/statistics.html						

Table A28: *Real GDP (Gross Domestic Product), Sabah (at 1978 constant prices)*

GDP by Purchaser's Value	1993	1994	1995	1996	1997	1998	1999
TOTAL	7,707	7,963	8,212	8,842	9,196	8,743	9,066
Agriculture & Livestock	2,071	2,164	2,376	2,647	2,949	2,701	3,188
Forestry & Logging	760	651	533	581	449	430	276
Fishing	150	160	182	202	201	223	221
Mining & Quarrying	1,085	1,029	922	785	731	1,038	924
Manufacturing	1,048	1,132	1,152	1,322	1,359	1,143	1,108
Others	2,594	2,826	3,047	3,307	3,507	3,209	3,351
Note: GDP in RM million Website: http://www.ids.org.my							

Table A29: *Distribution of employed persons by industry in Sabah, Malaysia*

SECTOR (in '000)	1995	1996	1997	1998	1999
Agriculture	288.5	354.0	325.9	410.4	424.4
Mining & Quarrying	7.0	7.2	9.3	5.3	7.0
Manufacturing	93.1	141.4	179.9	134.1	156.3
Electricity, Gas & Water	4.4	6.1	6.6	7.1	5.9
Construction	42.2	76.6	81.9	88.7	70.1
Wholesale & Retail Trade, Restaurants and Hotel	109.5	154.3	159.0	163.1	174.6
Transport, storage and communication	30.0	42.4	43.6	41.5	53.7
Finance, insurance, real estate and business services	20.9	25.7	26.3	28.1	28.3
Community, social and personnel services	158.2	192.2	202.3	227.0	222.6
TOTAL	753.8	1,029.9	1,034.8	1,105.3	1,143.0
Source: Yearbook of Statistics Sabah 2000					

Table A30: *Land area, population size, coastline and fishing grounds of coastal districts in Sabah 2000*

ZONE	DISTRICTS	Number Fishing Villages	Estimated Fulltime Fishermen	Population Size 2000	Pop Density[1] 2000	Marine Waters (km^2)	Coastline (km)				Land Area (km^2)			
							Islands	Mainland	Lagoons	Total	Islands	Coastal	Non-coastal	Total
SSME1	Kudat	65	2,915	68,242	53.11	6,803	503	49	112	664	620	630	35	1,285
	Kota Marudu	24	713	58,841	32.95	129	33	4	33	70	2	467	1,317	1,786
	Pitas	14	650	30,854	19.85	591	18	76	102	196	2	1,291	261	1,554
	Sub Total	*103*	*4,278*	*157,937*	*34.15*	*7,523*	*554*	*129*	*247*	*930*	*624*	*2,388*	*1,613*	*4,625*
SSME2	Sandakan	30	3,987	347,334	153.08	1,703	150	98	176	424	78	2,191	0	2,269
	Beluran	81	1,568	70,900	7.86	3,381	231	154	84	469	206	5,381	3,431	9,018
	Kinabatangan	0	NA	86,783	4.95	4,515	34	134	108	276	18	7,820	9,678	17,516
	Sub Total	*111*	*5,555*	*505,017*	*17.53*	*9,599*	*415*	*386*	*368*	*1,169*	*302*	*15,392*	*13,109*	*28,803*
SSME3	Tawau	36	2,036	304,888	49.83	1,967	210	82	186	478	292	1,771	4,056	6,119
	Semporna	65	1,781	108,236	91.49	5,894	367	101	77	545	234	770	179	1,183
	Kunak	25	669	48,571	49.01	317	25	37	15	77	4	223	764	991
	Lahad Datu	49	801	156,059	23.39	3,666	114	212	32	358	29	3,815	2,828	6,672
	Sub Total	*175*	*5,287*	*617,754*	*41.28*	*11,844*	*716*	*432*	*310*	*1,458*	*559*	*6,579*	*7,827*	*14,965*
NON SSME	Kota Belud	14	1,203	72,337	51.82	1,969	19	56	41	116	4	519	873	1,396
	Tuaran	20	490	82,212	65.93	11,774	22	32	94	148	1	285	961	1,247
	Kota Kinabalu	35	1,719	354,153	1,161.16	1,581	58	33	40	131	21	165	119	305
	Penampang	0	0	130,809	264.80	273	3	12	6	21	0	69	425	494
	Papar	37	356	86,649	69.32	428	3	54	5	62	0	471	779	1,250
	Beaufort	41	718	61,698	31.10	320	22	39	36	97	2	1,072	635	1,709
	Kuala Penyu	34	851	16,511	35.89	5,704	34	81	37	152	12	448	0	460
	Sipitang	20	388	29,311	10.62	345	0	31	1	32	0	161	2,599	2,760
	Sub Total	*201*	*5,725*	*833,680*	*86.65*	*22,394*	*161*	*338*	*260*	*759*	*40*	*3,190*	*6,391*	*9,621*
SSME Area		389	15,120	1,280,708	26.51	28,966	1,685	947	925	3,557	1,485	24,359	22,549	48,393
Non-SSME Coastal		201	5,725	833,680	86.65	22,394	161	338	260	759	40	3,190	6,391	9,621
Interior				335,001	21.34								16,222	16,222
TOTAL Sabah		590	20,845	2,449,389	33.27	*51,360*	*1,846*	*1,285*	*1,185*	*4,316*	*1,525*	*27,549*	*45,162*	*74,236*

Note: 1 – population density in individuals/km^2; NA = not available; **population** excluding immigrants

Sources: *Preliminary estimates of Malaysia Population and Housing Census 2000*

Website: http://www.iczm.sabah.gov.my

Table A31: *Gross Fish Production, Sabah 1995-1999 period*

Q – metric ton		1995		1996		1997		1998		1999	
V – '000 RM		Q	V	Q	V	Q	V	Q	V	Q	V
Marine Capture											
	Finfish	141,608	318,152	155,212	357,989	150,079	416,296	170,840	499,629	179,900	536,962
	Shrimp	12,398	100,355	11,521	95,652	10,290	97,980	9,151	98,387	5,609	103,324
	Crab	3,695	11,300	3,458	9,791	3,439	12,784	5,564	18,674	11,481	19,059
	Mollusks	7,413	29,587	9,847	39,716	9,387	41,402	10,541	42,562	10,045	37,763
	Others	1,348	1,597	105	733	1,070	702	132	828	178	1,206
	Sub Total	166,462	460,992	180,143	503,880	174,265	569,164	196,227	660,079	207,213	698,315
Marine Aquaculture											
	Pond	1,700	30,600	2,200	48,400	2,900	72,500	2,717	94,579	1,843	53,364
	Cage	881	19,885	360	18,710	227	11,378	198	10,534	475	12,362
	Mussels	17	60	37	83	29	56	27	52	33	47
	Oyster	10	208	10	255	73	321	83	200	95	193
	Seaweed	1,223	1,101	1,824	2,006	1,826	1,862	1,785	3,570	3,008	6,616
	Sub Total	3,831	51,854	4,431	69,454	5,055	86,117	4,810	108,935	5,454	72,582
Freshwater Fisheries											
	Aquaculture	6,123	46,855	6,500	49,680	6,791	48,501	6,929	48,500	**	**
	Capture	1,700	10,200	1,700	10,200	1,700	10,200	1,700	10,200	**	**
	Sub Total	7,823	57,055	8,200		8,491	58,701	8,629	58,700	**	**
Fry production and freshwater ornamentals											
Fish/shrimp fries in million	Ornamental	7,022	35	4,588	23	8,466	51	2,094	42	16,100	56
	FW Fish	NA	NA	4	NA	4	NA	NA	NA	3	NA
	Shrimp	228	6,384	792	17,424	272	6,800	602	15,050	235	70
	Marine Fish	0	0	0	0	0	0	0.11	NA	0.17	NA
TOTAL		178,116	576,319	192,773	650,662	187,811	720,832	209,666	827,714	212,569	770,898

Note: *** under review, NA = not available
Source: DOF Sabah annual fisheries report

Table A32: Fishermen by gear type and district (traditional gears), Sabah 1991

ZONE	FISHING DISTRICTS	NUMBER OF FISHERMEN USING TRADITIONAL FISHING GEARS								Total
		LN		HL		OT				
		SEL	BAG	hook & line	Long line	misc. traps	crab trap	shell coll.	others	
SSME-1	Kudat	66	0	321	0	10	0	0	0	397
	Kota Marudu	0	5	3	4	0	32	12	96	151
	Pitas	0	45	35	0	0	16	0	2	98
	Sub Total	66	50	359	4	10	47	12	98	646
SSME-2	Sandakan	0	0	252	50	55	40	0	0	397
	Beluran	0	0	0	6	27	12	18	0	63
	Sub Total	0	0	252	56	82	52	18	0	460
SSME-3	Tawau	0	87	32	8	113	0	0	21	261
	Semporna	0	0	584	30	174	0	0	58	846
	Kunak	0	132	15	0	0	0	0	0	147
	Lahad Datu	0	23	204	3	46	0	0	0	276
	Sub Total	0	242	835	41	333	0	0	79	1,530
NON SSME	Kota Belud	101	0	346	0	6	22	21	0	496
	Tuaran	283	0	113	0	0	0	0	0	396
	Kota Kinabalu	74	0	397	0	11	3	0	17	502
	Papar	20	0	167	0	0	7	0	11	205
	Beaufort	0	0	22	0	0	10	0	31	63
	Kuala Penyu	0	0	11	2	2	79	0	6	100
	Sipitang	0	12	29	0	46	1	0	0	88
	Sub Total	478	12	1085	2	65	122	21	65	1,850
	SSME area	66	292	1446	101	425	99	30	177	2,636
	Non-SSME area	478	12	1085	2	65	122	21	65	1,850
	GRAND TOTAL	544	304	2531	103	490	221	51	242	4,486

Note: SEL – selambau; BAG – bagang; Shell Coll. – shellfish collector
Source: DOF Sabah annual fisheries statistics

Table A33: Fishermen by gear type and district (commercial gears), Sabah 1991

ZONE	FISHING DISTRICTS	NUMBER OF FISHERMEN USING COMMERCIAL FISHING GEARS							Total
		TN	SN			GN			
		Trawl Net	Fish Purse Seine	Tuna Purse Seine	Other Seine Nets	Gill net	Trammel Net	Other Gill Nets	
SSME-1	Kudat	400	0	0	0	187	52	0	639
	Kota Marudu	70	0	0	0	366	79	0	515
	Pitas	0	0	0	0	55	0	0	55
	Sub Total	470	0	0	0	608	131	0	1,209
SSME-2	Sandakan	1,895	113	0	0	501	0	0	2,509
	Beluran	562	0	0	0	282	0	0	844
	Sub Total	2,457	113	0	0	783	0	0	3,353
SSME-3	Tawau	485	25	0	0	132	64	0	706
	Semporna	132	976	84	732	651	0	0	2,575
	Kunak	20	36	66	0	18	0	0	140
	Lahad Datu	93	128	0	0	47	0	0	268
	Sub Total	730	1,165	150	732	848	64	0	3,689
NON SSME	Kota Belud	49	0	0	7	460	0	0	516
	Tuaran	0	0	0	0	112	0	0	112
	Kota Kinabalu	503	90	0	0	143	92	0	828
	Papar	0		0	0	245	12	0	257
	Beaufort	130	8	0	0	30	288	0	456
	Kuala Penyu	240	41	0	23	202	85	0	591
	Sipitang	0	24	0	2	16	123	0	165
	Sub Total	922	163	0	32	1,208	600	0	2,925
	SSME area	3,657	1,278	150	732	2,239	195	0	8,251
	Non-SSME area	922	163	0	32	1,208	600	0	2,925
	GRAND TOTAL	4,579	1,441	150	764	3,447	795	0	11,176

Source: DOF Sabah annual fisheries statistics

Table A34: Fishermen by gear type and district (traditional gears), Sabah 2000

ZONE	FISHING DISTRICTS	NUMBER OF FISHERMEN USING TRADITIONAL FISHING GEARS								Total
		LN		HL		OT				
		SEL	BAG	hook & line	Long line	misc. traps	crab trap	shell coll.	others	
SSME-1	Kudat	0	0	1,362	4	14	15	24	112	1,531
	Kota Marudu	0	0	10	0	0	16	28	0	54
	Pitas	0	46	164	3	8	37	0	26	284
	Sub Total	0	46	1,536	7	22	68	52	138	1,869
SSME-2	Sandakan	0	0	401	152	211	139	0	0	903
	Beluran	0	0	0	51	117	65	87	7	327
	Sub Total	0	0	401	203	328	204	87	7	1,230
SSME-3	Tawau	15	478	154	64	145	27	0	30	913
	Semporna	0	0	489	164	45	47	0	81	826
	Kunak	0	360	88	0	10	0	0	0	458
	Lahad Datu	8	57	330	0	44	5	0	7	451
	Sub Total	23	895	1,061	228	244	79	0	118	2,648
NON SSME	Kota Belud	42	0	522	7	0	40	80	80	771
	Tuaran	242	0	73	0	0	58	0	0	373
	Kota Kinabalu	84	0	420	0	17	2	0	28	551
	Papar	62	0	114	0	0	7	0	0	183
	Beaufort	0	0	36	0	0	80	0	101	217
	Kuala Penyu	0	0	90	30	0	50	0	0	170
	Sipitang	0	0	78	0	0	1	0	0	79
	Sub Total	430	0	1,333	37	17	238	80	209	2,344
SSME area		23	941	2,998	438	594	351	139	263	5,747
Non-SSME area		430	0	1,333	37	17	238	80	209	2,344
GRAND TOTAL		453	941	4,331	475	611	589	219	472	8,091
Fishermen Breakdown by Ethnic Group		SEL	BAG	hook & line	long line	misc. traps	crab trap	shell coll.	others	Total
Bumiputera		453	465	3,322	290	483	493	219	327	6,052
Chinese		0	0	26	0	1	0	0	0	27
Others		0	476	983	185	127	96	0	145	2,012
GRAND TOTAL		453	941	4,331	475	611	589	219	472	8,091

Note: SEL – selambau; BAG – bagang; Shell Coll. – shellfish collector
Source: DOF Sabah annual fisheries statistics

Table A35: Fishermen by gear type and district (commercial gears), Sabah 2000

ZONE	FISHING DISTRICTS	NUMBER OF FISHERMEN USING COMMERCIAL FISHING GEARS							Total
		TN	SN			GN			
		Trawl Net	Fish Purse Seine	Tuna Purse Seine	Other Seine Nets	Gill net	Trammel Net	Other Gill Nets	
SSME-1	Kudat	563	113	0	71	556	81	0	1,384
	Kota Marudu	18	0	0	0	297	344	0	659
	Pitas	24	0	0	0	249	93	0	366
	Sub Total	605	113	0	71	1,102	518	0	2,409
SSME-2	Sandakan	2,111	106	0	0	867	0	0	3,084
	Beluran	581	0	0	0	522	138	0	1,241
	Sub Total	2,692	106	0	0	1,389	138	0	4,325
SSME-3	Tawau	608	0	0	0	243	272	0	1,123
	Semporna	128	307	255	23	226	9	7	955
	Kunak	0	154	30	0	27	0	0	211
	Lahad Datu	120	66	0	6	156	0	2	350
	Sub Total	856	527	285	29	652	281	9	2,639
NON SSME	Kota Belud	4	0	0	0	319	109	0	432
	Tuaran	0	0	0	0	90	27	0	117
	Kota Kinabalu	740	121	0	101	126	80	0	1,168
	Papar	5	6	0	0	142	20	0	173
	Beaufort	48	59	0	0	86	308	0	501
	Kuala Penyu	12	35	0	0	302	332	0	681
	Sipitang	161	44	0	0	9	95	0	309
	Sub Total	970	265	0	101	1,074	971	0	3,381
SSME area		4,153	746	285	100	3,143	937	9	9,373
Non-SSME area		970	265	0	101	1,074	971	0	3,381
GRAND TOTAL		5,123	1,011	285	201	4,217	1,908	9	12,754
Fishermen Breakdown by Ethnic Group		Trawl Net	Fish Purse Seine	Tuna Purse Seine	Other Seine Nets	Gill net	Trammel Net	Other Gill Nets	TOTAL
Bumiputera		2,347	389	92	175	3,909	1,864	7	8,783
Chinese		144	53	0	0	15	4	0	216
Others		2,632	569	193	26	293	40	2	3,755
GRAND TOTAL		5,123	1,011	285	201	4,217	1,908	9	12,754
Source: DOF Sabah annual fisheries statistics									

Note ** Excluding fishermen involved in the operation of other seine nets and GN category, commercial fishermen only make up 31% (6,419) of the commercial fishermen population

Table A36: *Distribution of fishermen by gear type and district in Sabah, 1991*

ZONE	DISTRICT	Number of Fishermen by Gear Group							Number of Gears in Operat ion						
		Total	TN	PS	GN	LN	HL	OT*	Total	TN	PS	GN	LN	HL	OT
SSME1	Kudat	1,036	400	0	239	66	321	10	577	182	0	244	13	122	16
	Kota Marudu	666	70	0	445	5	7	139	377	28	0	256	2	4	87
	Pitas	153	0	0	55	45	35	18	88	0	0	33	22	24	9
	Sub Total	1,855	470	0	739	116	363	167	1,042	210	0	533	37	150	112
SSME2	Sandakan	2,906	1,895	113	501	0	302	95	1,226	766	4	250	0	126	80
	Beluran	907	562	0	282	0	6	57	455	264	0	145	0	3	43
	Sub Total	3,813	2,457	113	783	0	308	152	1,681	1,030	4	395	0	129	123
SSME3	Tawau	967	485	25	196	87	40	134	594	151	2	191	87	39	124
	Semporna	3,421	132	1,792	651	0	614	232	790	22	181	198	0	293	96
	Kunak	287	20	102	18	132	15	0	102	4	17	10	66	5	0
	Lahad Datu	544	93	128	47	23	207	46	289	32	22	28	10	168	29
	Sub Total	5,219	730	2,047	912	242	876	412	1,775	209	222	427	163	505	249
NON SSME	Kota Belud	1,012	49	7	460	101	346	49	531	11	1	323	15	146	35
	Tuaran	508	0	0	112	283	113	0	148	0	0	55	54	39	0
	K Kinabalu	1,330	503	90	235	74	397	31	457	120	11	155	11	118	42
	Papar	462	0	0	257	20	167	18	217	0	0	129	3	80	5
	Beaufort	519	130	8	318	0	22	41	431	51	3	314	0	22	41
	Kuala Penyu	691	240	64	287	0	13	87	219	48	12	81	0	4	74
	Sipitang	253	0	26	139	12	29	47	188	0	12	111	5	26	34
	Sub Total	4,775	922	195	1,808	490	1,087	273	2,191	230	39	1,168	88	435	231
SSME Area		10,887	3,657	2,160	2,434	358	1,547	731	4,498	1,449	226	1,355	200	784	484
Non-SSME Area		4,775	922	195	1,808	490	1,087	273	2,191	230	39	1,168	88	435	231
TOTAL Sabah		15,662	4,579	2,355	4,242	848	2,634	1,004	6,689	1,679	265	2,523	288	1,219	715

Note: TN = trawl nets, SN = seine nets, GN = gill nets, LN = lift nets, HL = hook & line, OT = others – misc. static traditional gears
* OT – number of gears deployed per fishermen
Source: DOF Sabah annual fisheries statistics

Table A37: *Distribution of fishermen per gear type and number of fishing gears by districts in Sabah, 2000*

ZONE	DISTRICT	Number of Fishermen Deployed per Gear Unit							Number of Gears in Operation						
		Total	TN	PS	GN	LN	HL	OT*	Total	TN	PS	GN	LN	HL	OT
SSME1	Kudat	1.55	3.99	7.36	1.43		1.76	2.98	1,878	141	25	444	0	776	492
	Kota Marudu	0.59	3.00		1.09		0.24	12.89	1,202	6	0	588	0	41	567
	Pitas	1.31	3.00		1.55	1.00	1.61	1.66	497	8	0	221	46	104	118
	Sub Total	1.20	3.90	7.36	1.29	1.00	1.68	4.20	3,577	155	25	1,253	46	921	1,177
SSME2	Sandakan	0,42	3.09	21.20	1.59		0.20	16.13	9,592	683	5	546	0	2,714	5,644
	Beluran	0.85	3.44		0.85		0.60	2.93	1,841	169	0	777	0	85	810
	Sub Total	0.49	3.16	21.20	1.15		0.22	10.31	11,433	852	5	1,323	0	2799	6,454
SSME3	Tawau	0.75	5.53		1.00	1.24	1.00	7.38	2,730	110	0	515	397	218	1,490
	Semporna	0.73	2.84	6.22	1.29		1.52	9.73	2,441	45	94	188	0	430	1,684
	Kunak	2.05		13.14	3.00	3.00	1.83	13.60	327	0	14	9	120	48	136
	Lahad Datu	1.71	3.87	4.50	1.44	2.32	1.51	1.14	468	31	16	110	28	219	64
	Sub Total	0.89	4.60	6.78	1.15	1.68	1.41	7.65	5,966	186	124	822	545	915	3,374
NON SSME	Kota Belud	0.52	2.00		0.44	1.31	0.61	2.30	2,326	2	0	969	32	863	460
	Tuaran	0.25			1.54	6.54	0.62	30.00	1,970	0	0	76	37	117	1,740
	K Kinabalu	2.49	4.11	5.41	1.11	4.20	3.36	2.98	691	180	41	185	20	125	140
	Papar	1.26	5.00	3.00	1.74	5.17	1.14	10.57	282	1	2	93	12	100	74
	Beaufort	0.40	2.29	2.19	1.09		0.88	7.48	1,804	21	27	362	0	41	1,353
	Kuala Penyu	0.44	3.00	1.59	1.28		0.40	21.98	1,919	4	22	494	0	300	1,099
	Sipitang	0.99	3.93	4.89	1.18		0.33	20.00	392	41	9	88	0	234	20
	Sub Total	0.61	3.90	3.62	0.90	4.26	0.77	8.98	9,384	249	101	2,267	101	1,780	4,886
SSME Area		0.72	3.50	7.34	1.20	1.63	0.74	8.28	20,976	1,193	154	3,398	591	4,635	11,005
Non-SSME Area		0.61	3.90	3.62	0.90	4.26	0.77	8.98	9,384	249	101	2,267	101	1,780	4,886
TOTAL Sabah		0.69	3.55	5.87	1.08	2.01	0.75	8.40	30,360	1,442	255	5,665	692	6,415	15,891

Note: TN = trawl nets, SN = seine nets, GN = gill nets, LN = lift nets, HL = hook & line, OT = others – misc. static traditional gears
* OT – number of gears deployed per fishermen
Source: DOF Sabah annual fisheries statistics

Table A38: *Number of fishing gears and vessels by gear group, Sabah 1991*

Gear Group	GEAR TYPE	TOTAL Gears	Total Vessels	NM vessels	OE Vessels	IE Vessels	Breakdown of IE Vessels by GRT Class							
							< 5	5-10	10-15	15-20	20-25	25-40	40-70	>70
TN	Trawl Net	1,679	1,679	0	0	1,679	43	593	313	215	232	239	43	1
PS	Fish Purse Seine	112	112	0	16	96	16	24	15	9	8	10	8	6
	Tuna Purse Seine	25	25	0	0	25	13	5	0	0	7	0	0	0
	Other Seine Net	128	101	13	88	0	0	0	0	0	0	0	0	0
GN	Gill Net	1,871	1,845	701	1,052	92	30	44	4	4	2	6	2	0
	Trammel Net	652	652	21	616	15	0	4	0	0	0	10	0	1
LN	Selambau	96	96	0	96	0	0	0	0	0	0	0	0	0
	Bagang	192	192	47	145	0	0	0	0	0	0	0	0	0
HL	Ordinary hook & line	1,167	1,137	313	624	200	103	64	17	11	2	0	0	3
	Tuna Long Line	52	52	15	29	8	5	2	0	0	0	0	0	1
	Others HL	0	0	0	0	0	0	0	0	0	0	0	0	0
OT	Portable Trap	141	114	54	51	9	9	0	0	0	0	0	0	0
	Kelong Stake	142	136	28	96	12	11	1	0	0	0	0	0	0
	Pancang Stake	14	7	5	2	0	0	0	0	0	0	0	0	0
	Barrier Net	38	38	1	37	0	0	0	0	0	0	0	0	0
	Crab Trap	163	163	128	35	0	0	0	0	0	0	0	0	0
	Shellfish Collector	28	28	20	8	0	0	0	0	0	0	0	0	0
	Others	189	185	94	91	0	0	0	0	0	0	0	0	0
	GRAND TOTAL	6,689	6,562	1,440	2,986	2,136	230	737	349	239	251	265	53	12

Note: TN = trawl net; GN = gill net; LN = lift net; HL = hook & line; OT = other gears
NM = non-motorized; OE = outboard engine; IE = inboard engine
IE fishing vessels with unknown GRT as considered to be under the <5 GRT category
Source: DOF Sabah SMPP records

Table A39: *Number of fishing gears and vessels by gear group, Sabah 2000*

Gear Group	GEAR TYPE	TOTAL Gears	Total Vessels	NM vessels	OE Vessels	IE Vessels	Breakdown of IE Vessels by GRT Class							
							< 5	5-10	10-15	15-20	20-25	25-40	40-70	>70
TN	Trawl Net	1,442	1,422	0	6	1,416	67	292	262	183	196	380	35	1
PS	Fish Purse Seine	132	124	0	11	113	25	24	12	10	9	13	15	5
	Tuna Purse Seine	42	42	0	2	40	17	20	1	2	0	0	0	0
	Other Seine Net	81	56	4	41	11	4	5	2	0	0	0	0	0
GN	Gill Net	3,546	2,744	863	1,605	276	150	104	12	10	0	0	0	0
	Trammel Net	2,119	1,612	267	1,279	66	66	0	0	0	0	0	0	0
LN	Selambau	120	86	2	84	0	0	0	0	0	0	0	0	0
	Bagang	572	270	40	230	0	0	0	0	0	0	0	0	0
HL	Ordinary hook & line	5,403	2,367	599	728	1,040	710	208	79	24	14	4	1	0
	Tuna Long Line	880	360	125	100	135	83	45	0	0	1	5	1	0
	Others HL	132	7	7	0	0	0	0	0	0	0	0	0	0
OT	Portable Trap	3,314	294	103	167	24	16	3	3	2	0	0	0	0
	Kelong Stake	139	94	47	31	16	14	2	0	0	0	0	0	0
	Pancang Stake	35	35	0	35	0	0	0	0	0	0	0	0	0
	Barrier Net	20	5	0	5	0	0	0	0	0	0	0	0	0
	Crab Trap	11,250	491	236	217	38	37	1	0	0	0	0	0	0
	Shellfish Collector	383	134	103	18	13	13	0	0	0	0	0	0	0
	Others	750	313	128	94	91	34	45	12	0	0	0	0	0
GRAND TOTAL		30,360	10,456	2,524	4,653	3,279	1,236	749	383	231	220	402	52	6

Note: TN = trawl net; GN = gill net; LN = lift net; HL = hook & line; OT = other gears
NM = non-motorized; OE = outboard engine; IE = inboard engine
IE fishing vessels with unknown GRT as considered to be under the <5 GRT category
Source: DOF Sabah SMPP records

Table A40: *Distribution of fishing vessel type by district in Sabah, 1991*

ZONE	DISTRICTS	Number of Fishing Vessels				Number of Inboard Engine (IE) Vessels by GRT (Gross Tonnage)							
		Total	NB	OE	IE	<5	5-10	10-15	15-20	20-25	25-40	40-70	>70
SSME1	Kudat	577	70	232	275	15	110	51	37	22	32	8	0
	Kota Marudu	377	161	188	28	2	14	9	2	0	1	0	0
	Pitas	88	15	65	8	0	0	0	0	1	5	2	0
	Sub Total	1,042	246	485	311	17	124	60	39	23	38	10	0
SSME2	Sandakan	1,226	206	141	879	74	240	172	135	132	114	6	6
	Beluran	441	93	68	280	9	214	2	0	53	2	0	0
	Sub Total	1,667	299	209	1,159	83	454	174	135	185	116	6	6
SSME3	Tawau	585	155	277	153	1	35	53	33	15	16	0	0
	Semporna	754	180	493	81	15	25	20	10	6	4	1	0
	Kunak	102	23	55	24	2	5	0	0	10	6	1	0
	Lahad Datu	248	71	61	116	77	21	5	8	2	3	0	0
	Sub Total	1,689	429	886	374	95	86	78	51	33	29	2	0
NON SSME	Kota Belud	531	322	169	40	30	10	0	0	0	0	0	0
	Tuaran	148	0	148	0	0	0	0	0	0	0	0	0
	K Kinabalu	430	50	236	144	1	17	23	8	8	51	31	5
	Papar	217	11	205	1	1	0	0	0	0	0	0	0
	Beaufort	431	10	370	51	3	26	14	6	1	1	0	0
	Kuala Penyu	219	69	94	56	0	20	0	0	1	30	4	1
	Sipitang	188	4	184	0	0	0	0	0	0	0	0	0
	Sub Total	2,164	466	1,406	292	35	73	37	14	10	82	35	6
SSME Area		4,398	974	1,580	1,844	195	664	312	225	241	183	18	6
Non-SSME Area		2,164	466	1,406	292	35	73	37	14	10	82	35	6
TOTAL Sabah		6,562	1,440	2,986	2,136	230	737	349	239	251	265	53	12

Note: NM = non motorized boats; OE = outboard engine fishing boats; IE = inboard engine fishing vessels; unknown GRT included under the <5 GRT category
Source: DOF Sabah annual fisheries statistics

Table A41: *Distribution of fishing vessel type by district in Sabah, 2000*

ZONE	DISTRICTS	Number of Fishing Vessels				Number of Inboard Engine (IE) Vessels by GRT (Gross Tonnage)							
		Total	NB	OE	IE	<5	5-10	10-15	15-20	20-25	25-40	40-70	>70
SSME1	Kudat	1,266	75	255	936	511	220	96	41	21	38	9	0
	Kota Marudu	556	129	390	37	33	2	2	0	0	0	0	0
	Pitas	418	131	220	67	65	2	0	0	0	0	0	0
	Sub Total	2,240	335	865	1,040	609	224	98	41	21	38	9	0
SSME2	Sandakan	976	178	634	854	58	201	174	109	101	200	6	5
	Beluran	1699	485	360	164	23	70	23	9	11	28	0	0
	Sub Total	2,675	663	994	1,018	81	271	197	118	112	228	6	5
SSME3	Tawau	1115	295	670	150	40	5	5	30	43	25	2	0
	Semporna	900	283	165	452	338	59	20	18	12	5	0	0
	Kunak	196	90	94	12	0	0	0	0	4	7	1	0
	Lahad Datu	366	112	108	146	111	9	9	4	4	9	0	0
	Sub Total	2,577	780	1,037	760	489	73	34	52	63	46	3	0
NON SSME	Kota Belud	776	343	340	93	0	92	0	1	0	0	0	0
	Tuaran	258	61	162	35	0	35	0	0	0	0	0	0
	K Kinabalu	515	15	254	246	29	19	37	16	23	89	32	1
	Papar	166	20	145	1	0	1	0	0	0	0	0	0
	Beaufort	486	65	383	38	14	18	4	1	1	0	0	0
	Kuala Penyu	569	239	323	7	1	1	2	0	0	1	2	0
	Sipitang	194	3	150	41	13	15	11	2	0	0	0	0
	Sub Total	2,964	746	1,757	461	57	181	54	20	24	90	34	1
SSME Area		7,492	1,778	2,896	2,818	1,179	568	329	211	196	312	18	5
Non-SSME Area		2,964	746	1,757	461	57	181	54	20	24	90	34	1
TOTAL Sabah		10,456	2,524	4,653	3,279	1,236	749	383	231	220	402	52	6

Note: NM = non motorized boats; OE = outboard engine fishing boats; IE = inboard engine fishing vessels; unknown GRT included under the <5 GRT category
Source: DOF Sabah annual fisheries statistics

Table A42: *Marine fish landings by gear group and fishing zone, Sabah*

FISHING ZONE	FISHING DISTRICT	1991 Fish Landings (metric ton)				1999 Fish Landings (metric ton)				% Change 1991-1999		
		COM	TRAD	Sub Total	% Total	COM	TRAD	Sub Total	% Total	COM	TRAD	Sub Total
SSME-1	Kudat	9,851	1,261	11,112	10.25	27,759	6,432	34,191	16.50	181.79	410.07	207.69
	Kota Marudu	357	82	439	0.40	326	29	355	0.17	-8.68	-64.63	-19.13
	Pitas	66	144	210	0.19	138	330	468	0.23	109.09	129.17	122.86
	Sub Total	10,274	1,487	11,761	10.85	28,223	6,791	35,014	16.90	174.70	356.69	197.71
SSME-2	Sandakan	15,917	4,371	20,288	18.71	20,289	9,127	29,416	14.20	27.47	108.81	44.99
	Beluran	4,151	2,122	6,273	5.78	3,886	406	4,292	2.07	-6.38	-80.87	-31.58
	Sub Total	20,068	6,493	26,561	24.49	24,175	9,533	33,708	16.27	20.47	46.82	26.91
SSME-3	Tawau	3,510	1,202	4,712	4.35	13,743	5,731	19,474	9.40	291.54	376.79	313.29
	Semporna	3,463	701	4,164	3.84	9,742	2,268	12,010	5.80	181.32	223.54	188.42
	Kunak	6,839	4,062	10,901	10.05	19,221	3,946	23,167	11.18	181.05	-2.86	112.52
	Lahad Datu	885	1,975	2,860	2.64	4,038	10,824	14,862	7.17	356.27	448.05	419.65
	Sub Total	14,697	7,940	22,637	20.88	46,744	22,769	69,513	33.55	218.05	186.76	207.08
NON SSME AREA	Kota Belud	1,893	2,785	4,678	4.31	1,450	4,075	5,525	2.67	-23.40	46.32	18.11
	Tuaran	2079	6,744	8,823	8.14	82	833	915	0.44	-96.06	-87.65	-89.63
	Kota Kinabalu	17,123	3,116	20,239	18.66	51,632	2,737	54,369	26.24	201.54	-12.16	168.63
	Papar	3434	3,132	6,566	6.06	421	386	807	0.39	-87.74	-87.68	-87.71
	Beaufort	2,082	522	2,604	2.40	1,685	1,405	3,090	1.49	-19.07	169.16	18.66
	Kuala Penyu	3,346	72	3,418	3.15	2,878	91	2,968	1.43	-13.99	26.39	-13.17
	Sipitang	879	271	1,150	1.06	1,137	164	1,301	0.63	29.35	-39.48	13.13
	Sub Total	30,836	16,642	47,478	43.78	59,285	9,691	68,975	33.29	92.26	-41.77	45.28
TOTAL		75,875	32,562	108,437	100	158,427	48,784	207,210	100	108.80	49.82	91.09
SSME Area		45,039	15,920	60,959	56	99,142	39,093	138,235	67	120.12	145.56	126.77
Non-SSME Area		30,836	16,642	47,478	44	59,285	9,691	68,975	33	92.26	-41.77	45.28

Note: COM – commercial gears, TRAD – traditional gears
Source: DOF Sabah annual fisheries statistics

Table A43: *Marine fish landings by gear type and fishing zone, Sabah 1999*

FISHING ZONE	FISHING DISTRICT	Gear Landings (metric ton)							% Fish Landings (Grand Total)						
		TN	SN	GN	LN	HL	OT	Total	TN	SN	GN	LN	HL	OT	Total
SSME-1	Kudat	23,000	3,086	1,672	0	6,162	270	34,191	25.19	6.99	7.28	0.00	21.80	2.60	16.50
	K Marudu	7	0	319	0	8	21	355	0.01	0.00	1.39	0.00	0.03	0.20	0.17
	Pitas	0	0	138	232	78	20	468	0.00	0.00	0.60	2.28	0.28	0.19	0.23
	Sub Total	23,007	3,086	2,129	232	6,248	311	35,014	25.20	6.99	9.27	2.28	22.11	3.00	16.90
SSME-2	Sandakan	8,489	2,125	9,675	0	5,465	3,662	29,416	9.30	4.81	42.11	0.00	19.34	35.31	14.20
	Beluran	2,121	0	1,765	0	72	334	4,292	2.32	0.00	7.68	0.00	0.25	3.22	2.07
	Sub Total	10,610	2,125	11,440	0	5,537	3,996	33,708	11.62	4.81	49.80	0.00	19.59	38.53	16.27
SSME-3	Tawau	10,854	0	2,889	3,942	302	1,487	19,474	11.89	0.00	12.58	38.81	1.07	14.34	9.40
	Semporna	383	8,825	534	0	1,895	373	12,010	0.42	19.98	2.32	0.00	6.71	3.60	5.80
	Kunak	0	18,944	276	2,749	1,161	37	23,167	0.00	42.90	1.20	27.07	4.11	0.36	11.18
	Lahad Datu	871	2,406	762	1,047	9,282	495	14,862	0.95	5.45	3.32	10.31	32.85	4.77	7.17
	Sub Total	12,108	30,175	4,461	7,738	12,640	2,392	69,513	13.26	68.33	19.42	76.19	44.73	23.07	33.55
NON SSME AREA	Kota Belud	0	60	1,390	542	1,636	1,897	5,525	0.00	0.14	6.05	5.34	5.79	18.29	2.67
	Tuaran	0	0	82	543	255	35	915	0.00	0.00	0.36	5.35	0.90	0.34	0.44
	K Kinabalu	45,047	5,907	678	1,021	1,256	460	54,369	49.35	13.38	2.95	10.05	4.44	4.44	26.24
	Papar	0	0	421	80	230	77	807	0.00	0.00	1.83	0.79	0.81	0.74	0.39
	Beaufort	246	645	793	0	262	1,143	3,090	0.27	1.46	3.45	0.00	0.93	11.02	1.49
	K Penyu	29	1,342	1,506	0	35	56	2,968	0.03	3.04	6.56	0.00	0.12	0.54	1.43
	Sipitang	241	821	74	0	161	3	1,301	0.26	1.86	0.32	0.00	0.57	0.03	0.63
	Sub Total	45563	8775	4944	2186	3835	3671	68975	49.91	19.87	21.52	21.52	13.57	35.40	33.29
	SSME Area	45,725	35,386	18,030	7,970	24,425	6,699	138,235	50.09	80.13	78.48	78.48	86.43	64.60	66.71
	Non-SSME Area	45563	8775	4944	2186	3835	3671	68975	49.91	19.87	21.52	21.52	13.57	35.40	33.29
Grand Total		91,288	44,161	22,974	10,156	28,260	10,370	207,210	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Source: DOF Sabah annual fisheries statistics

Table A44: *Marine fish landings by resource group and fishing zone, Sabah 1999*

FISHING ZONE	FISHING DISTRICT	Fish Landings (metric ton)					% Fish Landings (Grand Total)				
		Demersal	Pelagic	Shrimp	Others	Sub Total	Demersal	Pelagic	Shrimp	Others	Sub Total
SSME-1	Kudat	22,878	8,121	1,250	1,941	34,191	27.51	8.39	11.30	11.93	16.50
	Kota Marudu	43	80	213	20	355	0.05	0.08	1.93	0.12	0.17
	Pitas	70	334	53	12	468	0.08	0.35	0.48	0.07	0.23
	Sub Total	*22,991*	*8,535*	*1,516*	*1,973*	*35,014*	*27.65*	*8.82*	*13.71*	*12.13*	*16.90*
SSME-2	Sandakan	13,937	9,908	1,907	3,664	29,416	16.76	10.24	17.25	22.52	14.20
	Beluran	1,408	1,199	973	712	4,292	1.69	1.24	8.80	4.38	2.07
	Sub Total	*15,345*	*11,107*	*2,880*	*4,376*	*33,708*	*18.45*	*11.48*	*26.04*	*26.90*	*16.27*
SSME3	Tawau	7,924	7,015	2,752	1,784	19,474	9.53	7.25	24.89	10.97	9.40
	Semporna	1,358	9,732	234	686	12,010	1.63	10.06	2.12	4.22	5.80
	Kunak	1,162	21,812	0	193	23,167	1.40	22.55	0.00	1.19	11.18
	Lahad Datu	5,532	8,417	415	498	14,862	6.65	8.70	3.75	3.06	7.17
	Sub Total	*15,976*	*46,976*	*3,401*	*3,161*	*69,513*	*19.21*	*48.56*	*30.76*	*19.43*	*33.55*
NON SSME AREA	Kota Belud	1,647	3,224	353	301	5,525	1.98	3.33	3.19	1.85	2.67
	Tuaran	50	788	16	62	915	0.06	0.81	0.14	0.38	0.44
	Kota Kinabalu	25,949	21,563	742	6,115	54,369	31.21	22.29	6.71	37.59	26.24
	Papar	288	396	78	45	807	0.35	0.41	0.71	0.28	0.39
	Beaufort	181	995	1,757	157	3,090	0.22	1.03	15.89	0.97	1.49
	Kuala Penyu	642	2,245	8	74	2,968	0.77	2.32	0.07	0.45	1.43
	Sipitang	81	910	307	3	1,301	0.10	0.94	2.78	0.02	0.63
	Sub Total	*28,838*	*30,121*	*3,261*	*6,757*	*68,975*	*34.68*	*31.14*	*29.49*	*41.54*	*33.29*
	SSME Area	54,312	66,618	7,797	9,510	138,235	65.32	68.86	70.51	58.46	66.71
	Non-SSME Area	28,838	30,121	3,261	6,757	68,975	34.68	31.14	29.49	41.54	33.29
Grand Total		83,150	96,739	11,058	16,267	207,210	100.00	100.00	100.00	100.00	100.00

Source: DOF Sabah annual fisheries statistics

Table A45: *Pelagic fish landings by gear type and fishing zone, Sabah 1999*

FISHING ZONE	FISHING DISTRICT	Gear Landings (metric ton)							% Fish Landings (Grand Total)						
		TN	SN	GN	LN	HL	OT	Total	TN	SN	GN	LN	HL	OT	Total
SSME-1	Kudat	3,704	1,969	1,104	0	1,339	5	8,121	17.31	4.63	9.26	0.00	12.86	0.31	8.39
	K Marudu	0	0	79	0	2	0	80	0.00	0.00	0.66	0.00	0.02	0.00	0.08
	Pitas	0	0	88	224	20	1	334	0.00	0.00	0.74	2.53	0.20	0.08	0.34
	Sub Total	*3,704*	*1,969*	*1,271*	*224*	*1,361*	*6*	*8,535*	*17.31*	*4.63*	*10.66*	*2.53*	*13.07*	*0.39*	*8.82*
SSME-2	Sandakan	1,097	2,125	4,437	0	1,725	525	9,908	5.13	4.99	37.23	0.00	16.57	32.56	10.24
	Beluran	133	0	1,056	0	6	4	1,199	0.62	0.00	8.86	0.00	0.06	0.26	1.24
	Sub Total	*1,230*	*2,125*	*5,493*	*0*	*1,731*	*529*	*11,107*	*5.75*	*4.99*	*46.09*	*0.00*	*16.63*	*32.82*	*11.48*
SSME-3	Tawau	2,313	0	1,322	3,254	47	80	7,015	10.81	0.00	11.09	36.82	0.45	4.96	7.25
	Semporna	0	8,805	154	0	772	1	9,732	0.00	20.69	1.30	0.00	7.41	0.08	10.06
	Kunak	0	18,944	127	2,472	261	8	21,812	0.00	44.51	1.07	27.97	2.51	0.50	22.55
	Lahad Datu	0	2,325	473	944	4,616	59	8,417	0.00	5.46	3.97	10.68	44.33	3.66	8.70
	Sub Total	*2,313*	*30,074*	*2,076*	*6,670*	*5,696*	*148*	*46,976*	*10.81*	*70.66*	*17.42*	*75.48*	*54.70*	*9.19*	*48.56*
NON SSME AREA	Kota Belud	0	60	1,155	300	847	863	3,224	0.00	0.14	9.69	3.39	8.13	53.52	3.33
	Tuaran	0	0	58	543	186	0	788	0.00	0.00	0.49	6.15	1.78	0.00	0.81
	K Kinabalu	14,155	5,568	477	1,021	278	66	21,563	66.14	13.08	4.00	11.55	2.67	4.07	22.29
	Papar	0	0	219	80	98	0	396	0.00	0.00	1.83	0.90	0.94	0.00	0.41
	Beaufort	0	645	223	0	127	0	995	0.00	1.52	1.87	0.00	1.22	0.00	1.03
	K Penyu	1	1,308	936	0	0	0	2,245	0.00	3.07	7.85	0.00	0.00	0.00	2.32
	Sipitang	0	811	10	0	89	0	910	0.00	1.91	0.08	0.00	0.86	0.00	0.94
	Sub Total	*14,156*	*8,392*	*3,077*	*1,944*	*1,624*	*929*	*30,121*	*66.14*	*19.72*	*25.82*	*21.99*	*15.60*	*57.59*	*31.14*
SSME Area		7,247	34,168	8,840	6,894	8,788	684	66,618	33.86	80.28	74.18	78.01	84.40	42.41	68.86
Non-SSME Area		14,156	8,392	3,077	1,944	1,624	929	30,121	66.14	19.72	25.82	21.99	15.60	57.59	31.14
Grand Total		21,403	42,560	11,917	8,837	10,412	1,612	96,739	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Source: DOF Sabah annual fisheries statistics

Table A46: *Demersal fish landings by gear type and fishing zone, Sabah 1999*

FISHING ZONE	FISHING DISTRICT	Gear Landings (metric ton)							% Fish Landings (Grand Total)						
		TN	SN	GN	LN	HL	OT	Total	TN	SN	GN	LN	HL	OT	Total
SSME-1	Kudat	18,056	1,118	561	0	4,823	262	24,820	28.75	72.30	6.27	0.00	27.02	3.65	24.97
	K Marudu	2	0	38	0	7	16	62	0.00	0.00	0.42	0.00	0.04	0.22	0.06
	Pitas	0	0	16	8	58	0	82	0.00	0.00	0.18	0.74	0.32	0.00	0.08
	Sub Total	18,058	1,118	615	8	4,888	278	24,964	28.76	72.30	6.87	0.74	27.38	3.87	25.11
SSME-2	Sandakan	5,572	0	5,238	0	3,740	3,051	17,601	8.87	0.00	58.51	0.00	20.95	42.41	17.70
	Beluran	1,167	0	558	0	65	330	2,120	1.86	0.00	6.23	0.00	0.37	4.59	2.13
	Sub Total	6,739	0	5,796	0	3,805	3,381	19,721	10.73	0.00	64.74	0.00	21.32	46.99	19.84
SSME-3	Tawau	6,999	0	679	688	255	1,086	9,707	11.15	0.00	7.58	63.98	1.43	15.09	9.76
	Semporna	168	20	363	0	1,123	371	2,045	0.27	1.29	4.05	0.00	6.29	5.15	2.06
	Kunak	0	0	150	276	900	29	1,355	0.00	0.00	1.67	25.71	5.04	0.40	1.36
	Lahad Datu	525	35	275	103	4,666	426	6,030	0.84	2.26	3.08	9.57	26.14	5.92	6.07
	Sub Total	7,692	55	1,467	1,067	6,945	1,911	19,137	12.25	3.54	16.38	99.26	38.91	26.57	19.25
NON SSME AREA	Kota Belud	0	0	131	0	789	1,028	1,948	0.00	0.00	1.46	0.00	4.42	14.29	1.96
	Tuaran	0	0	8	0	69	35	112	0.00	0.00	0.09	0.00	0.39	0.48	0.11
	K Kinabalu	30,281	339	152	0	979	313	32,064	48.22	21.93	1.70	0.00	5.48	4.35	32.25
	Papar	0	0	167	0	132	33	332	0.00	0.00	1.87	0.00	0.74	0.46	0.33
	Beaufort	0	0	46	0	136	157	338	0.00	0.00	0.51	0.00	0.76	2.18	0.34
	K Penyu	28	34	563	0	35	56	716	0.04	2.23	6.28	0.00	0.19	0.77	0.72
	Sipitang	0	0	9	0	72	3	84	0.00	0.00	0.10	0.00	0.40	0.04	0.08
	Sub Total	30,309	373	1,076	0	2,211	1,624	35,593	48.26	24.15	12.02	0.00	12.39	22.57	35.80
SSME Area		32,489	1,172	7,877	1,075	15,638	5,570	63,822	51.74	75.85	87.98	100.00	87.61	77.43	64.20
Non-SSME Area		30,309	373	1,076	0	2,211	1,624	35,593	48.26	24.15	12.02	0.00	12.39	22.57	35.80
Grand Total		62,798	1,546	8,953	1,075	17,849	7,194	99,415	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Source: DOF Sabah annual fisheries statistics

Table A47: *Marine shrimp landings by gear type and fishing zone, Sabah 1999*

FISHING ZONE	FISHING DISTRICT	Gear Landings (metric ton)							% Fish Landings (Grand Total)						
		TN	SN	GN	LN	HL	OT	Total	TN	SN	GN	LN	HL	OT	Total
SSME-1	Kudat	1,241	0	7	0	0	3	1,250	17.51	0.00	0.33	0.00	0.00	0.19	11.30
	K Marudu	5	0	203	0	0	5	213	0.07	0.00	9.63	0.00	0.00	0.32	1.93
	Pitas	0	0	34	0	0	19	53	0.00	0.00	1.61	0.00	0.00	1.21	0.48
	Sub Total	1,246	0	244	0	0	27	1,516	17.58	0.00	11.57	0.00	0.00	1.73	13.71
SSME-2	Sandakan	1,820	0	0	0	0	87	1,907	25.67	0.00	0.00	0.00	0.00	5.56	17.25
	Beluran	821	0	151	0	0	0	973	11.58	0.00	7.16	0.00	0.00	0.00	8.80
	Sub Total	2,641	0	151	0	0	87	2,880	37.25	0.00	7.16	0.00	0.00	5.56	26.05
SSME-3	Tawau	1,542	0	889	0	0	321	2,752	21.75	0.00	42.17	0.00	0.00	20.51	24.89
	Semporna	215	0	17	0	0	2	234	3.03	0.00	0.81	0.00	0.00	0.13	2.12
	Kunak	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Lahad Datu	346	46	14	0	0	10	415	4.88	81.63	0.66	0.00	0.00	0.64	3.75
	Sub Total	2,103	46	920	0	0	333	3,401	29.67	81.63	43.64	0.00	0.00	21.28	30.76
NON SSME AREA	Kota Belud	0	0	104	243	0	6	353	0.00	0.00	4.93	100.00	0.00	0.38	3.19
	Tuaran	0	0	16	0	0	0	16	0.00	0.00	0.76	0.00	0.00	0.00	0.14
	K Kinabalu	612	0	50	0	0	81	742	8.63	0.00	2.37	0.00	0.00	5.18	6.71
	Papar	0	0	35	0	0	44	78	0.00	0.00	1.66	0.00	0.00	2.81	0.71
	Beaufort	246	0	525	0	0	987	1,757	3.47	0.00	24.90	0.00	0.00	63.07	15.89
	K Penyu	0	0	8	0	0	0	8	0.00	0.00	0.38	0.00	0.00	0.00	0.07
	Sipitang	241	10.35	55.08	0	0	0	306.59	3.40	18.37	2.61	0.00	0.00	0.00	2.77
	Sub Total	1,099	10	793	243	0	1,118	3,261	15.50	18.37	37.62	100.00	0.00	71.44	29.49
SSME Area		5,990	46	1,315	0	0	447	7,797	84.50	81.63	62.38	0.00	0.00	28.56	70.51
Non-SSME Area		1,099	10	793	243	0	1,118	3,261	15.50	18.37	37.62	100.00	0.00	71.44	29.49
Grand Total		7,089	56	2,108	243	0	1,565	11,058	100.00	100.00	100.00	100.00	0.00	100.00	100.00

Source: DOF Sabah annual fisheries statistics

Table A48: *Marine fish landing by ISSCAAP group in 1998-1999, Sabah (in '000 metric ton)*

ISSCAAP CODE	1998 PERIOD SSME 1	SSME 2	SSME 3	SSME area	WC	Total	1999 PERIOD SSME 1	SSME 2	SSME 3	SSME area	WC	Total
24	0.07	0.07	0.48	0.62	2.39	3.00	0.04	0.21	0.65	0.90	2.53	3.43
25	0.01	0.79	0.12	0.92	0.01	0.93	0.01	0.87	0.21	1.09	0.01	1.11
31	0.01	0.32	0.07	0.40	1.17	1.58	0.01	0.47	0.13	0.61	1.07	1.68
33	7.05	11.94	10.53	29.52	13.74	43.27	8.80	11.39	12.19	32.38	13.15	45.53
34	2.71	7.99	14.66	25.36	15.76	41.11	3.43	7.26	19.60	30.29	13.87	44.15
35	2.32	0.63	15.98	18.93	2.11	21.03	1.87	0.80	13.85	16.52	1.82	18.35
36	1.64	2.32	6.13	10.09	6.04	16.12	1.15	1.93	8.46	11.54	6.03	17.57
37	1.77	0.89	3.59	6.25	8.75	15.00	2.08	1.12	5.06	8.26	8.40	16.67
38	0.25	2.10	1.60	3.95	2.10	6.05	0.31	1.74	1.39	3.44	2.37	5.80
39	12.25	0.81	1.38	14.44	9.02	23.46	13.83	0.67	1.41	15.91	9.71	25.62
42	0.44	3.54	1.09	5.07	0.58	5.65	0.40	2.86	1.68	4.94	0.67	5.61
43	0.03	0.00	0.04	0.07	0.35	0.41	0.03	0.00	0.07	0.10	0.32	0.42
45	1.38	2.32	2.96	6.66	1.73	8.39	1.52	2.88	3.40	7.80	3.26	11.06
56	0.15	0.17	0.19	0.51	0.41	0.92	0.26	0.09	0.24	0.59	0.46	1.04
57	1.04	1.32	1.09	3.45	5.76	9.20	1.26	1.41	1.09	3.76	5.25	9.01
75	0.01	0.02	0.05	0.08	0.03	0.12	0.00	0.00	0.00	0.00	0.00	0.00
76	0.01	0.00	0.00	0.00	0.00	0.01	0.02	0.02	0.08	0.12	0.05	0.18
TOTAL	31.13	35.23	59.93	126.3	69.95	196.3	35.02	33.71	69.51	138.2	68.98	207.2

ISSCAAP (*International Standard Statistical Classification Of Aquatic Animals and Plants*)

24 *Shads, milkfishes etc.*
Chacunda shad, slender shad, longtail shad

25 *Miscellaneous*
Barramundi (giant sea perch)

31 *Flounders, halibuts, soles etc.*
Tonguefish, sole, flatfish

33 *Red fishes, basses, congers, etc.*
Parrotfish, croaker, wrass, goatfish, spotted sicklefish, fusilier, rabbit fish, catfish, jewfish, grunter, triggerfish, mangrove snapper, sweetlip, silver biddy, grouper, threadfin bream, sharptoothed bass, ponyfish, bombay-duck, conger eel, red snapper, lizard fish, sillago-whitings, monocle bream, emperors, spadefish, snapper, eel, false trevally

34 *Jacks, mullets, sauries, etc.*
Amberjack, barracuda, black kingfish, pomfret, mullet, hardtail scad, horse mackerel, golden trevally, threadfin, ox-eye scad, big-eye scad, rainbow runner, selar scad, yellow striped scad, round scad , queenfish

35 *Herrings, sardines, anchovies, etc.*
Rainbow sardine, anchovy, dorab wolf-herring, indo-pacific tarpon

36 *Tunas, bonitos, billfishes, etc.*
Longtail tuna, kawakawa (little eastern tuna), frigate tuna, sailfish, marlin, spanish mackerel

37 *Mackerels, snoeks, cutlass fishes, etc.*
Indian mackerel, ribbon fish, japanese mackerel

38 *Sharks and rays*

39 *Misc. marine fishes*
Trash fishes, mixed unidentified fishes

42 *Sea spiders, crabs, etc.*
Mud crab, pelagic crab, horse shoe crab

43 *Lobsters, spiny rock lobster, etc.*
Spiny lobster, slipper lobster

45 *Shrimps, prawns, etc.*
Small shrimps, banana prawns, king prawns, giant tiger prawn, green tiger prawn, sand prawn, white prawn, yellow prawn, pink prawn, greasy back prawn, rainbow prawn, sharp-rostrum prawn, red prawn

56 *Clams, cockles, ark shells, etc.*
Blood cockle, carpet clam, other clams/snails

57 *Cephalopods*
Common squid, cuttlefish, octopus

76 *Misc. Invertebrates*
Sea cucumbers, jellyfish

Source: DOF Sabah annual fisheries statistics

Table A49: *Quarterly marine fish landings by fishing region, Sabah (1991-1999 period)*

YEAR	Q	Fish Landings ('000 metric tons)					% Fish Landings			
		SSME1	SSME2	SSME3	Non-SSME	TOTAL	SSME1	SSME2	SSME3	Non-SSME
1991	1	2.25	5.96	5.08	9.32	22.6	9.96	26.37	22.48	41.24
	2	2.37	7.07	5.52	12.66	27.6	8.59	25.62	20.00	45.87
	3	2.83	6.64	5.85	11.60	26.92	10.51	24.67	21.73	43.09
	4	4.32	6.90	5.89	14.23	31.31	13.80	22.04	18.81	45.45
Sub Total		11.77	26.57	22.34	47.81	108.43	10.85	24.50	20.60	44.09
1992	1	4.02	7.09	6.05	14.22	31.36	12.82	22.61	19.29	45.34
	2	7.81	7.48	7.37	12.36	35.02	22.30	21.36	21.05	35.29
	3	4.64	7.94	7.49	12.08	32.15	14.43	24.70	23.30	37.57
	4	4.74	9.15	8.98	14.92	37.79	12.54	24.21	23.76	39.48
Sub Total		21.21	31.66	29.89	53.58	136.32	15.56	23.22	21.93	39.30
1993	1	4.45	9.35	8.72	13.75	36.26	12.27	25.79	24.05	37.92
	2	16.06	8.49	8.66	13.83	47.02	34.16	18.06	18.42	29.41
	3	6.17	8.06	11.35	10.99	36.57	16.87	22.04	31.04	30.05
	4	6.18	8.41	11.14	9.55	35.28	17.52	23.84	31.58	27.07
Sub Total		32.86	34.31	39.87	48.12	155.13	21.18	22.12	25.70	31.02
1994	1	7.60	9.45	12.02	10.58	39.66	19.16	23.83	30.31	26.68
	2	10.64	10.33	11.26	13.31	45.52	23.37	22.69	24.74	29.24
	3	6.52	9.27	10.51	11.78	38.08	17.12	24.34	27.60	30.93
	4	6.66	7.34	12.08	10.98	37.08	17.96	19.80	32.58	29.61
Sub Total		31.42	36.39	45.87	46.65	160.34	19.60	22.70	28.61	29.09
1995	1	5.60	7.23	12.49	10.84	36.17	15.48	19.99	34.53	29.97
	2	9.26	7.26	14.29	13.48	44.29	20.91	16.39	32.26	30.44
	3	6.38	7.98	15.42	11.97	41.73	15.29	19.12	36.95	28.68
	4	6.54	9.62	17.93	10.19	44.28	14.77	21.73	40.49	23.01
Sub Total		27.78	32.09	60.13	46.48	166.47	16.69	19.28	36.12	27.92
1996	1	6.83	10.12	16.49	13.34	46.78	14.60	21.63	35.25	28.52
	2	6.70	8.29	15.01	14.61	44.62	15.02	18.58	33.64	32.74
	3	6.49	8.47	14.97	15.96	45.87	14.15	18.47	32.64	34.79
	4	5.57	8.29	13.89	15.13	42.87	12.99	19.34	32.40	35.29
Sub Total		25.59	35.17	60.36	59.04	180.14	14.21	19.52	33.51	32.77
1997	1	5.76	7.24	14.55	13.47	41.03	14.04	17.65	35.46	32.83
	2	8.02	6.71	14.88	16.04	45.65	17.57	14.70	32.60	35.14
	3	6.03	7.52	12.95	15.32	41.83	14.42	17.98	30.96	36.62
	4	5.31	8.53	16.63	15.36	45.84	11.58	18.61	36.28	33.51
Sub Total		25.12	30.00	59.01	60.19	174.35	14.41	17.21	33.85	34.52
1998	1	5.76	9.82	17.28	16.29	49.17	11.71	19.97	35.14	33.13
	2	8.19	8.65	16.72	17.08	50.64	16.17	17.08	33.02	33.73
	3	9.37	7.96	14.48	16.10	47.9	19.56	16.62	30.23	33.61
	4	7.81	8.81	12.10	15.82	44.54	17.53	19.78	27.17	35.52
Sub Total		31.13	35.24	60.58	65.29	192.25	16.19	18.33	31.51	33.96
1999	1	7.79	9.77	18.2	19.07	54.84	14.20	17.82	33.19	34.77
	2	9.31	9.12	18.86	17.25	54.54	17.07	16.72	34.58	31.63
	3	8.49	7.67	14.44	16.69	47.28	17.96	16.22	30.54	35.30
	4	9.41	7.16	18.01	15.98	50.56	18.61	14.16	35.62	31.61
Sub Total		35.00	33.72	69.51	68.99	207.22	16.89	16.27	33.54	33.29
TOTAL		241.88	295.15	447.56	496.15	1,480.65	16.34	19.93	30.23	33.51

Note: Q = quarter
Source: DOF Sabah annual fisheries statistics

Table A50: *Marine fish landings by gear type and fishing zones in Sabah, 1991-1999 period (in '000 metric ton)*

YEAR	SSME1							SSME2						
	TN	SN	GN	LN	HL	OT	Total	TN	SN	GN	LN	HL	OT	Total
1991	5.95	0.00	4.33	0.91	0.45	0.13	11.76	8.42	4.05	7.60	0.00	3.03	3.47	26.56
1992	12.03	0.00	6.21	0.22	0.55	2.70	21.70	8.01	4.81	9.93	0.04	3.63	5.22	31.64
1993	16.96	0.00	4.72	0.11	0.50	10.58	32.86	7.77	4.83	14.41	0.00	2.33	4.96	34.31
1994	24.97	0.50	2.96	0.27	0.52	2.18	31.39	8.20	2.52	19.09	0.00	2.72	3.86	36.38
1995	20.37	1.66	3.42	0.19	0.70	1.43	27.78	7.33	2.66	15.16	0.00	2.51	3.47	31.13
1996	18.04	2.56	2.67	0.10	2.00	0.21	25.58	8.75	1.87	16.12	0.00	4.42	4.02	35.17
1997	15.01	2.20	3.26	0.08	3.42	1.17	25.13	7.47	2.32	11.04	0.00	4.84	4.33	30.01
1998	19.38	5.09	2.99	0.23	4.64	0.26	32.59	7.70	2.07	14.15	0.00	6.45	4.86	35.23
1999	23.01	3.09	2.13	0.23	6.25	0.31	34.19	10.61	2.12	11.44	0.00	5.54	4.00	33.71
	SSME3							NON-SSME						
	TN	SN	GN	LN	HL	OT	Total	TN	SN	GN	LN	HL	OT	Total
1991	3.21	9.86	1.62	4.76	2.34	0.84	22.64	13.37	6.50	10.97	6.86	8.93	0.85	47.48
1992	3.49	13.24	1.30	8.58	2.72	0.71	30.04	11.08	4.45	15.30	8.94	11.66	1.50	52.93
1993	3.26	21.14	1.53	7.43	5.95	0.54	39.84	11.48	4.44	11.06	6.64	12.76	1.73	48.11
1994	4.50	17.84	1.76	11.06	6.85	0.53	42.55	15.37	9.87	9.85	6.12	6.53	2.27	50.01
1995	4.93	24.20	3.70	14.00	12.82	1.29	60.94	16.48	7.79	6.80	6.63	6.83	2.11	46.62
1996	7.61	33.82	3.24	19.24	9.50	0.87	74.27	20.44	6.17	6.06	5.13	5.01	2.31	45.12
1997	9.08	19.36	2.71	15.76	11.17	0.94	59.01	36.34	8.66	5.10	3.28	4.26	2.49	60.12
1998	4.25	28.62	3.48	9.97	12.78	1.49	60.60	45.44	8.89	4.55	2.52	4.12	2.30	67.83
1999	12.11	30.17	4.46	7.74	12.64	2.39	69.51	45.56	8.78	4.94	2.19	3.84	3.67	68.98
	SSME AREA							TOTAL						
	TN	SN	GN	LN	HL	OT	Total	TN	SN	GN	LN	HL	OT	Total
1991	17.58	13.91	13.55	5.67	5.82	4.44	60.96	30.96	20.41	24.51	12.53	14.74	5.29	108.44
1992	23.53	18.05	17.44	8.84	6.90	8.63	83.38	34.61	22.49	32.74	17.78	18.56	10.12	136.31
1993	27.99	25.97	20.66	7.54	8.78	16.08	107.01	39.46	30.40	31.73	14.18	21.54	17.80	155.12
1994	37.67	20.86	23.81	11.33	10.09	6.57	110.32	53.04	30.73	33.66	17.45	16.62	8.84	160.33
1995	32.63	28.52	22.28	14.19	16.03	6.19	119.85	49.11	36.30	29.08	20.82	22.86	8.30	166.46
1996	34.40	38.25	22.03	19.34	15.92	5.10	135.02	54.84	44.42	28.09	24.47	20.93	7.40	180.14
1997	31.56	23.88	17.01	15.84	19.43	6.44	114.15	67.90	32.54	22.11	19.12	23.68	8.92	174.27
1998	31.33	35.78	20.62	10.20	23.87	6.61	128.42	76.77	44.68	25.17	12.72	28.00	8.91	196.26
1999	45.73	35.38	18.03	7.97	24.43	6.70	137.41	91.29	44.16	22.98	10.16	28.26	10.37	207.21

Note: TN = trawl nets, SN = seine nets, GN = gill nets, LN = lift nets, HL = hook & line, OT = others – misc. static traditional gears
Source: DOF Sabah annual fisheries statistics

Table A51: *Marine fish landings by lift net gear and fishing zones in Sabah, 1991-1999 (in metric tons)*

YEAR	SSME1			SSME2			SSME3			NON-SSME			TOTAL		
	Selambau	*Bagang*	*TOTAL*	*Selambau*	*Bagang*	*TOTAL*	*Selambau*	*Bagang*	*TOTAL*	*Selambau*	*Bagang*	*TOTAL*	*Selambau*	*Bagang*	*TOTAL*
1991	790	115	905	0	0	0	0	4,676	4,676	6,858	91	6,949	7,648	4,882	12,530
1992	101	114	215	0	42	42	2	8,532	8,534	8,824	8	8,832	8,927	8,696	17,623
1993	18	88	106	0	0	0	14	7,418	7,432	6,644	0	6,644	6,676	7,506	14,182
1994	36	226	265	0	0	0	24	11,036	11,060	6,124	0	6,124	6,184	11,262	17,446
1995	8	186	194	0	0	0	15	13,986	14,001	6,625	0	6,625	6,648	14,172	20,820
1996	0	102	102	0	0	0	25	19,212	19,236	5,129	0	5,129	5,154	19,314	24,468
1997	0	83	83	0	0	0	30	15,730	15,760	3,276	0	3,276	3,306	15,813	19,119
1998	0	228	228	0	0	0	29	9,944	9,973	2,520	0	2,520	2,549	10,172	12,721
1999	0	232	232	0	0	0	43	7,694	7,737	2,186	0	2,186	2,229	7,926	10,115
TOTAL	953	1,374	2,330	0	42	42	182	98,228	98,419	48,186	99	48,243	49,321	99,743	149,024
%	40.9	59.1	100%	0.0	100.0	100%	0.2	99.8	100%	99.9	0.1	100%	33.1	66.9	100%

	BREAKDOWN OF SELAMBAU LANDINGS BY FISHING ZONES								
	1991	1992	1993	1994	1995	1996	1997	1998	1999
SSEM1	10.33	10.90	0.27	0.58	0.12	0.00	0.00	0.00	0.00
SSME2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SSME3	0.00	0.22	0.21	0.39	0.23	0.49	0.91	1.14	1.93
NON-SSME AREA	89.67	88.89	99.52	99.03	99.65	99.51	99.09	98.86	98.07
TOTAL	100%	100%	100%	100%	100%	100%	100%	100%	100%

	BREAKDOWN OF BAGANG LANDINGS BY FISHING ZONES								
	1991	1992	1993	1994	1995	1996	1997	1998	1999
SSEM1	2.36	1.31	1.17	2.01	1.31	0.53	0.52	2.24	2.93
SSME2	0.00	0.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SSME3	95.78	98.11	98.83	97.99	98.69	99.47	99.48	97.76	97.07
NON-SSME AREA	1.86	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL	100%	100%	100%	100%	100%	100%	100%	100%	100%

	Selambau	*Bagang*	*TOTAL*
1991	61.0	39.0	100%
1992	50.7	49.3	100%
1993	47.1	52.9	100%
1994	35.4	64.6	100%
1995	31.9	68.1	100%
1996	21.1	78.9	100%
1997	17.3	82.7	100%
1998	20.0	80.0	100%
1999	22.0	78.0	100%
TOTAL	33.1	66.9	100%

Source: DOF Sabah annual fisheries statistics

Table A52: *Marine fish landings by gear group, resource type and fishing zone in Sabah, 1991-1999 period (in '000 metric ton)*

YEAR	SSME1			SSME2			SSME3			NON-SSME			TOTAL		
	COM	TRA	TOTAL	COM	TRA	TOTAL	COM	TRA	TOTAL	COM	TRA	TOTAL	COM	TRA	TOTAL
1991	10.27	1.84	12.12	20.07	6.49	26.56	14.70	7.94	22.64	30.84	16.64	47.48	91.79	37.29	108.79
1992	19.91	3.35	23.26	22.75	8.89	31.64	18.03	12.01	30.04	29.16	22.21	51.37	108.80	52.65	136.31
1993	21.68	11.18	32.86	27.01	7.30	34.31	25.92	13.92	39.84	26.98	21.13	48.11	124.41	59.64	155.12
1994	28.43	3.00	31.42	29.81	6.57	36.38	27.32	18.55	45.87	31.87	14.78	46.66	138.43	49.06	160.33
1995	25.45	2.33	27.78	25.13	6.97	32.10	32.00	28.11	60.11	31.90	14.57	46.47	135.62	58.41	166.46
1996	23.27	2.31	25.58	26.73	8.44	35.17	44.67	29.60	74.27	32.67	12.45	45.12	147.92	60.28	180.14
1997	20.47	4.66	25.13	20.84	9.17	30.01	31.15	27.86	59.01	50.09	10.02	60.12	138.93	60.31	174.27
1998	26.01	5.13	31.14	23.92	11.31	35.23	35.68	24.25	59.93	61.00	8.94	69.95	167.61	60.52	196.26
1999	28.22	6.79	35.01	24.18	9.53	33.71	46.74	22.77	69.51	59.28	9.69	68.98	158.42	48.78	207.21

YEAR	SSME1			SSME2			SSME3			NON-SSME			TOTAL		
	DEM	PEL	TOTAL	DEM	PEL	TOTAL	DEM	PEL	TOTAL	DEM	PEL	TOTAL	DEM	PEL	TOTAL
1991	6.15	5.62	11.76	18.80	7.76	26.56	5.61	17.03	22.64	21.74	25.74	47.48	52.30	56.14	108.44
1992	13.69	9.57	23.26	20.84	10.80	31.64	6.04	24.00	30.04	24.17	27.20	51.37	64.75	71.56	136.31
1993	26.33	6.53	32.86	21.42	12.88	34.31	7.59	32.25	39.84	24.33	23.79	48.11	79.66	75.45	155.12
1994	24.04	7.38	31.42	22.91	13.48	36.38	10.94	34.93	45.87	25.26	21.39	46.66	83.15	77.18	160.33
1995	20.13	7.64	27.78	20.30	11.80	32.10	17.59	42.52	60.11	24.58	20.53	45.12	82.60	82.50	165.11
1996	18.74	6.83	25.58	23.89	11.28	35.17	19.23	55.04	74.27	24.58	20.53	45.12	86.45	93.69	180.14
1997	17.63	7.50	25.13	19.61	10.40	30.01	19.50	39.51	59.01	35.45	24.67	60.12	92.19	82.07	174.27
1998	22.70	8.44	31.14	23.41	11.82	35.23	19.58	40.35	59.93	35.95	29.99	65.94	101.65	90.60	192.25
1999	27.17	8.53	35.71	22.60	11.11	33.71	22.54	46.98	69.51	38.49	29.79	68.29	110.80	96.41	207.21

Note: COM – commercial gear; TRA– traditional gear; DEM – demersal; PEL – pelagic
Source: DOF Sabah annual fisheries statistics

Table A53: *Retail value of marine fish landings by resource group and fishing districts in Sabah, 1999 period*

ZONE	FISHING DISTRICTS	Landings ('000 metric ton)				RETAIL VALUE (RM Million)				Retail Price RM/KG			
		FISH	CRUS	OTHER	TOTAL	FISH	CRUS	OTHER	TOTAL	FISH	CRUS	OTHER	TOTAL
SSME1	Kudat	31.00	1.68	1.52	34.19	223.52	17.97	6.87	248.36	7.21	10.70	4.52	7.26
	Kota Marudu	0.12	0.22	0.01	0.36	0.60	2.41	0.02	3.03	5.00	10.95	2.00	8.42
	Pitas	0.41	0.06	0.01	0.47	1.63	0.65	0.03	2.31	3.98	10.83	3.00	4.91
	Sub Total	31.53	1.96	1.54	35.02	225.75	21.03	6.92	253.70	7.16	10.73	4.49	7.24
SSME2	Sandakan	23.84	4.40	1.18	29.42	120.56	55.19	2.81	178.56	5.06	12.54	2.38	6.07
	Beluran	2.61	1.34	0.34	4.29	9.18	9.57	0.50	19.24	3.52	7.14	1.47	4.48
	Sub Total	26.45	5.74	1.52	33.71	129.74	64.76	3.31	197.80	4.91	11.28	2.18	5.87
SSME3	Tawau	14.94	3.83	0.71	19.47	48.96	32.55	2.28	83.78	3.28	8.50	3.21	4.30
	Semporna	11.09	0.75	0.17	12.01	35.40	5.77	1.30	42.47	3.19	7.69	7.65	3.54
	Kunak	22.97	0.00	0.19	23.17	65.17	0.00	1.03	66.20	2.84		5.42	2.86
	Lahad Datu	13.95	0.57	0.34	14.86	48.77	6.47	1.26	56.50	3.50	11.35	3.71	3.80
	Sub Total	62.95	5.15	1.41	69.51	198.30	44.79	5.87	248.95	3.15	8.70	4.16	3.58
NON SSME AREA	Kota Belud	4.87	0.44	0.21	5.53	32.75	2.71	0.34	35.80	6.72	6.16	1.62	6.47
	Tuaran	0.84	0.05	0.03	0.92	4.78	0.50	0.28	5.55	5.69	10.00	9.33	6.03
	Kota Kinabalu	47.51	1.37	5.49	54.37	159.51	15.06	31.12	205.68	3.36	10.99	5.67	3.78
	Papar	0.68	0.11	0.01	0.81	3.31	0.87	0.06	4.24	4.87	7.91	6.00	5.23
	Beaufort	1.18	1.91	0.00	3.09	8.40	15.65	0.00	24.05	7.12	8.19		7.78
	Kuala Penyu	2.89	0.06	0.02	2.97	11.66	0.41	0.06	12.13	4.03	6.83	3.00	4.08
	Sipitang	0.99	0.31	0.00	1.30	2.59	3.14	0.00	5.73	2.62	10.13		4.41
	Sub Total	58.96	4.25	5.76	68.99	223.00	38.34	31.86	293.18	3.78	9.02	5.53	4.25
TOTAL SABAH		179.21	17.10	10.22	207.21	776.77	168.92	47.95	993.64	4.33	9.88	4.69	4.80

Note: FISH – finfish; CRUS – crustaceans; OTHER – various invertebrates
Source: DOF Sabah annual fisheries statistics

Table A54: *Marine fish landings by resource type and fishing districts in Sabah, 1991 period (in metric tons)*

RESOURCE TYPE	SSME1			SSME2		SSME3				Non-SSME Area	SSME Area	Annual Total	% Non-SSME Area	% SSME Area
	Kudat	Kota Marudu	Pitas	Sandakan	Beluran	Tawau	Semporna	Lahad Datu	Kunak					
D-Fish	4,330	66	29	7,540	1,250	1,887	704	680	541	16,403	17,027	33,430	49.1	50.9
D-Shrimp	824	226	3	4,424	2,278	875	73	217	0	3,575	8,920	12,495	28.6	71.4
P-Fish	5,339	103	173	7,015	742	1,801	3,168	1,784	10,275	25,737	30,400	56,137	45.8	54.2
Others	619	44	5	1,309	2,003	149	219	179	85	1,763	4,612	6,375	27.7	72.3
Total	11,112	439	210	20,288	6,273	4,712	4,164	2,860	10,901	47,478	60,959	108,437	43.8	56.2

Source: DOF Sabah annual fisheries report

Table A55: *Marine fish landings by resource type and fishing districts in Sabah, 1992 period (in metric tons)*

RESOURCE TYPE	SSME1			SSME2		SSME3				Non-SSME Area	SSME Area	Annual Total	% Non-SSME Area	% SSME Area
	Kudat	Kota Marudu	Pitas	Sandakan	Beluran	Tawau	Semporna	Lahad Datu	Kunak					
D-Fish	8,032	97	59	8,536	1,643	1,697	756	862	891	16,334	22,573	38,907	42.0	58.0
D-Shrimp	594	192	62	3,658	1,802	1,010	83	116	0	4,514	7,517	12,031	37.5	62.5
P-Fish	9,268	95	203	10,169	628	1,306	3,701	1,614	17,381	27,195	44,365	71,560	38.0	62.0
Others	893	3,295	468	2,781	2,423	238	155	213	15	3,326	10,481	13,807	24.1	75.9
Total	18,787	3,679	792	25,144	6,496	4,251	4,695	2,805	18,287	51,369	84,936	136,305	37.7	62.3

Source: DOF Sabah annual fisheries report

Table A56: *Marine fish landings by resource type and fishing districts in Sabah, 1993 period (in metric tons)*

RESOURCE TYPE	SSME1			SSME2		SSME3				Non-SSME Area	SSME Area	Annual Total	% Non-SSME Area	% SSME Area
	Kudat	Kota Marudu	Pitas	Sandakan	Beluran	Tawau	Semporna	Lahad Datu	Kunak					
D-Fish	12,677	89	25	11,072	2,022	1,568	1,064	1,471	1,717	15,761	31,705	47,466	33.2	66.8
D-Shrimp	548	140	67	2,339	1,036	1,011	81	154	0	3,968	5,376	9,344	42.5	57.5
P-Fish	6,231	117	185	11,547	1,337	1,175	5,607	2,130	23,338	23,785	51,667	75,452	31.5	68.5
Others	888	9,875	2,016	3,976	977	210	93	199	23	4,596	18,257	22,853	20.1	79.9
Total	20,344	10,221	2,293	28,934	5,372	3,964	6,845	3,954	25,078	48,110	107,005	155,115	31.0	69.0

Source: DOF Sabah annual fisheries report

Table A57: *Marine fish landings by resource type and fishing districts in Sabah, 1994 period (in metric tons)*

RESOURCE TYPE	SSME1		SSME2			SSME3				Non-SSME Area	SSME Area	Annual Total	% Non-SSME Area	% SSME Area
	Kudat	Kota Marudu	Pitas	Sandakan	Beluran	Tawau	Semporna	Lahad Datu	Kunak					
D-Fish	18,665	126	56	11,431	3,451	2,715	1,120	1,748	2,453	15,186	41,765	56,951	26.7	73.3
D-Shrimp	651	266	113	1,777	2,470	1,707	141	214	0	5,151	7,339	12,490	41.2	58.8
P-Fish	6,863	173	343	10,429	3,049	2,041	7,510	3,303	22,071	21,393	55,782	77,175	27.7	72.3
Others	1,481	2,286	400	3,518	258	450	224	122	46	4,927	8,785	13,712	35.9	64.1
Total	27,660	2,851	912	27,155	9,228	6,913	8,995	5,387	24,570	46,657	113,671	160,328	29.1	70.9
Source: DOF Sabah annual fisheries report														

Table A58: *Marine fish landings by resource type and fishing districts in Sabah, 1995 period (in metric tons)*

RESOURCE TYPE	SSME1		SSME2			SSME3				Non-SSME Area	SSME Area	Annual Total	% Non-SSME Area	% SSME Area
	Kudat	Kota Marudu	Pitas	Sandakan	Beluran	Tawau	Semporna	Lahad Datu	Kunak					
D-Fish	15,597	148	105	11,942	1,443	4,098	3,499	1,791	4,318	14,551	42,941	57,492	25.3	74.7
D-Shrimp	1,208	260	131	1,615	1,853	1,556	175	137	0	5,421	6,935	12,356	43.9	56.1
P-Fish	7,105	160	379	10,885	919	3,613	13,838	3,320	21,749	22,147	61,968	84,115	26.3	73.7
Others	1,419	774	490	3,124	321	744	496	77	700	4,354	8,145	12,499	34.8	65.2
Total	25,329	1,342	1,105	27,566	4,536	10,011	18,008	5,325	26,767	46,473	119,989	166,462	27.9	72.1
Source: DOF Sabah annual fisheries report														

Table A59: *Marine fish landings by resource type and fishing districts in Sabah, 1996 period (in metric tons)*

RESOURCE TYPE	SSME1		SSME2			SSME3				Non-SSME Area	SSME Area	Annual Total	% Non-SSME Area	% SSME Area
	Kudat	Kota Marudu	Pitas	Sandakan	Beluran	Tawau	Semporna	Lahad Datu	Kunak					
D-Fish	15,354	168	115	13,388	2,324	7,175	1,317	1,718	3,449	15,658	45,007	60,665	25.8	74.2
D-Shrimp	1,201	269	114	1,891	2,253	2,187	147	119	0	4,058	8,180	12,238	33.2	66.8
P-Fish	6,310	181	342	9,589	1,694	6,053	15,129	3,044	30,817	20,534	73,159	93,693	21.9	78.1
Others	1,452	57	15	3,185	850	1,285	820	76	938	4,868	8,679	13,547	35.9	64.1
Total	24,317	675	586	28,053	7,122	16,699	17,413	4,957	35,204	45,117	135,026	180,143	25.0	75.0
Source: DOF Sabah annual fisheries report														

Table A60: *Marine fish landings by resource type and fishing districts in Sabah, 1997 period (in metric tons)*

RESOURCE TYPE	SSME1			SSME2		SSME3				Non-SSME Area	SSME Area	Annual Total	% Non-SSME Area	% SSME Area
	Kudat	Kota Marudu	Pitas	Sandakan	Beluran	Tawau	Semporna	Lahad Datu	Kunak					
D-Fish	13,906	60	93	11,898	983	5,828	785	3,205	3,798	27,448	40,555	68,003	40.4	59.6
D-Shrimp	937	216	66	1,520	1,499	3,209	230	168	0	2,184	7,843	10,027	21.8	78.2
P-Fish	7,207	85	207	8,531	1,864	5,809	13,469	4,417	15,817	24,668	57,407	82,075	30.1	69.9
Others	1,318	748	288	3,028	687	1,069	294	195	717	5,816	8,344	14,160	41.1	58.9
Total	23,368	1,109	654	24,977	5,033	15,914	14,778	7,985	20,332	60,115	114,150	174,265	34.5	65.5

Source: DOF Sabah annual fisheries report

Table A61: *Marine fish landings by resource type and fishing districts in Sabah, 1998 period (in metric tons)*

RESOURCE TYPE	SSME1			SSME2		SSME3				Non-SSME Area	SSME Area	Annual Total	% Non-SSME Area	% SSME Area
	Kudat	Kota Marudu	Pitas	Sandakan	Beluran	Tawau	Semporna	Lahad Datu	Kunak					
D-Fish	19,461	67	105	15,273	776	6,326	971	5,092	1,783	27,866	49,854	77,720	35.9	64.1
D-Shrimp	1,088	259	33	1,918	400	2,502	214	243	0	1,473	6,655	8,128	18.1	81.9
P-Fish	7,972	111	361	10,513	1,307	6,354	10,708	6,793	16,495	29,988	60,614	90,602	33.1	66.9
Others	1,618	27	43	4,167	882	1,359	450	288	354	6,616	9,188	15,804	41.9	58.1
Total	30,139	463	541	31,871	3,364	16,542	12,342	12,416	18,632	65,943	126,311	192,254	34.3	65.7

Source: DOF Sabah annual fisheries report

Table A62: *Marine fish landings by resource type and fishing districts in Sabah, 1999 period (in metric tons)*

RESOURCE TYPE	SSME1			SSME2		SSME3				Non-SSME Area	SSME Area	Annual Total	% Non-SSME Area	% SSME Area
	Kudat	Kota Marudu	Pitas	Sandakan	Beluran	Tawau	Semporna	Lahad Datu	Kunak					
D-Fish	22,878	43	70	13,937	1,408	7,924	1,358	5,532	1,162	29,167	54,311	83,478	34.9	65.1
D-Shrimp	1,941	213	53	1,907	973	2,752	234	415	0	2,570	8,488	11,058	23.2	76.8
P-Fish	8,121	80	334	9,908	1,199	7,015	9,732	8,417	21,812	29,793	66,617	96,410	30.9	69.1
Others	1,941	20	12	3,664	712	1,784	686	498	193	6,756	9,510	16,266	41.5	58.5
Total	34,882	355	468	29,416	4,292	19,474	12,010	14,862	23,167	68,286	138,927	207,213	33.0	67.0

Source: DOF Sabah annual fisheries report

Table A63: *Demersal fish landings by resource category and fishing zone in Sabah, 1991-1999 period*

Production (in '000 metric tons)																				
YEAR	SSME1				SSME2				SSME3				NON-SSME				TOTAL			
	FIN	SHP	OTR	Total	FIN	SHP	OTR	Total	FIN	SHP	OTR	Total	FIN	SHP	OTR	Total	FIN	SHP	OTR	Total
1991	4.43	1.05	0.67	6.15	8.79	6.70	3.31	18.80	3.81	1.17	0.63	5.61	16.40	3.58	1.76	21.74	33.43	12.50	6.38	52.30
1992	8.19	0.85	4.66	13.69	10.18	5.46	5.20	20.84	4.21	1.21	0.62	6.04	16.33	4.51	3.33	24.17	38.91	12.03	13.81	64.75
1993	12.79	0.76	12.78	26.33	13.09	3.38	4.95	21.42	5.82	1.25	0.53	7.59	15.76	3.97	4.60	24.33	47.47	9.34	22.85	79.66
1994	18.85	1.03	4.17	24.04	14.88	4.25	3.78	22.91	8.04	2.06	0.84	10.94	15.19	5.15	4.93	25.26	56.95	12.49	13.71	83.15
1995	15.85	1.60	2.68	20.13	13.39	3.47	3.45	20.30	13.71	1.87	2.02	17.59	15.66	4.06	4.87	24.58	58.60	10.99	13.01	82.60
1996	15.64	1.58	1.52	18.74	15.71	4.14	4.04	23.89	13.66	2.45	3.12	19.23	15.66	4.06	4.87	24.58	60.67	12.24	13.55	86.45
1997	14.06	1.22	2.35	17.63	12.88	3.02	3.72	19.61	13.62	3.61	2.28	19.50	27.45	2.18	5.82	35.45	68.00	10.03	14.16	92.19
1998	19.63	1.38	1.69	22.70	16.05	2.32	5.05	23.41	14.17	2.96	2.45	19.58	27.87	1.47	6.62	35.95	77.72	8.13	15.80	101.65
1999	22.99	2.21	1.97	27.17	15.34	2.88	4.38	22.60	15.98	3.40	3.16	22.54	29.17	2.57	6.76	38.49	83.48	11.06	16.27	110.80
% demersal landings																				
YEAR	SSME1				SSME2				SSME3				NON-SSME				TOTAL			
	FIN	SHP	OTR	Total	FIN	SHP	OTR	Total	FIN	SHP	OTR	Total	FIN	SHP	OTR	Total	FIN	SHP	OTR	Total
1991	72.03	17.07	10.89	100	46.76	35.64	17.61	100	67.91	20.86	11.23	100	75.44	16.47	8.10	100	63.92	23.90	12.20	100
1992	59.82	6.21	34.04	100	48.85	26.20	24.95	100	69.70	20.03	10.26	100	67.56	18.66	13.78	100	60.09	18.58	21.33	100
1993	48.58	2.89	48.54	100	61.11	15.78	23.11	100	76.68	16.47	6.98	100	64.78	16.32	18.91	100	59.59	11.72	28.68	100
1994	78.41	4.28	17.35	100	64.95	18.55	16.50	100	73.49	18.83	7.68	100	60.13	20.39	19.52	100	68.49	15.02	16.49	100
1995	78.74	7.95	13.31	100	65.96	17.09	17.00	100	77.94	10.63	11.48	100	63.71	16.52	19.81	100	70.94	13.31	15.75	100
1996	83.46	8.43	8.11	100	65.76	17.33	16.91	100	71.03	12.74	16.22	100	63.71	16.52	19.81	100	70.18	14.16	15.67	100
1997	79.75	6.92	13.33	100	65.68	15.40	18.97	100	69.85	18.51	11.69	100	77.43	6.15	16.42	100	73.76	10.88	15.36	100
1998	86.48	6.08	7.44	100	68.56	9.91	21.57	100	72.37	15.12	12.51	100	77.52	4.09	18.41	100	76.46	8.00	15.54	100
1999	84.62	8.13	7.25	100	67.88	12.74	19.38	100	70.90	15.08	14.02	100	75.79	6.68	17.56	100	75.34	9.98	14.68	100

Note: FIN – finfish; SHP – shrimp; OTR – other invertebrates including jellyfish, mangrove crabs, spiny lobsters and shellfish
Source: DOF Sabah annual fisheries report

Table A64: *Pelagic fish landings by selected species and fishing zone in Sabah, 1991-1992 period (in metric ton)*

ZONE	DISTRICT	1991 period							1992 period						
		MA	RS	SD	AN	TN	OT	TOT	MA	RS	SD	AN	TN	OT	TOT
SSME1	Kudat	679	718	191	1	1,859	1,891	5,339	1,463	551	18	7	3,081	4,148	9,268
	Kota Marudu	0	0	0	0	0	103	103	1	0	0	0	25	69	95
	Pitas	6	0	35	72	1	59	173	11	0	45	40	21	86	203
	Sub Total	685	718	226	73	1,860	2,053	5,615	1,475	551	63	47	3,127	4,303	9,566
SSME2	Sandakan	737	732	763	21	1,728	3,034	7,015	1,447	1,161	937	43	1,665	4,916	10,169
	Beluran	0	0	0	0	0	742	742	0	0	0	0	0	628	628
	Sub Total	737	732	763	21	1,728	3,776	7,757	1,447	1,161	937	43	1,665	5,544	10,797
SSME3	Tawau	99	0	38	302	173	1,189	1,801	117	0	54	123	276	736	1,306
	Semporna	962	536	294	0	724	652	3,168	661	278	533	0	863	1,366	3,701
	Kunak	1,072	342	640	1,663	5,322	1,862	10,901	4,501	3,697	978	1,348	3,862	3,901	18,287
	Lahad Datu	218	1	91	209	501	1,840	2,860	194	0	33	39	423	2,116	2,805
	Sub Total	2,351	879	1,063	2,174	6,720	5,543	18,730	5,473	3,975	1,598	1,510	5,424	8,119	26,099
NON SSME AREA	Kota Belud	132	671	80	0	216			111	744	160	0	488		
	Tuaran	325	1,959	1,019	0	0			86	1,367	1,425	0	2,763		
	K Kinabalu	2,962	1,357	618	0	96			521	911	632	0	764		
	Papar	1,336	250	9	0	148			937	736	64	0	685		
	Beaufort	306	0	0	0	16			276	0	0	0	20		
	Kuala Penyu	754	133	41	0	173			642	332	7	0	126		
	Sipitang	184	0	50	0	33			164	0	62	0	40		
	Sub Total	5,999	4,370	1,817	0	682	12,869	25,737	2,737	4,090	2,350	0	4,886	13,132	27,195
SSME AREA		3,773	2,329	2,052	2,268	10,308	11,372	32,102	8,395	5,687	2,598	1,600	10,216	17,966	46,462
NON-SSME AREA		5,999	4,370	1,817	0	682	12,869	25,737	2,737	4,090	2,350	0	4,886	13,132	27,195
TOTAL		9,772	6,699	3,869	2,268	10,990	24,241	57,839	11,132	9,777	4,948	1,600	15,102	31,098	73,657
% SSME AREA		38.61	34.77	53.04	100.00	93.79	46.91	55.50	75.41	58.17	52.51	100.00	67.65	57.77	63.08
% NON-SSME AREA		61.39	65.23	46.96	0.00	6.21	53.09	44.50	24.59	41.83	47.49	0.00	32.35	42.23	36.92

Note: MA – mackerel (*Rastrelliger* spp.); RS – round scad (*Decapterus* spp.); SD – sardine; AN – anchovy; TN – mixed neritic and coastal tuna; OT – other pelagic species; TOT – sub total

Source: DOF Sabah annual fisheries statistics

Table A65: *Pelagic fish landings by selected species and fishing zone in Sabah, 1993-1994 period (in metric ton)*

ZONE	DISTRICT	1993 period							1994 period						
		MA	RS	SD	AN	TN	OT	TOT	MA	RS	SD	AN	TN	OT	TOT
SSME1	Kudat	1,262	527	14	17	1,311	3,100	6,231	1,903	1,611	292	31	991	2,035	6,863
	Kota Marudu	3	0	0	0	24	90	117	3	0	0	0	31	139	173
	Pitas	5	0	34	27	11	108	185	3	0	96	100	11	133	343
	Sub Total	1,270	527	48	44	1,346	3,298	6,533	1,909	1,611	388	131	1,033	2,307	7,379
SSME2	Sandakan	1,296	1,024	1,146	101	1,003	6,977	11,547	667	565	614	64	1,433	7,086	10,429
	Beluran	0	15	0	0	0	1,322	1,337	0	0	0	0	0	3,049	3,049
	Sub Total	1,296	1,039	1,146	101	1,003	8,299	12,884	667	565	614	64	1,433	10,135	13,478
SSME3	Tawau	150	0	39	270	205	511	1,175	90	0	50	1,152	0	749	2,041
	Semporna	869	706	689	0	2,445	898	5,607	552	766	1,278	0	3,681	1,233	7,510
	Kunak	4,923	5,300	4,379	1,129	4,675	4,672	25,078	3,112	4,796	7,474	1,397	2,583	5,208	24,570
	Lahad Datu	298	0	36	28	455	3,137	3,954	396	242	120	112	481	4,036	5,387
	Sub Total	6,240	6,006	5,143	1,427	7,780	9,218	35,814	4,150	5,804	8,922	2,661	6,745	11,226	39,508
NON SSME AREA	Kota Belud	186	548	79	20	286			14	593	42	0	435		
	Tuaran	20	771	730	0	1,826			42	1,162	2,392	0	84		
	K Kinabalu	928	897	439	0	769			1,083	2,114	504	0	1,048		
	Papar	587	328	112	0	892			296	232	72	0	416		
	Beaufort	231	0	0	0	69			604	0	0	0	46		
	Kuala Penyu	640	375	44	0	163			398	873	340	0	296		
	Sipitang	243	0	58	0	32			137	0	32	0	28		
	Sub Total	2,835	2,919	1,462	20	4,037	12,512	23,785	2,574	4,974	3,382	0	2,353	8,110	21,393
SSME AREA		8,806	7,572	6,337	1,572	10,129	20,815	55,231	6,726	7,980	9,924	2,856	9,211	23,668	60,365
NON-SSME AREA		2,835	2,919	1,462	20	4,037	12,512	23,785	2,574	4,974	3,382	0	2,353	8,110	21,393
TOTAL		11,641	10,491	7,799	1,592	14,166	33,327	79,016	9,300	12,954	13,306	2,856	11,564	31,778	81,758
% SSME AREA		75.65	72.18	81.25	98.74	71.50	62.46	69.90	72.32	61.60	74.58	100.00	79.65	74.48	73.83
% NON-SSME AREA		24.35	27.82	18.75	1.26	28.50	37.54	30.10	27.68	38.40	25.42	0.00	20.35	25.52	26.17

Note: MA – mackerel (*Rastrelliger* spp.); RS – round scad (*Decapterus* spp.); SD – sardine; AN – anchovy; TN – mixed neritic and coastal tuna; OT – other pelagic species; TOT – sub total

Source: DOF Sabah annual fisheries statistics

Table A66: *Pelagic fish landings by selected species and fishing zone in Sabah, 1995-1996 period (in metric ton)*

ZONE	DISTRICT	1995 period							1996 period						
		MA	RS	SD	AN	TN	OT	TOT	MA	RS	SD	AN	TN	OT	TOT
SSME1	Kudat	858	2,115	838	58	1,209	2,027	7,105	969	1,081	1,435	30	745	2,050	6,310
	Kota Marudu	2	0	0	0	26	132	160	0	0	0	0	21	160	181
	Pitas	0	0	91	62	35	191	379	0	0	46	41	51	204	342
	Sub Total	860	2,115	929	120	1,270	2,350	7,644	969	1,081	1,481	71	817	2,414	6,833
SSME2	Sandakan	680	604	668	58	1,656	7,219	10,885	508	398	493	84	1,298	6,808	9,589
	Beluran	0	0	0	0	0	919	919	0	0	284	0	0	1,410	1,694
	Sub Total	680	604	668	58	1,656	8,138	11,804	508	398	777	84	1,298	8,218	11,283
SSME3	Tawau	18	0	0	1,800	0	1,795	3,613	139	0	0	3,395	0	2,519	6,053
	Semporna	1,147	1,167	2,135	13	6,681	2,695	13,838	1,262	1,032	2,813	20	7,509	2,493	15,129
	Kunak	2,448	4,716	8,449	977	1,658	8,519	26,767	2,642	7,514	12,509	1,760	1,820	8,959	35,204
	Lahad Datu	268	856	158	132	255	3,656	5,325	256	779	98	80	254	3,490	4,957
	Sub Total	3,881	6,739	10,742	2,922	8,594	16,665	49,543	4,298	9,325	15,421	5,256	9,583	17,461	61,343
NON SSME AREA	Kota Belud	2	471	39	6	79			46	262	80	12	548		
	Tuaran	150	1,868	2,020	0	388			202	1,386	1,402	0	517		
	K Kinabalu	1,317	2,172	2,392	0	1,373			1,313	1,882	524	0	2,651		
	Papar	149	317	56	0	211			119	320	44	0	142		
	Beaufort	1,028	0	0	0	143			443	0	5	0	40		
	Kuala Penyu	351	495	216	0	197			201	267	172	0	165		
	Sipitang	121	3	42	12	23			63	0	19	38	79		
	Sub Total	3,118	5,326	4,765	18	2,414	6,506	22,147	2,387	4,118	2,246	51	4,142	7,590	20,534
SSME AREA		5,421	9,458	12,339	3,100	11,520	27,153	68,991	5,775	10,805	17,678	5,410	11,698	28,093	79,459
NON-SSME AREA		3,118	5,326	4,765	18	2,414	6,506	22,147	2,387	4,118	2,246	51	4,142	7,590	20,534
TOTAL		8,539	14,784	17,104	3,118	13,934	33,659	91,138	8,163	14,922	19,924	5,461	15,840	35,683	99,993
% SSME AREA		63.49	63.97	72.14	99.42	82.68	80.67	75.70	70.75	72.41	88.73	99.07	73.85	78.73	79.46
% NON-SSME AREA		36.51	36.03	27.86	0.58	17.32	19.33	24.30	29.25	27.59	11.27	0.93	26.15	21.27	20.54

Note: MA – mackerel (*Rastrelliger* spp.); RS – round scad (*Decapterus* spp.); SD – sardine; AN – anchovy; TN – mixed neritic and coastal tuna; OT – other pelagic species; TOT – sub total
Source: DOF Sabah annual fisheries statistics

Table A67: *Pelagic fish landings by selected species and fishing zone in Sabah, 1997-1998 period (in metric ton)*

ZONE	DISTRICT	1997 period							1998 period						
		MA	RS	SD	AN	TN	OT	TOT	MA	RS	SD	AN	TN	OT	TOT
SSME1	Kudat	794	787	2,084	146	568	2,828	7,207	1,694	883	2,083	25	553	2,734	7,972
	Kota Marudu	0	0	0	0	7	78	85	0	0	0	0	3	108	111
	Pitas	9	0	37	34	14	113	207	9	0	65	112	43	132	361
	Sub Total	803	787	2,121	180	589	3,019	7,499	1,704	883	2,148	137	599	2,973	8,443
SSME2	Sandakan	604	534	590	69	865	5,869	8,531	498	455	519	55	540	8,446	10,513
	Beluran	117	0	332	0	0	1,415	1,864	7	0	6	0	0	1,294	1,307
	Sub Total	721	534	922	69	865	7,284	10,395	505	455	525	55	540	9,740	11,820
SSME3	Tawau	176	0	0	2,282	0	3,351	5,809	130	0	0	2,081	0	4,143	6,354
	Semporna	434	541	3,340	2	7,301	1,851	13,469	92	356	5,465	0	3,704	1,091	10,708
	Kunak	1,143	3,033	6,789	752	405	8,210	20,332	1,109	3,776	7,213	755	1,032	4,747	18,632
	Lahad Datu	472	903	136	85	183	6,206	7,985	807	748	180	123	244	10,314	12,416
	Sub Total	2,224	4,477	10,266	3,121	7,889	19,619	47,596	2,139	4,881	12,857	2,959	4,980	20,296	48,111
NON SSME AREA	Kota Belud	52	168	17	58	806			22	243	10	17	945		
	Tuaran	45	911	53	0	70			16	727	19	0	153		
	K Kinabalu	3,008	4,264	852	0	3,157			3,971	5,289	845	0	1,928		
	Papar	94	343	99	0	61			42	41	22	0	34		
	Beaufort	54	0	4	0	208			178	0	0	0	541		
	Kuala Penyu	174	381	303	0	358			200	395	272	0	356		
	Sipitang	27	0	52	33	4			58	1	826	5	128		
	Sub Total	3,454	6,067	1,379	91	4,664	9,013	24,668	4,488	6,695	1,994	23	4,085	12,703	29,988
SSME AREA		3,748	5,799	13,308	3,370	9,343	29,922	65,490	4,347	6,218	15,530	3,151	6,118	33,009	68,374
NON-SSME AREA		3,454	6,067	1,379	91	4,664	9,013	24,668	4,488	6,695	1,994	23	4,085	12,703	29,988
TOTAL		7,202	11,866	14,687	3,461	14,007	38,935	90,158	8,834	12,913	17,524	3,174	10,204	45,712	98,362
% SSME AREA		52.04	48.87	90.61	97.38	66.70	76.85	72.64	49.20	48.15	88.62	99.28	59.96	72.21	69.51
% NON-SSME AREA		47.96	51.13	9.39	2.62	33.30	23.15	27.36	50.80	51.85	11.38	0.72	40.04	27.79	30.49

Note: MA – mackerel (*Rastrelliger* spp.); RS – round scad (*Decapterus* spp.); SD – sardine; AN – anchovy; TN – mixed neritic and coastal tuna; OT – other pelagic species; TOT – sub total

Source: DOF Sabah annual fisheries statistics

Table A69: *Pelagic fish landings by selected species and fishing zone in Sabah, 1999 period (in metric ton)*

ZONE	DISTRICT	1999 period							1991-1999 period						
		MA	RS	SD	AN	TN	OT	TOT	MA	RS	SD	AN	TN	OT	TOT
SSME1	Kudat	1,993	681	1,556	77	308	3,506	8,121	11,615	8,954	8,511	392	10,625	24,319	64,416
	Kota Marudu	0	0	13	0	0	67	80	9	0	13	0	137	945	1,104
	Pitas	25	0	94	105	38	72	334	68	0	543	593	225	1,098	2,527
	Sub Total	2,018	681	1,664	182	346	3,644	8,534	11,693	8,954	9,068	985	10,987	26,362	68,049
SSME2	Sandakan	554	549	544	52	371	7,838	9,908	6,991	6,022	6,274	547	10,559	58,194	88,587
	Beluran	0	0	35	8	0	1,156	1,199	124	15	657	8	0	11,935	12,739
	Sub Total	554	549	579	60	371	8,995	11,108	7,115	6,037	6,931	555	10,559	70,129	101,326
SSME3	Tawau	207	0	0	1,988	0	4,820	7,015	1,126	0	181	13,393	654	19,813	35,167
	Semporna	128	883	2,263	0	5,201	1,257	9,732	6,107	6,265	18,810	35	38,109	13,536	82,862
	Kunak	1,537	6,712	8,612	298	1,635	4,373	23,167	22,487	39,886	57,043	10,079	22,992	27,268	179,755
	Lahad Datu	807	1,859	241	148	314	11,493	14,862	3,716	5,388	1,093	956	3,110	20,560	34,823
	Sub Total	2,679	9,453	11,116	2,434	7,150	21,943	54,776	33,435	51,539	77,128	24,464	64,865	81,176	332,607
NON SSME AREA	Kota Belud	60	269	9	15	916			625	3,969	516	128	4,719		
	Tuaran	0	396	0	0	161			886	10,547	9,060	0	5,962		
	K Kinabalu	3,304	4,392	571	0	2,161			18,407	23,278	7,377	0	13,947		
	Papar	25	15	12	0	37			3,585	2,582	490	0	2,626		
	Beaufort	183	0	0	0	318			3,303	0	9	0	1,401		
	Kuala Penyu	210	388	287	0	372			3,570	3,639	1,682	0	2,206		
	Sipitang	1	1	735	73	4			998	5	1,876	161	371		
	Sub Total	3,783	5,460	1,614	88	3,970	14,878	29,793	31,375	44,019	21,009	291	31,233	97,134	225,241
SSME AREA		5,250	10,683	13,359	2,676	7,867	34,582	74,418	52,243	66,530	93,127	26,004	86,411	177,667	501,982
NON-SSME AREA		3,783	5,460	1,614	88	3,970	14,878	29,793	31,375	44,019	21,009	291	31,233	97,134	225,241
TOTAL		9,034	16,144	14,973	2,764	11,837	49,460	104,211	83,618	110,549	114,136	26,295	117,644	274,801	727,223
% SSME AREA		58.12	66.18	89.22	96.82	66.46	69.92	71.41	62.48	60.18	81.59	98.89	73.45	64.65	69.03
% NON-SSME AREA		41.88	33.82	10.78	3.18	33.54	30.08	28.59	37.52	39.82	18.41	1.11	26.55	35.35	30.97

Note: MA – mackerel (*Rastrelliger* spp.); RS – round scad (*Decapterus* spp.); SD – sardine; AN – anchovy; TN – mixed neritic and coastal tuna; OT – other pelagic species; TOT – sub total

Source: DOF Sabah annual fisheries statistics

Table A70: *Average fisherman share of marine fish landings by fishing districts in Sabah, 1998 period*

Economic Parameters	SSME1			SSME2		SSME3				Non-SSME Area	SSME Area	Annual Total
	Kudat	Kota Marudu	Pitas	Sandakan	Beluran	Tawau	Semporna	Lahad Datu	Kunak			
No. Fishermen	2,915	713	650	1,568	3,987	2,036	1,781	669	801	5,725	15,120	20,845
Q-landing	30,139	463	541	31,871	3,364	16,542	12,342	12,416	18,632	65,943	126,311	192,254
V-landing	130.90	2.25	1.73	151.39	3.46	56.87	29.23	31.88	33.22	205.96	440.93	646.89
Fish Value RM/KG	4.34	4.86	3.20	4.75	1.03	3.44	2.37	2.57	1.78	3.12	3.49	3.36
ECONOMIC RETURNS TO FISHING INDUSTRY												
Mt/fisherman	10.34	0.65	0.83	20.33	0.84	8.12	6.93	18.56	23.26	11.52	8.35	9.22
RM/fisherman	44,906	3,156	2,662	96,550	868	27,932	16,412	47,653	41,473	35,976	29,162	31,033

Source: Adapted from DOF Sabah annual fisheries report

Table A71: *Average fisherman share of marine fish landings by fishing districts in Sabah, 1999 period*

Economic Parameters	SSME1			SSME2		SSME3				Non-SSME Area	SSME Area	Annual Total
	Kudat	Kota Marudu	Pitas	Sandakan	Beluran	Tawau	Semporna	Lahad Datu	Kunak			
No. Fishermen	2,915	713	650	1,568	3,987	2,036	1,781	669	801	5,725	15,120	20,845
Q-landing	34,882	355	468	29,416	4,292	19,474	12,010	14,862	23,167	68,286	138,927	207,213
V-landing	155.50	2.52	1.79	134.23	6.62	63.86	30.56	38.57	44.10	220.56	477.75	698.31
Fish Value RM/KG	4.46	7.10	3.82	4.56	1.54	3.28	2.54	2.60	1.90	3.23	3.44	3.37
ECONOMIC RETURNS TO FISHING INDUSTRY												
Mt/fisherman	11.97	0.50	0.72	18.76	1.08	9.56	6.74	22.22	28.92	11.93	9.19	9.94
RM/fisherman	53,345	3,534	2,754	85,606	1,660	31,365	17,159	57,653	55,056	38,526	31,597	33,500

Note: Q-landing in metric ton; V-landing in RM million

Source: Adapted from DOF Sabah annual fisheries report

Table A72: *Statistics of marine aquaculture systems in Sabah, 1999*

ZONE	DISTRICT	Cage Culture			Shrimp Culture			Seaweed Culture		Mussel Culture		Oyster Culture	
		no. cage units	Area (m^2)	no. farmers	no. ponds	area (ha)	no. farmers	area (ha)	no. farmers	Area (m^2)	no. farmers	Area (m^2)	no. farmers
SSME1	Kudat	167	10,372	12									
	Kota Marudu	15	243	15						390	15	270	15
	Pitas	72	2,664	12									
	Sub Total	254	13,279	39						390	15	270	15
SSME2	Sandakan	366	2,279	71	71	62.00	9					80	5
	Beluran	72	144	5									
	Sub Total	438	2423	76	71	62.00	9					80	5
SSME3	Tawau	86	774	2	1,320	924.00	48			1,242	41		
	Semporna	36	16,188	3				283.28	511				
	Kunak							6.73	55				
	Lahad Datu				4	4.00	1						
	Sub Total	122	16,962	5	1,324	928	49	290.01	566	1,242	41		
NON SSME AREA	Kota Belud	11	222	30						446	41	424	45
	Tuaran	522	20,083	58						402	22	59,676	65
	Kota Kinabalu	95	1,086	5									
	Papar				16	5.17	9						
	Beaufort	24	171	3	2	0.75	1						
	Kuala Penyu	147	935	31									
	Sipitang												
	Sub Total	799	22,497	127	18	5.92	10			848	63	60,100	110
SSME Area		814	32,664	120	1,395	990.00	58	290.01	566	1,632	56	350	20
Non-SSME Area		799	22,497	127	18	5.92	10			848	63	60,100	110
TOTAL		1,613	55,161	247	1,413	995.92	68	290.01	566	2,480	119	60,450	130

Source: DOF Sabah annual fisheries statistics

Table A73: *Marine aquaculture production by district and species in Sabah, 1999 period (in metric tons)*

ZONE	DISTRICT	Production (metric ton)						Wholesale Value (RM '000)					
		Shrimp	FinFish	Mussel	Oyster	Seaweed	Total	Shrimp	FinFish	Mussel	Oyster	Seaweed	Total
SSME1	Kudat		114.75				114.75		5,086.53				5,086.53
	Kota Marudu		1.80	0.23	0.10		2.13		27.00	0.46	0.25		27.71
	Pitas		0.16				0.16		2.18				2.18
	Sub Total		116.71	0.23	0.10		117.04		5,115.71	0.46	0.25		5,116.42
SSME2	Sandakan	38.00	71.00				109.00	1,064.00	908.80				1,972.80
	Beluran		16.95				16.95		160.77				160.77
	Sub Total	38.00	87.95				125.95	1,064.00	1,069.57				2,133.57
SSME3	Tawau	1,798.26	7.20	20.00			1,825.46	52,149.59	86.40	20.00			52,255.99
	Semporna		46.80			2,961.85	3,008.65		1,990.84			6,516.07	8,506.91
	Kunak					46.53	46.53					100.04	100.04
	Lahad Datu	0.05					0.05	1.58					1.58
	Sub Total	1,798.31	54.00	20.00		3,008.38	4,880.69	52,151.17	2,077.24	20.00		6,616.11	60,864.52
NON SSME AREA	Kota Belud		0.14	1.66	1.41		3.21		2.39	4.16	3.52		10.07
	Tuaran		200.82	11.00	92.16		303.98		3,614.92	22.00	189.32		3,826.24
	Kota Kinabalu		10.75				10.75		418.07				418.07
	Papar	6.72					6.72	147.84					147.84
	Beaufort	0.03	1.54				1.57	0.57	45.08				45.65
	Kuala Penyu		2.59				2.58		44.48				44.48
	Sipitang												
	Sub Total	6.75	215.84	12.66	93.57	0.00	328.82	148.41	4,124.94	26.16	192.84	0.00	4,492.35
	SSME Area	1,836.31	258.66	20.23	0.10	3,008.38	5,123.68	53,215.17	8,262.52	20.46	0.25	6,616.11	68,114.51
	NON-SSME Area	6.75	215.84	12.66	93.57	0.00	328.82	148.41	4,124.94	26.16	192.84	0.00	4,492.35
	TOTAL	1,843.06	474.50	32.89	93.67	3,008.38	5,452.50	53,363.58	12,387.5	46.62	193.09	6,616.11	72,606.86
	% SSME AREA	99.63	54.51	61.51	0.11	100.00	93.97	99.72	66.70	43.89	0.13	100.00	93.81
	% NON-SSME AREA	0.37	45.49	38.49	99.89	0.00	6.03	0.28	33.30	56.11	99.87	0.00	6.19

Source: DOF Sabah annual fisheries statistics

Table A74: *Number of fish processing plants and cold storage facilities in Sabah, 2000*

ZONE	DISTRICT	No. of Processing Plants	Ice Production metric ton/day	No. of Cold Rooms	Cold Storage Capacity (metric ton)		Number Workers
					Ice	Fish	
SSME1	Kudat	5	54.05	11	225	225	40
	Kota Marudu	-	-	2	4	-	2
	Pitas	-	-	-	-	-	-
	Sub Total	5	54.05	-	229	225	42
SSME2	Sandakan	11	220.92	26	547	680	468
	Beluran	1	1.00	1	15	10	7
	Sub Total	12	221.92	-	562	690	475
SSME3	Tawau	8	85.27	17	289	1,250	121
	Semporna	9	25.30	19	85	252	120
	Kunak	3	12.00	6	20	25	17
	Lahad Datu	3	11.72	3	18	0	17
	Sub Total	23	132.29	-	412	1527	275
NON SSME AREA	Kota Belud	2	14.70	2	20	-	7
	Tuaran	-	-	-	-	-	-
	Kota Kinabalu	6	149.30	21	200	220	144
	Papar	-	-	-	-	-	-
	Beaufort	-	-	7	-	-	3
	Kuala Penyu	2	6.50	2	28	-	19
	Sipitang	1	0.40	1	2	-	2
	Sub Total	11	170.90	33	250	220	175
SSME AREA		40	410.26	85	1,203	2,442	792
NON-SSME AREA		11	170.90	33	250	220	175
TOTAL		51	581.16	118	1443	2,662	967
% SSME AREA		78.43	70.59	72.03	83.37	91.74	81.90
% NON SSME AREA		21.57	29.41	27.97	16.63	8.26	18.1

Source: DOF Sabah annual fisheries statistics

Table A75: *Estimated fish meal production in Sabah during the 1992-1999 period (metric ton)*

Fish meal production								
DISTRICTS	*92*	*93*	*94*	*95*	*96*	*97*	*98*	*99*
West Coast	11,212	10,204	9,505	8,741	7,734	5,676	20,403	10,360
a. Non-SSME	NA	NA	NA	NA	NA	NA	*17,885*	8,056
b. SSME1	NA	NA	NA	NA	NA	NA	*2,518*	2,304
SSME2	2,200	7,400	6,033	4,399	2,558	2,161	4,329	3,552
SSME3	3,527	4,844	4,350	2,957	2,508	4,388	2,498	628
a. Tawau	NA	NA	NA	*267*	*230*	*56*	*57*	24
b. Kunak	NA	NA	NA	*2,690*	*2,278*	*4,332*	*2,441*	604
Total	16,939	22,448	19,888	16,097	12,800	12,225	27,231	14,538
Raw materials used								
YEAR	*92*	*93*	*94*	*95*	*96*	*97*	*98*	*99*
West Coast	44,848	36,600	34,200	25,308	19,756	23,841	67,847	40,224
a. Non-SSME	NA	NA	NA	NA	NA	NA	*55,753*	*29,510*
b. SSME1	NA	NA	NA	NA	NA	NA	*12,094*	*10,714*
SSME2	8,800	28,593	23,395	14,941	9,207	7,949	15,927	25,128
SSME3	14,108	17,564	15,883	9,021	10,445	27,457	8,208	2,168
a. Tawau	NA	NA	NA	*952*	*800*	*334*	*344*	*141*
b. Kunak	NA	NA	NA	*8,069*	*9,645*	*27,123*	*7,864*	*2,027*
Total	67,756	82,757	73,478	49,270	39,408	59,247	91,982	67,520
Total fish landings								
YEAR	*92*	*93*	*94*	*95*	*96*	*97*	*98*	*99*
West Coast	74,626	80,968	78,080	74,249	70,695	85,246	101,092	103,990
a. Non-SSME	*51,368*	*48,110*	*46,657*	*46,473*	*45,117*	*60,115*	*69,949*	*68,976*
b. SSME1	*23,258*	*32,858*	*31,423*	*27,776*	*25,578*	*25,131*	*31,144*	*35,014*
SSME2	31,640	34,306	36,383	32,102	35,175	30,010	35,235	33,708
SSME3	30,039	39,841	45,865	60,111	74,274	59,010	59,933	69,513
a. Tawau	*4,251*	*3,964*	*6,913*	*10,011*	*16,699*	*15,914*	*16,542*	*19,474*
b. Kunak	*18,287*	*25,078*	*24,570*	*26,767*	*35,204*	*20,332*	*18,632*	*23,167*
Total	108,794	136,305	155,115	160,328	166,462	180,143	196,259	207,211
% Total fish landings utilized for fish meal production								
YEAR	*92*	*93*	*94*	*95*	*96*	*97*	*98*	*99*
West Coast	60.10	45.20	43.80	34.09	27.95	27.97	67.11	38.68
a. Non-SSME	NA	NA	NA	NA	NA	NA	*79.71*	*42.78*
b. SSME1	NA	NA	NA	NA	NA	NA	*38.83*	*30.60*
SSME2	27.81	83.35	64.30	46.54	26.17	26.49	45.20	74.55
SSME3	46.97	44.09	34.63	15.01	14.06	46.53	13.70	2.92
Total	62.28	60.71	47.37	30.73	23.67	32.89	46.87	32.59
Exports of fish meal								
YEAR	*92*	*93*	*94*	*95*	*96*	*97*	*98*	*99*
Quantity	7,761	13,643	11,103	11,746	8,951	8,756	19,195	8,830
Value	10.49	17.04	12.47	12.52	10.69	12.21	31.35	7.67

Note: in metric ton, statistics for Kudat (SSME1) included in West Coast for 1992-1997 period, Export value = RM million

Source: DOF Sabah annual fisheries statistics

Table A76: *Direction of foreign trade, Sabah (1996-1999) (in RM million)*

Destination	IMPORTS (C.I.F.)				EXPORTS (F.O.B.)			
	1996	1997	1998*	1999**	1996	1997	1998*	1999**
DOMESTIC MARKET								
Peninsular	5,150.1	5,997.0	4,493.4	1,867.1	2,254.5	1,827.9	1,940.1	739.2
Sarawak	506.8	574.3	489.6	146.9	375.3	292.9	659.8	509.4
ASEAN COUNTRIES								
Singapore	471.7	474.8	470.4	207.9	475.5	571.2	437.8	88.3
Thailand	255.4	168.0	151.5	39.0	304.0	197.4	240.6	108.3
Philippines	28.3	46.4	39.9	24.1	237.6	236.3	634.3	121.1
Indonesia	289.2	187.1	238.0	71.5	111.5	174.4	187.5	92.9
Brunei DS	1.1	0.6	0.9	0.5	168.4	93.5	76.3	21.9
EUROPE (E.C. COUNTRIES)								
Germany	203.2	244.7	127.9	39.3	24.4	52.2	58.6	54.3
UK	160.1	163.3	90.2	29.2	135.1	96.2	158.4	57.4
Italy	77.1	82.9	70.6	10.8	20.8	21.6	46.6	19.1
France	59.0	60.9	52.7	17.4	21.4	33.9	53.2	12.8
Netherlands	62.9	102.9	46.1	16.9	490.9	452.2	900.0	223.9
Others	2.2	56.6	150.9	40.2	130.0	105.8	96.9	43.1
NORTH AMERICA								
USA	743.1	844.9	1,391.3	172.1	198.1	279.6	263.8	156.3
Canada	48.4	89.8	98.5	37.7	6.4	9.3	19.0	6.0
NORTH-EAST ASIA								
Japan	1,065.0	1,213.1	569.1	164.5	2,040.7	1,850.7	1,486.5	548.5
Taiwan	203.9	237.4	148.3	42.3	473.5	519.4	447.4	144.1
China	266.6	338.5	246.6	124.0	1,228.7	1,225.7	1,419.7	440.3
Hong Kong	67.1	49.1	39.4	17.3	277.5	508.3	544.1	115.4
S. Korea	216.3	97.8	273.6	25.8	710.8	928.8	978.8	354.1
Others	233.0	65.6	85.3	28.7	520.9	1,147.8	2,708.6	768.2
OCEANIA								
Australia	121.8	125.8	119.3	48.7	44.7	52.0	139.2	13.9
OTHERS	646.8	647.0	445.0	200.3	419.4	568.7	765.8	226.9
TOTAL	10,878.3	11,868.5	9,838.2	3,372.2	10,649.9	11,245.8	14,263.0	4,865.4

Note: * provisional figures subject to change; ** - provisional figures (Jan – May only)
Source: Monthly Statistical Bulletin, Sabah, July, 1999
Website: http://www.sabah.gov.my/didr/ftrade.html

Table A77: *Annual trade of fisheries products, Sabah 1962-1999*

YEAR	Q ('000 metric ton)		V (RM million)		RM/Kg		Trade of Balance	
	Import	Export	Import	Export	Import	Export	Q	V
62	2.062	2.141	2.709	2.887	1.314	1.349	0.079	0.178
63	1.885	1.667	2.769	2.512	1.469	1.507	-0.218	-0.257
64	2.773	1.394	3.524	2.401	1.271	1.722	-1.379	-1.123
65	2.295	1.617	3.127	4.273	1.363	2.642	-0.678	1.146
66	2.405	1.972	3.411	5.990	1.418	3.038	-0.433	2.579
67	2.849	2.313	3.568	7.509	1.252	3.246	-0.536	3.941
68	2.431	2.169	3.391	8.482	1.395	3.911	-0.262	5.092
69	2.726	2.238	3.992	7.338	1.464	3.279	-0.488	3.346
70	3.098	2.405	4.495	8.703	1.451	3.619	-0.693	4.208
71	2.818	2.316	4.145	10.636	1.471	4.593	-0.502	6.491
72	3.542	2.586	5.173	12.439	1.460	4.810	-0.956	7.266
73	3.954	2.769	6.869	18.507	1.737	6.684	-1.185	11.638
74	4.145	2.605	9.092	13.713	2.193	5.264	-1.540	4.621
75	4.148	2.699	8.401	14.880	2.025	5.513	-1.449	6.479
76	5.443	3.902	11.206	29.596	2.059	7.585	-1.541	18.390
77	3.957	3.563	10.245	32.671	2.589	9.170	-0.394	22.426
78	5.195	3.989	11.767	37.008	2.265	9.278	-1.206	25.241
79	7.719	4.260	12.822	45.194	1.661	10.609	-3.459	32.372
80	11.136	3.588	21.966	35.127	1.973	9.790	-7.548	13.161
81	7.574	4.040	21.430	46.873	2.829	11.602	-3.534	25.443
82	7.709	4.219	22.375	56.657	2.902	13.429	-3.490	34.282
83	9.369	5.899	24.005	85.914	2.562	14.564	-3.470	61.909
84	10.263	6.869	25.150	87.629	2.451	12.757	-3.394	62.479
85	8.381	6.812	21.779	73.869	2.599	10.844	-1.569	52.090
86	6.872	7.306	19.625	85.080	2.856	11.645	0.434	65.455
87	6.157	9.252	19.531	92.797	3.172	10.030	3.095	73.266
88	8.640	8.528	19.044	90.467	2.204	10.608	-0.112	71.423
89	5.174	13.270	22.269	101.697	4.304	7.664	8.096	79.428
90	5.731	19.310	23.942	122.071	4.178	6.322	13.579	98.129
91	7.011	23.092	25.499	139.931	3.637	6.060	16.081	114.432
92	5.945	26.934	28.506	146.075	4.795	5.423	20.989	117.569
93	5.614	31.217	27.075	154.429	4.823	4.947	25.603	127.353
94	7.413	32.657	32.370	170.012	4.367	5.206	25.244	137.643
95	6.303	36.353	36.401	200.630	5.775	5.519	30.050	164.229
96	6.703	35.962	37.043	216.582	5.527	6.023	29.259	179.539
97	6.144	36.049	38.707	237.037	6.300	6.575	29.905	198.330
98	5.454	44.874	34.028	317.733	6.239	7.081	39.420	283.705
99	7.469	37.854	40.235	319.095	5.387	8.430	30.385	278.860

Note: Q = quantity, V = volume, Trade of Balance = Export - Import
Source: adapted from DOF Sabah annual fisheries statistics

Table A78: *Annual Export of fisheries products, Sabah 1990-1999*

EXPORT VOLUME 000 mt	90	91	92	93	94	95	96	97	98	99
DESTINATION										
Japan	2.16	2.24	2.69	2.85	4.90	5.38	4.80	4.88	6.76	4.23
Within Malaysia	5.97	10.21	11.06	16.06	16.00	18.52	18.79	15.27	15.63	12.91
Singapore	3.52	3.30	2.59	3.11	2.47	1.73	1.70	3.17	4.46	0.75
Hong Kong	2.31	1.47	0.73	1.11	1.58	2.22	3.06	4.76	2.93	4.27
parts of Asia	3.44	3.96	7.94	5.88	5.25	6.08	4.80	5.49	15.59	12.57
Europe	0.54	0.60	0.78	0.99	1.30	1.56	1.88	1.94	1.31	1.49
Americas	1.37	1.31	1.15	1.21	1.16	0.86	0.93	0.54	1.82	1.64
TOTAL	19.31	23.09	26.93	31.22	32.66	36.35	35.96	36.05	44.87	37.85
Malaysia	5.97	10.21	11.06	16.06	16.00	18.52	18.79	15.27	15.63	12.91
Overseas	13.34	12.88	15.88	15.16	16.66	17.83	17.17	20.78	29.24	24.94
TOTAL	19.31	23.09	26.93	31.22	32.66	36.35	35.96	36.05	44.87	37.85
% destination										
Within Malaysia	30.9	44.2	41.0	51.4	49.0	51.0	52.2	42.3	34.83	34.11
Overseas	69.1	55.8	59.0	48.6	51.0	49.0	47.8	57.7	65.17	65.89
TOTAL	100	100	100	100	100	100	100	100	100	100
EXPORT VALUE RM million	90	91	92	93	94	95	96	97	98	99
DESTINATION										
Japan	45.16	51.58	53.42	46.45	49.32	59.44	74.49	87.15	110.88	96.62
Within Malaysia	25.41	33.56	34.95	40.49	49.93	63.70	63.98	62.89	77.25	90.01
Singapore	12.45	13.75	9.40	14.19	11.47	11.69	9.77	6.37	4.46	5.07
Hong Kong	7.60	8.62	13.87	18.16	21.65	26.44	34.17	37.14	49.46	50.05
parts of Asia	5.15	5.67	11.49	12.64	11.19	16.05	12.54	16.24	33.98	30.69
Europe	4.03	5.55	6.97	5.04	9.70	10.01	13.47	21.85	26.64	30.53
Americas	22.27	21.20	15.98	17.46	16.74	13.30	8.17	5.42	15.01	16.13
TOTAL	122.07	139.93	146.08	154.43	170.01	200.63	216.58	237.04	317.73	319.10
Within Malaysia	25.41	33.56	34.95	40.49	49.93	63.70	63.98	62.89	77.25	90.01
Overseas	96.66	106.37	111.12	113.94	120.08	136.93	152.60	174.15	240.48	229.09
TOTAL	122.07	139.93	146.08	154.43	170.01	200.63	216.58	237.04	317.73	319.10
% destination										
Within Malaysia	20.8	24.0	23.9	26.2	29.4	31.8	29.5	26.5	24.31	28.21
Overseas	79.2	76.0	76.1	73.8	70.6	68.2	70.5	73.5	75.69	71.79
TOTAL	100	100	100	100	100	100	100	100	100	100

Note: Americas include USA, Canada, Mexico and South America
Source: DOF Sabah annual fisheries statistics
adopted from Biusing (1999). Strategic Action Plan for Regional Fisheries Development in Sabah, Malaysia. DOF Sabah. (unpublished paper).

Table A79: *Trade of Fishery Commodities by Country, Sabah 1998-1999*

COUNTRY	1998				1999			
	IMPORT		EXPORT		IMPORT		EXPORT	
	Q	V	Q	V	Q	V	Q	V
DOMESTIC MARKET								
Peninsular	2,604.06	16,221,394	11,218.25	67,940,342	3,747.16	21,627,584	8,815.74	83,138,971
Sarawak	17.30	460,701	4,412.23	9,311,824	11.98	400,719	4,093.29	6,871,071
Sub Total	2,621.36	16,682,095	15,630.48	77,252,166	3,759.14	22,028,303	12,909.03	90,010,042
FOREIGN MARKET								
Argentina	-	-	-	-	0.45	2,538	-	-
Australia	1.63	63,553	829.59	1,109,571	3.56	83,339	1,424.79	2,628,978
Belgium	-	-	10.20	469,560	-	-	10.20	469,756
Brunei	-	-	933.88	3,869,019	-	-	646.55	3,526,421
Cambodia	-	-	-	-	-	-	0.32	2,000
Canada	78.90	116,543	-	-	165.99	181,889	-	-
Chile	2.66	16,410	-	-	3.93	27,618	-	-
China	129.01	531,389	4,176.74	9,295,565	183.81	735,106	1,834.60	6,872,777
Denmark	0.18	9,725	120.00	201,185	0.68	10,101	225.25	710,042
France	-	-	196.56	6,605,253	0.13	5,125	160.82	6,731,761
Germany	-	-	120.74	3,778,965	0.06	3,196	9.72	315,648
Greece	-	-	-	-	-	-	12.00	283,860
Hong Kong	0.74	54,061	2,932.67	49,456,997	19.03	253,376	4,271.30	50,048,421
India	-	-	-	-	0.02	2,508	-	-
Indonesia	1,249.62	7,734,477	5,264	8,687,228	1,072.95	8,251,536	2,460.51	980,384
Italy	-	-	406.70	4,548,268	-	-	723.75	10,822,259
Japan	92.91	1,202,936	6,759.04	110,878,418	5.25	178,216	4,231.84	96,617,168
Korea	110.33	487,078	648.05	1,621,890	-	-	1,454.18	5,859,844
Mexico	0.07	14,256	-	-	0.13	15,276	-	-
Monaco	-	-	9.72	337,488	-	-	-	-
Netherlands	-	-	68.56	2,558,000	-	-	-	-
New Zealand	23.19	149,551	-	-	2.65	40,760	-	-
Norway	5.35	169,834	-	-	13.13	414,949	-	-
Peru	18.72	39,900	-	-	-	-	-	-
Philippines	51.23	35,820	606.07	788,805	335.64	196,169	1,677.18	2,651,778
Portugal	-	-	-	-	-	-	30.00	1,400,992
Singapore	16.35	76,131	823.89	4,462,104	4.92	332,711	748.11	5,067,398
Spain	-	-	242.25	4,649,121	-	-	148.92	5,443,765
Sri Langka	-	-	1,108.00	1,800,854	-	-	1,216.00	352,716
Sweden	-	-	-	-	40.00	53,600	-	-
Switzerland	-	-	-	-	-	-	25.00	25,000
Taiwan	2.70	48,635	770.45	2,662,587	1.47	43,270	1,020.87	5,076,101
Thailand	1,096.78	5,907,478	1,254.40	4,147,285	1,298.14	6,492,056	830.78	2,740,091
UK	-	-	138.98	3,491,474	-	-	140.49	4,331,060
USA	40.69	680,567	1,823.42	15,061,058	558.19	883,270	1,642.10	16,127,074
Sub Total	2,923.46	17,345,424	29,243.91	240,480,695	3,710.13	18,206,609	24,945.28	229,085,294
TOTAL	5,544.82	34,027,519	44,874.39	317,732,861	7,469.27	40,234,912	37,854.31	319,095,336
% Domestic	47.28	49.03	34.83	24.31	50.33	54.75	34.10	28.21
% Foreign	52.72	50.97	65.17	75.69	49.67	45.25	65.90	71.79
TOTAL	100	100	100	100	100	100	100	100

Note: Q – quantity (metric ton); V = volume (Ringgit Malaysia)
Source: adapted from DOF Sabah annual fisheries statistics

Table A80: *Breakdown of fisheries trade commodities, Sabah 1997-1999 period*

FISHERIES COMMODITY	1997				1998				1999			
	IMPORT		EXPORT		IMPORT		EXPORT		IMPORT		EXPORT	
	Q	V	Q	V	Q	V	Q	V	Q	V	Q	V
Live Fish	0.118	2.431	0.468	13.141	0.042	1.740	0.527	15.328	0.032	1.680	0.587	21.371
Fish (fresh or chilled)	0.000	0.004	1.049	7.741	0.000	0.008	1.745	13.466	0.000	0.000	1.790	13.258
Frozen Fish	0.639	4.594	8.261	21.155	0.912	6.960	8.197	26.087	0.618	4.867	8.448	27.344
Frozen Fish Fillet	0.057	0.434	0.228	0.968	0.006	0.260	0.045	0.194	0.018	0.392	0.391	1.432
Traditionally processed	0.069	0.672	0.479	1.356	0.040	0.332	0.460	0.952	0.028	0.251	0.761	1.399
Frozen Shrimp	0.012	0.180	5.522	141.814	0.016	0.135	5.282	175.915	0.187	3.050	6.709	184.499
Frozen Crustaceans	0.019	0.911	0.385	8.473	0.015	0.174	0.357	4.247	0.003	0.028	0.482	4.055
Processed Crustaceans	0.113	0.465	3.240	6.715	0.236	1.293	1.093	16.038	0.282	1.255	1.108	17.004
Other Fish Products	0.540	3.090	6.223	21.162	0.029	0.364	5.884	30.487	0.054	0.812	5.989	33.637
Processed & Canned Fish	4.135	23.600	0.116	0.611	3.551	21.305	0.322	0.575	3.895	24.127	0.085	0.347
Fish Meals	0.368	0.415	8.766	12.214	0.390	0.756	19.500	31.785	1.176	1.258	8.830	8.034
Miscellaneous	0.074	1.911	1.312	1.687	0.307	0.702	1.462	2.658	1.177	2.513	2.675	6.715
TOTAL	6.144	38.707	36.049	237.037	5.545	34.028	44.874	317.733	7.469	40.235	37.854	319.095

Note: *live fish* include both freshwater and marine including fries; *traditionally processed* include smoked, in brine, salted or dried; *Other fish products* include invertebrates, fish and other aquatic animals; fish meals unfit for human consumption, miscellaneous include seaweed, fermented shrimp paste – belacan, fish fats and oils and other aquatic products

Q – quantity in '000 metric ton; V = value in RM million

Source: adapted from DOF Sabah annual fisheries statistics

Table A81: *Exports of marine live fish from Sabah, 1990-1999 (Q in metric ton; V in RM'000)*

YEAR	Brunei		Hong Kong		Malaysia		Singapore		Taiwan		Others		TOTAL	
	Q	V	Q	V	Q	V	Q	V	Q	V	Q	V	Q	V
1990	0.93	18.4	207.53	4,020.5	18.1	177.8	6.12	110.7	3.42	100.6	0.38	8.8	236.46	4,436.9
1991	0.74	15.0	288.40	5,541.3	21.16	307.4	12.7	166.2	0.71	7.5	-	-	232.71	6,037.5
1992	1.44	28.7	445.92	9,572.8	7.70	162.2	9.97	238.0	-	-	0.25	4.8	465.28	10,006.5
1993	0.76	18.8	574.53	12,939.8	16.47	444.4	20.15	427.6	0.90	18.0	-	-	612.81	13,848.6
1994	0.64	9.7	415.81	9,623.6	30.39	684.4	25.19	441.7	-	-	-	-	472.06	10,759.1
1995	1.80	20.7	404.89	10,210.4	23.82	757.5	33.00	930.0	11.73	283.2	-	-	475.24	12,201.7
1996	0.12	3.0	279.06	7,449.7	31.45	1,176.9	15.84	470.0	1.96	61.6	-	-	328.43	9,161.1
1997	0.07	2.0	379.39	9,948.6	60.54	2,423.2	21.48	568.0	6.09	183.6	-	-	467.57	13,125.4
1998	-	-	397.35	10,782.6	98.78	3,542.7	21.46	587.8	8.62	369.2	0.46	12.6	526.67	15,294.9
1999	-	-	461.24	15,972.8	74.45	3,644.1	32.26	1,118.6	17.66	605.5	0.30	6.0	585.91	21,347.0
TOTAL	6.50	116.30	3,854.12	96,062.1	382.86	13,320.6	198.17	5058.6	51.09	1,629.2	1.39	32.2	4,403.14	116,218.7

Source: DOF Sabah annual fisheries statistics

Table A82: *Exports of dried seaweed from Sabah, 1990-1999 (Q in metric ton; V in RM'000)*

YEAR	Denmark		Hong Kong		Korea		Philippines		China		Others		TOTAL	
	Q	V	Q	V	Q	V	Q	V	Q	V	Q	V	Q	V
1990	282.17	282,339									20.49	9,237	302.66	391,576
1991	271.13	356,422					2.00	700			112.50	167,245	385.63	524,367
1992	357.00	411,545											357.00	411,545
1993	617.82	510,584									38.00	2,960	655.82	513,544
1994	759.15	642,328									41.72	37,380	800.87	679,708
1995	960.00	987,089					20.00	6,000			20.00	22,016	1,000.00	1,015,105
1996	864.50	1,492,776					151.00	196,998					1,015.50	1,689,774
1997	539.00	443,812									469.00	700,620	1,288.00	1,548,932
1998	120.00	201,185	60.00	120,000					890.00	1,465,000	313.00	477,596	1,383.00	2,263,781
1999	225.25	710,042	1,513.41	3,196,681	838.04	2,468,488	30.71	59,150			63.32	182,524	2,670.73	6,616,885
TOTAL	4996.02	6,038,122	1,573.41	3,316,681	838.04	2,468,488	203.71	262,848	890.00	1,465,000	1078.03	1,599,578	9,859.21	15,655,217

Source: DOF Sabah annual fisheries statistics

Table A83: *Exports of fish meal from Sabah, 1990-1999 (Q in metric ton; V in RM'000)*

YEAR	Peninsular		Sarawak		Singapore		Indonesia		Others		TOTAL	
	Q	V	Q	V	Q	V	Q	V	Q	V	Q	V
1990	1,442.21	1,664,384	1,768.69	2,228,064	2,100.15	2,746,868					5,313.05	6,639,316
1991	4,515.36	5,747,079	1,558.34	2,270,436	1,826.07	2,487,390					7,900.78	10,504,905
1992	4,211.07	5,936,873	1,923.90	2,390,236	1,534.06	2,034,522			90.00	129,496	7,761.03	10,491,127
1993	8.984.90	11,245,119	2,499.56	2,875,104	1,460.76	1,999,789	95.40	103,684	494.73	677,987	13,643.35	17,038,323
1994	6,570.24	7,500,462	3,032.62	3,328,809	1,428.80	1,531,536			80.00	104,462	11,102.66	12,465,269
1995	8,108.06	8,741,905	3,054.20	3,174,901	384.00	327,350			200.00	273,310	11,746.26	12,517,466
1996	6,544.20	7,557,162	2,226.55	2,888,007	140.00	191,300			40.00	53,915	8,950.75	10,690,384
1997	5,329.00	7,523,960	3,107.04	4,227,658	200.00	267,000			120.00	191,948	8,756.04	12,210,566
1998	4,684.96	7,793,880	3,709.20	5,517,150	200.00	335,644	5,252.00	8,675,228	5,348.85	9,029,140	19,194.91	31,351,042
1999	537.25	707,417	3,835.00	4,931,588			2,460.00	976,200	1,998.05	1,418,859	8,570.30	7,670,648
TOTAL	41,952.234	64,418,241	26,715.1	33,831,953	9,273.84	11,921,399	7,807.40	9,755,112	8,371.63	11,879,117	102,939.13	131,579,046

Source: DOF Sabah annual fisheries statistics

Table A84: *Fisheries trade statistics in the SSME area during the 1991-1999 period*

YEAR	Sabah Total Fisheries Trade				Fisheries Trade with Indonesia				Fisheries Trade with the Philippines			
	Imports		Exports		Imports		Exports		Imports		Exports	
	Q	V	Q	V	Q	V	Q	V	Q	V	Q	V
1991	7,011	25.499	23,092	139.931	1,102.74	3.811	25.04	0.058	32.42	0.092	2,058.67	2.186
1992	5,945	28.506	26,934	146.075	1,029.76	4.496	379.96	0.058	149.61	0.198	4,295.46	4.166
1993	5,614	27.075	31,217	154.429	1,069.10	4.234	120.55	0.142	369.58	0.393	734.31	1.121
1994	7,413	32.370	32,657	170.012	1,050.55	4.245	5.67	0.031	112.83	0.490	747.20	0.934
1995	6,303	36.401	36,353	200.629	983.36	5.714	12.39	0.069	25.67	0.119	1,297.81	2.193
1996	6,703	37.043	35,962	216.582	1,051.26	6.274	19.72	0.207	43.88	0.169	557.33	0.943
1997	6,144	38.707	36,049	237.037	822.95	5.899	10.00	0.068	5.92	0.034	518.63	0.795
1998	5,545	34.028	44,874	317.733	1,249.62	7.734	5,264.00	8.687	51.23	0.036	606.07	0.789
1999	7,469	40.235	37,854	319.095	1,072.95	8.251	2,460.51	0.980	335.64	0.196	1,677.18	2.652
Total	58,146	299.864	304,992	1,901.5	9,432.29	50.659	8,297.84	10.299	1,127.78	1.727	12,492.66	15.779

TRADING PARTNER		1991	1992	1993	1994	1995	1996	1997	1998	1999	TOTAL
IMPORTS											
Indonesia	Q	15.73	17.32	19.04	14.17	15.60	15.68	13.39	22.54	14.37	16.22
	V	14.95	15.77	15.64	13.12	15.70	16.94	15.24	22.73	20.51	16.89
Philippines	Q	0.46	2.52	6.58	1.52	0.41	0.65	0.10	0.92	4.49	1.94
	V	0.36	0.69	1.45	1.51	0.33	0.46	0.09	0.11	0.49	0.58
EXPORTS											
Indonesia	Q	0.11	1.41	0.39	0.02	0.03	0.05	0.03	11.73	6.50	2.72
	V	0.04	0.04	0.09	0.02	0.03	0.10	0.03	2.73	0.31	0.54
Philippines	Q	8.92	15.95	2.35	2.29	3.57	1.55	1.44	1.35	4.43	4.10
	V	0.00	2.85	0.73	0.55	1.09	0.44	0.34	0.25	0.83	0.83

Note: Q = quantity (in metric ton), V = value (in RM million)
Source: adapted from DOF Sabah annual fisheries statistics

Table A85: *Fisheries trade statistics of selected commodities in the SSME area*

a. Dried Anchovies exported to the Philippines

YEAR	Sabah's Total Exports of Dried Anchovies (A)		Dried Anchovies Exports to the Philippines (B)		% Exported (Philippines) B/A		Total Exports to Philippines (C)		% Dried Anchovies Contribution (B/C)	
	Q	V	Q	V	Q	V	Q	V	Q	V
1991	739.16	2,860,015	129.80	164,380	17.56	5.75	2058.67	2,185,725	6.31	7.52
1992	511.15	1,601,050	226.36	243,904	44.28	15.23	4295.46	4,165,963	5.27	5.85
1993	360.64	1,201,485	192.65	258,594	53.42	21.52	734.31	1,121,203	26.24	23.06
1994	390.82	1,103,460	286.39	306,717	73.28	27.80	747.2	934,409	38.33	32.82
1995	297.05	575,214	285.43	481,164	96.09	83.65	1297.81	2,193,134	21.99	21.94
1996	382.24	739,071	379.73	719,579	99.34	97.36	557.33	943,141	68.13	76.30
1997	444.36	850,286	426.07	682,620	95.88	80.28	518.63	794,731	82.15	85.89
1998	392.65	482,576	389.50	454,696	99.20	94.22	606.07	788,805	64.27	57.64
1999	685.06	751,351	682.69	719,476	99.65	95.76	1,677.18	2,651,778	40.70	27.13
TOTAL	4,203.13	10,164,508	2,998.62	4,031,130	71.34	39.66	12,492.66	15,778,889	24.00	25.55

b. Selected fisheries commodities imported from Indonesia via SSME-3 area (Tawau Zone)

Commodity		1991	1992	1993	1994	1995	1996	1997	1998	1999	TOTAL
Lobsters (A)	Q	0.46	10.15	11.98	3.7	0	14.43	12.86	8.97	3.60	66.15
	V	15,903	400,540	481,500	153,422	0	659,765	771,600	531,267	216,000	3,229,997
Frozen Fish (B)	Q	498.26	631.17	631.44	796.13	934.08	862.25	550.05	752.15	460.35	6,115.88
	V	1,973,620	2,988,003	3,107,337	3,549,250	5,277,320	5,156,981	3,985,050	6,182,350	3,913,796	36,133,707
Frozen Shrimps (C)	Q	432.78	183.40	301.32	101.06	15.34	136.76	109.9	236.04	414.67	1,943.25
	V	1,340,104	285,801	452,874	164,441	375,095	220,402	429,800	807,943	3,718,272	8,276,232
Combined (A+B+C)	Q	931.50	824.72	944.74	900.89	949.42	1,013.44	672.81	997.16	878.62	8,125.28
	V	3,329,627	3,674,344	4,041,711	3,867,113	5,652,415	6,037,148	5,186,450	7,521,560	7,848,068	47,639,936
Total Fisheries Imports (D)	Q	1,102.74	1,029.76	1,069.10	1,050.55	983.36	1,051.26	822.95	1,249.62	1,072.95	9,432.29
	V	3,811,406	4,495,500	4,233,528	4,245,385	5,714,427	6,273,372	5,898,983	7,734,477	8,251,536	50,658,614
% (A+B+C)/D	Q	84.47	80.09	88.37	85.75	96.55	96.40	81.76	79.80	81.89	86.14
	V	87.36	81.73	95.47	91.09	98.91	96.23	87.92	97.25	95.11	94.04

Note: Q = export quantity (metric ton), V = export value (RM)

Source: adapted from DOF Sabah annual fisheries statistics

TRADITIONAL FISHING BOATS IN SABAH

Non-Motorized fishing boats

Outboard engine fishing boats

TRADITIONAL FISHING BOATS IN SABAH

Non-Motorized fishing boats

Outboard engine fishing boats

COMMERCIAL FISHING BOATS IN SABAH

Commercial trawlers

Commercial purse seiners

COMMERCIAL FISHING OPERATIONS

Commercial purse seining

Commercial purse seiners

COMMERCIAL FISHING OPERATIONS


Commercial purse seining


Commercial purse seiners

TRADITIONAL FISHING GEARS

Selambau Liftnet Operations

Bagang Liftnet Operation (bagang perahu)

TRADITIONAL FISHING GEARS

Bagang Liftnet Operations (bagang tetap)


Bagang Liftnet Operation (bagang perahu)

TRADITIONAL FISHING GEARS

Sadak Gear – target species are acetes shrimp

Beach Seine Net

TRADITIONAL FISHING GEARS

Fish traps in Semporna

Fishing operation in Semporna

CORAL REEF RESIDENT FISHES SOLD AT THE TAWAU FISH MARKET

CORAL REEF RESIDENT FISHES SOLD AT THE SEMPORNA FISH MARKET

LANDINGS AT THE SEMPORNA FISH MARKET

Miscellaneous invertebrates-1

Miscellaneous invertebrates-2

PELAGIC LANDING

Miscellaneous Pelagic Landings-1

Miscellaneous Pelagic Landings-2

PELAGIC LANDING


Miscellaneous Pelagic Landings-3

Miscellaneous Pelagic Landings-4

PELAGIC LANDING


Miscellaneous Pelagic Landings-5

Miscellaneous Pelagic Landings-6

PELAGIC LANDING


Miscellaneous Pelagic Landings-7


Miscellaneous Pelagic Landings-8

DEMERSAL LANDING


Miscellaneous Demersal Landings-1


Miscellaneous Demersal Landings-2

DEMERSAL LANDING


Miscellaneous Demersal Landings-3


Miscellaneous Demersal Landings-4

DEMERSAL LANDING

Miscellaneous Demersal Landings-5

Miscellaneous Demersal Landings-6

DEMERSAL LANDING

Miscellaneous Demersal Landings-7

Miscellaneous Demersal Landings-8

TRADITIONAL FISH PROCESSING


Dried anchovies caught by bagang liftnet


Salted fish

TRADITIONAL FISH PROCESSING


Dried cephalopods


Dried cephalopods

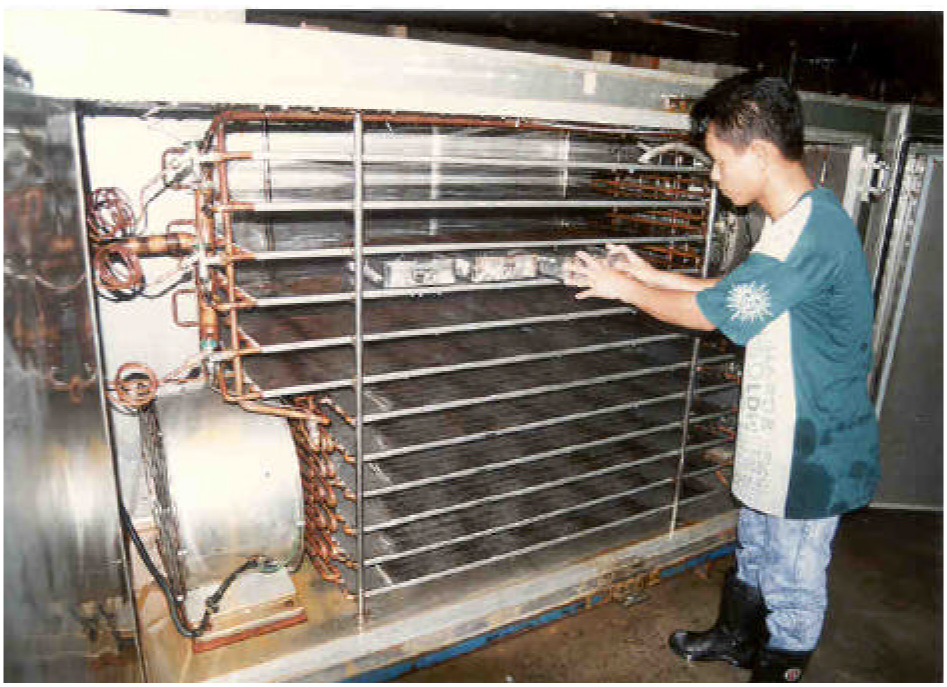
TRADITIONAL FISH PROCESSING

Miscellaneous dried products

Dried acetes shrimp

COMMERCIAL FISH PROCESSING

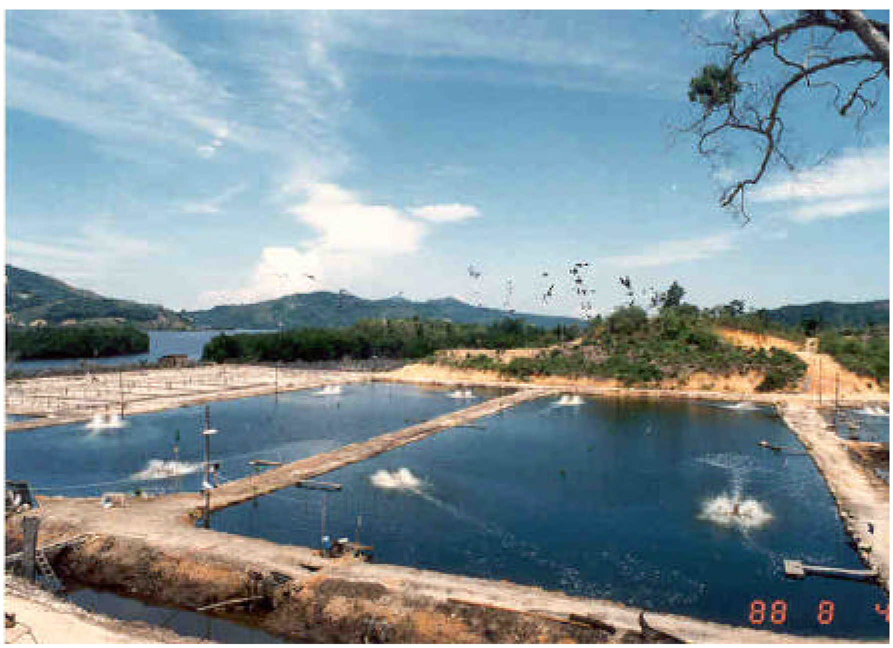
COMMERCIAL FISH PROCESSING



COMMERCIAL FISH PROCESSING

COMMERCIAL FISH PROCESSING

SHRIMP FARMING



SHRIMP FARMING

SEAWEED FARMING

SHRIMP FARMING

SEAWEED FARMING

SHRIMP FARMING

SEAWEED FARMING

MOLLUSK CULTURE

MARINE CAGE CULTURE